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## **SOCIAL MEDIA AND CORRUPTION**

Ruben Enikolopov, Maria Petrova and Konstantin  
Sonin

***DEVELOPMENT ECONOMICS,  
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# SOCIAL MEDIA AND CORRUPTION

## Abstract

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JEL Classification: L82, L86, P16

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# Social Media and Corruption\*

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February 2016

## Abstract

There is ample evidence that in democratic countries traditional mass media affect people's behavior and foster political and corporate accountability. Do new media such as blogs play a similar role in non-democratic countries, where offline media are often suppressed? We study consequences of blog posts about corruption in Russian state-controlled companies. We show that anti-corruption blog posts by Aleksei Navalny, a popular Russian civic activist, had a negative causal impact on market returns of state-controlled companies. For identification, we exploit the analysis of the precise timing of blog posts combined with quasi-random variation in access to blog platform caused by hacker attacks. The effect becomes less pronounced and even positive for the posts that attract the most attention, consistent with disciplining effect of social media. Furthermore, the posts have a long-term impact on returns and are associated with higher management turnover and less minority shareholder conflicts. Taken together, our results suggest that social media can discipline corruption even in a country with limited political competition and heavily censored mass media.

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# 1. Introduction

In democracies, mass media is an important instrument for monitoring the behavior of public officials, limiting corruption, and reducing political rents of the incumbents (Strömberg 2004; Besley and Prat 2006; Ferraz and Finnan, 2008, 2011; Snyder and Strömberg 2010; Brunetti and Weder 2003). In contrast, in countries where the governments censor news and suppress electoral institutions, the role of traditional mass media in promoting accountability might be limited (McMillan and Zoido 2004, Djankov et al. 2003, King, Pan, and Roberts 2013, 2014), and the provision of better information does not necessarily lead to socially beneficial outcomes (Chong et al, 2015, Malesky, Schuler, and Tran 2011, Fergusson, Vargas, and Vela 2013).

Emerging new media has recently become an alternative source of independent information for citizens and, potentially, an agent of political change in non-democratic regimes.<sup>1</sup> Theoretically, citizens and activists might use social media for sharing information about wrongdoings by politicians or public officials. This information can, in turn, change the way both people and public officials behave, by encouraging more transparency and improving accountability.<sup>2</sup> On the other hand, low entry barriers – anyone can easily create Twitter or Facebook content – makes the reputation and the quality of individual blogs a serious concern.<sup>3</sup> Also, many governments engage in various kinds of online censorship and propaganda activities.<sup>4</sup> In this environment, it is not clear whether or not social media can have a real impact on political and corporate accountability.

This paper has three goals. First, to identify the *causal* impact of blog posts on the performance of state-controlled companies whose managers were accused of corruption. Second, to investigate whether the effect is limited to short-term price changes, or whether it also affects long-term stock performance and corporate practices of the targeted firms, thus

<sup>1</sup> Enikolopov, Makarin, and Petrova (2015) show that social media penetration affected protest participation in Russia in 2011. Acemoglu, Hassan, Tahoun (2015) show that activity in Twitter during Tahrir Square protests precedes spikes in protest participation, which is consistent with the voluminous anecdotal evidence on the critical role the new media played in the uprisings of Arab Spring and elsewhere (e.g., Lotan et al. 2011, Sabadelo 2011) and a survey study of protest participants in Tahrir Square (Tufekci, 2011).

<sup>2</sup> In an effort to promote accountability around the world, the U.S. Department of State spent at least \$120 million since 2008 on various initiatives to promote net freedom abroad. Indian crowdsourcing website “I Paid a Bribe” attracted more than 4 millions visits since its launch in 2010, while Chinese city of Guangzhou passed the law allowing anti-corruption investigators to act based on information from the web (see more evidence in Qin, Strömberg, and Wu, 2016). In 2013, Uhuru Kenyatta, the President of Kenya, set up a website allowing visitors to report corruption cases directly to him.

<sup>3</sup> Gentzkow and Shapiro (2006) and Cage (2013) emphasize the importance of reputation for traditional media. Others reasons why online social media may not have any impact is that online activity may crowd out offline actions (Larson, 2014) or that social media may be strategically manipulated (Esfandiari 2010, Morozov, 2011, Edmond 2013).

<sup>4</sup> Qin, Strömberg, and Wu (2016) provide a comprehensive overview of the role social media plays in China, focusing on both types of content, available online, and methods used by Chinese government for online censorship and propaganda. Online censorship is also studied at Deibert et al. (2008), Deibert et al. (2010), King, Pan, and Roberts (2013, 2014), Lorentzen (2014).

potentially strengthening accountability. Finally, to discern the mechanisms of the social media influence. To do this, we study the impact of posts reporting corporate governance violations and outright corruption in Russian state-controlled companies written by an individual blogger, Aleksei Navalny, on the stock returns of these companies.<sup>5</sup>

Making a causal inference about the impact of social media posts is not a trivial task. The content of social media is highly endogenous, since it typically reflects real-life events and mimics the content of offline media. To address this issue, we use precise timing of blog posts within a trading day to trace their effect on performance of the companies with political connections to the Russian government.<sup>6</sup> We employ five-minute trading data, controlling for dummies for trading days and hours of the day. We take into account the online and offline information environment by focusing only on the posts that were not preceded by mentions of the companies in any other public source. We show that the stock returns of the companies mentioned in Navalny's posts go down within 3 hours after the posts are made, amounting to a daily effect of 0.5 percentage points, with some focused posts (mentioning a certain company at least five times) having an effect of 1.1 percentage points. The magnitudes of these effects are comparable with the average effect of the quarterly report announcements for these companies (2 percentage points).

To ensure that our results reflect causal effect of blog posts on performance of state-controlled companies rather than a strategic timing of the posts, we use distributed denial of service (DDoS) attacks as a source of exogenous variation for the timing of the posts. Although these DDoS attacks did not specifically target Navalny's blog, they affected the accessibility of the entire LiveJournal.com platform for at least several hours; as a result, Navalny was unable to post, while other users were unable to read the previous posts from his blog. The attacks that we take into consideration were, allegedly, politically motivated, but, critically, were not sponsored by the state-controlled companies we study or any other commercial interest.<sup>7</sup> Thus, they should not be correlated with the underlying determinants of asset prices.

We compare the performance of companies on the days with DDoS attacks, during which Navalny was unable to write because of exogenous reasons, with the performance of

<sup>5</sup> We focus on the period that pre-dates the time when Navalny became a national political figure in Russia. Concentrating on a popular individual blog, rather than a randomly chosen blog, we follow the tradition of scholars studying the effects of traditional mass media, e.g. New York Times (Puglisi 2011), Fox News (DellaVigna and Kaplan 2007), or NTV channel in Russia (Enikolopov, Petova, and Zhuravskaya 2011).

<sup>6</sup> Our precise-timing approach is similar to that of Gentzkow, Shapiro, and Sinkinson (2011), who studied the impact of newspaper entries and exits on electoral politics.

<sup>7</sup> For example, when in 2009 LiveJournal.com, Facebook, and Twitter were down for most part of the day, the New York Times (<http://bits.blogs.nytimes.com/2009/08/07/attack-on-twitter-came-in-two-waves/>) attributed this to the Russian government's efforts to an individual blogger reporting on Georgia-Russia conflict.

companies on the days when the blogger voluntarily chose not to blog about these companies.<sup>8</sup> We find no differences in the performance of the companies on the days of DDoS attacks and on the days when Navalny chose not to make any posts or blogged about issues unrelated to these companies. We also find that other large publicly traded companies in Russia did not react to DDoS attacks, which is consistent with DDoS attacks being unrelated to underlying price fundamentals. These findings are consistent with the assumption that there was no underlying unobserved heterogeneity driving Navalny's decision to write in a blog, which underpins the causal interpretation of the impact of his posts. Overall, our results indicate that blog posts about corruption indeed had a measurable impact on stock performance of the targeted companies.

Our second goal is to analyze whether the results are limited to temporary changes in stock prices or they have longer-term consequences for accountability. Specifically, we examine the impact of blog posts on both long-term stock performance and corporate practices of the targeted companies. We start by demonstrating that long-short portfolios constructed based on the mentions of companies in Navalny's blog posts substantially outperform the market over the entire time horizon of our study (three and a half years). We also show that the magnitude of the blog posting effect *diminishes* when the blogger becomes more popular, or when particular blog posts are shared more frequently on other social media through retweets and reposts. This finding contrasts with the previous studies in finance that find the impact of traditional media to be stronger when the audience of media messages is larger (e.g., Engelberg and Parsons 2011, Tetlock 2011, Peress 2014). This finding is consistent with greater attention to blog posts making it more likely that the profit diversion in the targeted companies will decrease in response to these blog posts, which counterbalances the negative information and attention effects.<sup>9</sup>

In line with this argument, we also show that the companies are more likely to have management turnover and are less likely to have shareholder conflicts following the blog posts targeting these companies. The limitation of our findings is that they are based on quarterly data. Still, taken together, the three sets of results (long-term impact of posts, interactions with popularity indices, and changes in companies) suggest that social media

<sup>8</sup> These attacks happened often enough to be comparable with the number of posts about particular companies, with the unconditional probability of seeing a post about a particular company in a given day being 4.6%, while the unconditional probability of seeing a DDoS attack in a given day being 1.1%

<sup>9</sup> Blog posts can affect shareholder value through several different channels. First, new information and increased attention might lower market perceptions of the quality of management, thus reducing stock prices. Second, the blog posts might increase regulators' and politicians' awareness of mismanagement in the company and, thus, make corruption more costly for managers, which will lead to a positive effect on stock prices. Third, exposure of corrupt practices can make it harder to funnel illicit payments to politicians, which may weaken firms' political connections and cause a reduction in shareholder value (Fisman, 2001, Faccio, 2006, Fisman and Wang, 2015).

play an important and positive role in improving corporate accountability, leading to less profit diversion and corruption in politically connected companies. Previous studies have shown that although publications in the international press about corporate governance violations in Russian companies increased the probability that these violations were redressed, similar publications in Russian-language media outlets did not have any effect (Dyck, Volchkova, and Zingales, 2008). Our results show that an individual blogger who started out with absolutely no popularity just in three years was able to become more influential than most popular business newspapers.

Our final goal is to understand the mechanism underlying the effect of blog posts on stock market performance. Revelation of new information might cause investors to mark down their perception of the companies' management. However, our interviews with market participants indicate that there was little new information in most of the blog posts that we study, which suggests that the effect is at least partly driven by the agenda-setting (attention-attraction) mechanism.<sup>10</sup> To test which of the channels is actually at work, we use information about the popularity of the posts that appeared during the same trading day, yet did not contain any market-relevant information, since such posts might have distracted attention of the audience. It appears that the impact of Navalny's blog posts becomes smaller as more people get distracted, thus supporting the agenda-setting hypothesis. As Navalny's posting behavior was unrelated to different measures of popularity of alternative blogs, the reverse causality is unlikely to explain these results.

The diminishing impact of Navalny's posts suggests, among other things, that people, whose behavior was affected by Navalny's blog posts are unlikely to be professional investors who can hardly get distracted by non-market posts in Russian-language blogs. In addition, we find that the average transaction size goes down after Navalny's blog posts, suggesting that people influenced by such blog posts are individuals rather than institutional traders. Again, this points to the significance of the agenda-setting aspect of information revelation.

Taken together, our results provide evidence that social media can trigger accountability mechanisms in large state-controlled companies even in a country with limited political competition and censorship of traditional media. There is a causal effect of the publications in social media on the behavior of market participants, and, correspondingly, on the valuation of state-controlled companies. These results counter the hypothesis that low

<sup>10</sup> Though agenda-setting is a classic mechanism through which media can affect voters' behavior (McCombs and Shaw, 1972, McCombs, 2004), it has not been yet studied in the context of online social media.

entry barriers in the blogosphere make social media publications irrelevant. Similarly, governments' efforts to control mass media do not eliminate the significant role of social media. Our contribution is not only in documenting the real-world impact of social media, but also in identifying some of the mechanisms through which social media can affect accountability.

The effects that we study are not limited to individual blogs in one particular country. Figure 1 demonstrates that countries with greater social media penetration have less corruption, controlling for the level of economic development, while Figure 2 shows that native-language blogs are more likely to mention corruption in countries with less media freedom. Indeed, if social media improves accountability by providing additional checks on corruption and becomes an alternative source of information, one should expect to see less corruption in countries with greater social media penetration, and more information about corruption via social media in countries with lower traditional media freedom. However, such simple cross-country comparisons cannot be interpreted as evidence of a causal effect, and this is where our better-identified within-country results add to the understanding of the mechanisms of social media.

Our paper contributes to the literature that studies the causal impact of media on political outcomes. Most of this literature is focused on the impact of media on people's behavior in democracies such as the U.S. (e.g., DellaVigna and Kaplan 2007; Snyder and Strömberg 2010, Eisensee and Strömberg 2007; Knight and Chiang 2011), or Italy (e.g., Barone, d'Acunto, and Narciso 2014; Drago, Nannincini, and Sobbrino 2014; Durante, Pinotti, and Tesei 2015).<sup>11</sup> For hybrid and authoritarian regimes, the existing works show that state propaganda is effective (Adena et al. 2015, Yanagizawa-Drott, 2014), but so far there is almost no empirical evidence that media enhances accountability in such countries. Moreover results in Malesky, Schuler, and Tran (2012) suggest that in an authoritarian country using online media to monitor public officials may lead to perverse consequences. On the contrary, our results suggest that in a context of an imperfect democracy, social media can promote accountability even in the situation, when traditional local media fail to make a difference (Dyck, Volchkova, and Zingales 2008).

Our paper is also related to emerging literature that uses online data to forecast political developments and financial markets. Acemoglu, Hassan, and Tahoun (2015) show that Twitter activity could predict future returns of firms connected to President Mubarak during the protest demonstrations in Egypt in 2011-2012, though they are mostly focused on the

<sup>11</sup> For a thorough overview of this literature, see DellaVigna and Gentzkow (2010) and Prat and Strömberg (2011).

impact of actual protests on Tahrir Square on the performance of connected firms. Qin, Strömberg, and Wu (2016) show that protest-related content precede actual protests in China, and Sina Weibo penetration precedes the spikes of protest events in a country. Da, Engelberg, and Gao (2011) show that Google Trends can be a good proxy for investor attention and that it predicts future returns. Chen, De, Hu, and Wang (2013) find that the content of the crowdsourcing platform *Seeking Alpha* predicts future returns.<sup>12</sup> Barbera (2015) identifies users' ideal points by analyzing the accounts they follow in Twitter. Knight and Halberstam (2015) find that Twitter users belonging to majority political groups are exposed to more information and get information more quickly than minority groups. All these papers are focused on predictions made using information available online (e.g., on Twitter), but they do not attempt to identify the effect (or lack thereof) of blogging and social media.

Our paper is also related to the literature that studies the impact of ICTs on political preferences and policy outcomes. A number of recent works identifies the impact of broadband penetration on economic growth (e.g. Czernich et al. 2011), voting behavior (Miner 2012, Falck, Gold, and Heblich 2013, Larcinese and Miner 2013, Campante, Durante, and Sobbrío 2014), sexual crime rates (Bhuller et al. 2013), or policy outcomes (Gavazza, Nardotto and Valletti 2015); however, these papers do not provide evidence that the effects are due to the accessibility of online newspapers, search engines, email, Skype communications, or social media.

The rest of the paper is organized as follows: Section 2 provides some background information on state-owned companies in Russia, the LiveJournal social network, and Aleksei Navalny's blog. Section 3 describes the data. Section 4 presents the theoretical framework. Section 5 presents an analysis of the causal impact of blog posts. Section 6 presents the results that separate information effects from attention effects. Section 7 investigates longer term real-life consequences of blog postings and reports some robustness checks. Section 8 concludes.

## **2. Background**

### *2.1 State-controlled companies in Russia*

Despite massive privatization in the 1990s, many companies in Russia are still state-controlled or have been renationalized (Chernykh, 2011). Between 2005 and 2014, the output of these companies accounted for more than 50% of Russia's GDP. Though the state is their

<sup>12</sup> Dougal, Engelberg, Garcia, and Parsons (2012), and Tetlock (2011) look at the impact of media on financial outcomes. Our approach is different as we focus on accountability outcomes and mechanisms.

largest owner, most of these companies are publicly traded. In theory, their management is checked by a board of directors, with the majority of directors appointed by the government. In practice, management at the Russian state-owned companies typically enjoys a degree of freedom unheard of in privately held companies around the world. Accordingly, multiple instances of corporate governance violations and outright fraud have been documented, including share dilution and asset stripping (Desai, Dyck, and Zingales 2007, Durnev and Guriiev 2011, Dyck, Volchkova, and Zingales 2008; see also Shleifer and Treisman 2005).

While millions of dollars have been diverted from these companies (see Black, Kraakman, and Tarasova 2000, for an early account), information about fraud has been difficult to find, and digging into it could be dangerous, as the case of Sergei Magnitsky, the lawyer at Hermitage Capital who died in jail, suggests.<sup>13</sup> Because Russia suffers from a lack of political competition, widespread corruption, and unfair and inefficient courts, minority shareholders have few tools to address issues of corporate governance: attention from international newspapers such as the *Wall Street Journal* or *Financial Times* was one of the few sources they could rely on (Dyck, Volchkova, and Zingales, 2008). However, such tools were inaccessible for ordinary minority shareholders, who had virtually no effective tools to prevent abuse by the insiders of large Russian companies, especially state-controlled ones. The expansion of Internet and the growing influence of online and social media have provided such a tool.

## 2.2 *The Internet and social media in Russia*

As Internet penetration in the country has steadily increased, social media has been playing an increasingly important role as a channel of communication in Russia. By 2012, the country had more than 60 million active Internet users; in other words, more than 40% of the Russian population and 15% of all European Internet users (comScore 2013). The social network engagement of Russia's online population (88%) is similar to that in Norway (89%), Germany (90%), and France (91%). Since 2009, Russian Internet users have spent more than 10 hours per month in social networks, which is one of the highest engagement rates in the world (Blinova, 2013, comScore 2012).

One of Russia's most popular and influential social media sites is LiveJournal (LiveJournal.com). Initially incorporated in the United States and aimed at an English-language audience, by 2005 LiveJournal was hosting 9 million accounts on its Russian site; at that time, 45% of all blog posts in Russia were made on LiveJournal.

<sup>13</sup> "The Enemy Within", *The Economist*, March 9, 2013.

The Internet in general and social media in particular have enjoyed relative freedom in Russia; attempts to control online content began occurring in 2012, i.e., after the period we examine in this paper. This freedom has made LiveJournal and other social media outlets important conduits for transmitting information and enhancing political debate, which was gradually phased out of Russian TV and major newspapers after Vladimir Putin came to power in 2000. Indeed, since 2009, Freedom House has ranked mass media in Russia as “not free,” and Reporters Without Borders has classified Russia as a country with a “difficult situation” in terms of freedom of the press.<sup>14</sup>

### 2.3 *Aleksei Navalny*

Aleksei Navalny, a then-32-year-old lawyer and a member of the opposition party Yabloko, began blogging about corruption in state-controlled companies in 2008. From the very beginning, his goals were political rather than financial.<sup>15</sup> Unlike shareholder activists such as Bill Browder of Hermitage Capital, Navalny had very small stakes in the companies he wrote about. These stakes allowed him to enjoy shareholder privileges, yet were not large enough to earn him significant profits from changes in stock prices. The popularity of Navalny’s blog surged after he launched the *Rospil* project, which focuses on protecting minority shareholders of large state-owned companies and, by extension, the management of taxpayers’ property by the Putin government (Healy and Ramanna, 2013).

In one post, for example, Navalny questioned the charitable spending of Transneft, a major oil transportation company in Russia that owns the largest pipeline in the world and transports more than 90% of Russia’s oil. In 2008, the company spent, according to its own accounting, more on charity than on capital investments. When asked to name Transneft’s recipient charities, company managers said they did not plan to disclose this information. Navalny then contacted a number of leading charity organizations in Russia, none of which reported receiving donations from Transneft. This story attracted much public attention, and in 2011 Transneft started disclosing recipients of its charity donations.

In 2012, Navalny’s blog ([navalny.livejournal.com](http://navalny.livejournal.com)) had more than 70,000 regular followers, making it one of Russia’s most popular blogs in Russia (one of the top ten according to Yandex, Russia’s most widely used search engine), with many more people

<sup>14</sup> See Gehlbach (2010), Gehlbach and Sonin (2014), Treisman (2011), and Guriev and Treisman (2015) on government control of the media in Russia.

<sup>15</sup> Personal interview with Aleksei Navalny by the authors. He claims to invest stakes of around \$1000 in each company (compare with e.g. \$600 million market capitalization of Gazprom), but being a minority shareholder allowed him to demand for information from these companies. We do not have independent verification of his motivation, but, however, Russian media and blogs (including pro-government ones) never discussed any evidence in favor of him getting rich based on his stock market investment .

following the blog through Facebook, VKontakte (the most popular social network in Russia), Twitter (in which his posts are automatically reposted), and RSS feeds.

By late 2011, Navalny's blog had become mostly political, with posts related mainly to elections and politicians rather than to corruption in state-controlled companies. His blog continued to attract more and more attention; eventually, he became an informal leader of the Russian opposition. In 2011, the BBC described him as "arguably the only major opposition figure to emerge in Russia in the past five years,"<sup>16</sup> and in 2012 the *Wall Street Journal* called him "the man Vladimir Putin fears most."<sup>17</sup> In September 2013, Navalny received 27%, the second-largest share of the vote, in the incumbent-dominated Moscow mayoral elections.

In this paper, we focus on the period between January 2008 and August 2011, when Navalny's blog was devoted almost exclusively to the issue of corruption in state-controlled companies; during this time period, Navalny was not yet considered a major political figure.

#### *2.4 Distributed denial-of-service (DDoS) attacks*

A distributed denial of service (DDoS) attack is a form of cyberwarfare, which represents a coordinated effort to disrupt the normal service of the targeted website by overwhelming its server with too much traffic (Douligieris and Mitrokotsa, 2004). In the simplest form of a DDoS attack, many individual computers continuously reload the targeted website in their browsers. More sophisticated and effective DDoS attacks involve the use of multitudes of independent computers and servers without the consent of their owners.

During the past decade, DDoS attacks worldwide have been mainly targeted at government websites, independent news services, and commercial websites (Nazario 2009). After examining worldwide data, Zuckerman et al. (2010) concluded that "DDoS and other cyber-attacks are common against independent media and human rights sites, even outside of elections, protests, and military actions."

Deibert et al. (2010) document the early use of cyber-weapons against the Russian opposition. In 2011 and 2012, the most popular independent news sources in Russia were targeted on days of major opposition-led events, such as meetings or marches, and on the election days (Jaitner 2013). In April 2011, the *New York Times* reported on a series of recent DDoS attacks on the LiveJournal platform that apparently targeted Russian opposition communication.<sup>18</sup>

<sup>16</sup> <http://www.bbc.co.uk/news/world-europe-16057045> (accessed September 24, 2012).

<sup>17</sup> <http://online.wsj.com/article/SB10001424052970203986604577257321601811092.html> (accessed September 24, 2012).

<sup>18</sup> "Russians Riled by Attacks on Blogging Service," Michael Schwirtz, *New York Times*, April 9, 2011.

An important feature of the DDoS attacks that we will use in our identification is that even if the goal of an attack is to silence a specific blogger, services are disrupted for all (or a large part) of the blogging platform, making it hard for all bloggers to post, even if they were not targets of the attack, and also hard for users to read blogs. In particular, although prior to August 2011 there is no evidence that Aleksei Navalny himself was targeted by DDoS attacks, his blog was affected by attacks on other LiveJournal bloggers (see Section 5.3 for details).

### 3. Data

In our analysis we use data from several sources.<sup>19</sup> First, we use data from social media. Our main variable of interest is the mentions of specific companies in Navalny's blog posts at [navalny.livejournal.com](http://navalny.livejournal.com). To identify them, we ran an automatic search for all publicly available posts between January 2008 and August 2011.<sup>20</sup>

We distinguish between ordinary blog posts (mentioning a company at least once in the text of the post), and important blog posts (mentioning a company more than five times in the text of the post).<sup>21</sup> If post mentions different companies, we classify it as a post about each of the companies mentioned. We also record the exact time (hour and minute) at which it became publicly available. Since Navalny reported almost exclusively negative information on the companies he wrote about, we do not classify posts as positive and negative;<sup>22</sup> this allows us to avoid subjective estimates of the tone of the coverage. In total, our dataset contains 318 blog posts about the companies on 233 different trading days.

Figure A1 in the online appendix shows the timing of Navalny's posts. The posts were not evenly dispersed—sometimes he blogged actively, posting multiple entries in a short time span (e.g., at the end of 2008 and the beginning of 2010) and sometimes he went fallow, with almost no blog posts (e.g., at the end of 2010, when he was at Yale taking part in the Yale World Fellows Program). Figure A2 in the online appendix shows the distribution of

<sup>19</sup> All variables and sources are summarized in Table A1 in Appendix.

<sup>20</sup> We focus on this period because before January 2008 Navalny was not involved in an anticorruption campaign, and after August 2011 his blog posts became almost exclusively political and less focused on the companies. Another reason to cut our sample in August 2011 is that after that DDoS attacks started to explicitly target Navalny's blog, so the assumption that DDoS attacks constitute a good source of exogenous variation no longer holds.

<sup>21</sup> We tried to separate posts into more important and less important with the help of research assistants, but resulting classification was not consistent among different RAs. In addition, it turns out that this automatic classification performs better (in terms of market reaction triggered) than any of RA-based classification. We checked that our results are robust to small changes in the importance criterion.

<sup>22</sup> We tried to do that with the help of our research assistants and we find that most of these posts could indeed be classified as "negative", with the number of "positive" posts being negligible.

Navalny's posts across days of the week and hours of the day. He was more likely to post in the middle of the workweek and workday to maximize his audience.<sup>23</sup>

We focus on ten companies Navalny owned shares in and wrote about: Transneft, VTB, Gazprom, Rosneft, Sberbank, Surgutneftegas, Lukoil, Gazprom Neft, RusHydro, and Inter RAO UES.<sup>24</sup> Table A2 in the online appendix summarizes statistics for Navalny's posts by type and by company. In the analysis, we look separately at four companies to which Navalny paid special attention, which we define as being mentioned in more than 75 posts (Transneft, VTB, Gazprom, and Rosneft). For some tests, we use data on all companies in Russian stock index, including the ones that Navalny was not writing about.

In addition to the data on Navalny's blog posts, we also collected information on the number of times these posts were referred to on VKontakte, retweeted on Twitter, and reposted on LiveJournal.com and other blogs. We also use data on the number of comments for each post and a Google Trends' Search Volume Index (SVI) for "Navalny" as a proxy for Navalny's popularity.

Second, we employ data on stock prices on the Russian stock exchange MICEX from finam.ru (intraday data), export.rbc.ru (daily data), and micex.ru (data on the number of transactions). We use data on stock prices, trading volume, and number of transactions.

Third, we use data on precise timing of the mentions of the companies from the two leading newswires in Russia (Reuters and ITAR TASS). Similar to the data on blogs, we distinguish between "ordinary" and "important" news stories, depending on whether newswire stories mention the companies more than five times.

We also collected data on mentions of the companies in three alternate news sources: online news from Yandex News, a news aggregator of the most popular search engine in Russia; other blogs from Yandex's blog aggregator service; and the Web archives of the two most respectable Russian business daily newspapers, *Vedomosti* (a joint project of the *Financial Times* and the *Wall Street Journal*) and *Kommersant*.<sup>25</sup>

Fourth, we collect data on DDoS attacks on the LiveJournal blog service from 2003 to 2011. Using Google News and Yandex News for specific time periods, we identify the incidence and the timing of attacks using publications in online newspapers worldwide (see Table A1 in the online appendix for the list of sources). We double-checked our data with a

<sup>23</sup> Personal interview with Aleksei Navalny by the authors.

<sup>24</sup> One company in the baseline sample, Lukoil, is privately held. However, it is so tightly regulated and closely influenced that its market behavior and features is very similar to most of the other major oil companies, which are state-owned. This was arguably be the reason why Navalny included Lukoil in his list. Our empirical results are fully robust to exclusion of Lukoil.

<sup>25</sup> The same two Russian newspapers were used by Dyck, Volchkova, and Zingales (2008).

worldwide list of such attacks compiled by Zuckerman et al. (2010). The DDoS attacks were sufficiently frequent for our purposes: the unconditional probability of a DDoS attack on a given trading day is 1.1%, while the average unconditional probability of observing a post by Navalny about a particular company in a given trading day is 4.6%.

Fifth, we use data on the number of visitors to LiveJournal.com (from <http://top100.rambler.ru/>) and data on the top 30 blog posts in Russian blogosphere (from [yablor.ru](http://yablor.ru)).

Finally, we use data on the exact dates and times of quarterly reports and information on management turnover from these reports. We also employ data on ongoing corporate conflicts with minority shareholders from the Investor Protection Association, a leading Russian association of institutional investors.<sup>26</sup>

Figure 3 shows how Aleksei Navalny's popularity has changed over time using Google Trends' SVI for the keyword "Navalny" (in Russian). It demonstrates that his popularity evolved exponentially between 2008 and the end of 2010. We use SVI as a proxy for Navalny's popularity in some specifications below.

## 4. Theoretical Framework

To highlight potential mechanisms through which blog postings might affect stock returns, we propose a simple theoretical model in the spirit of Desai, Dyck, and Zingales (2007). The goal of is not to provide a full-fledged theoretical model, but rather to highlight potential mechanisms of blog posts' impact on the performance of the companies mentioned in a post.

Consider a company with a manager who can divert a fraction of the company's profit. We assume that there is imperfect protection of the minority shareholders' rights and allow for some uncertainty about the manager's propensity to steal. In addition, it is possible to enter into corrupt deals with a government.

Specifically, the market value of the company is  $V = (1 - d)(1 - t)$ , where  $d$  is the manager's level of profit diversion,  $t$  is the tax rate, and the expected pre-tax profit without diversion is normalized to 1. The maximand in the manager's problem is

$$V = \lambda(1 - d)(1 - t) + \gamma d - a\delta \frac{d^2}{2},$$

<sup>26</sup> For more information on IPA see <http://ipa-moscow.com/>. Dyck, Volchkova, and Zingales (2008) use data on corporate governance violations by Troika Dialog, which stopped to provide data prior to 2008. IPA continues to collect the same data using the term "presence of a conflict with minority shareholders," and this is the data that we use in our analysis.

where  $\lambda$  is the manager's share in the company,  $\delta$  stands for the quality of protection of shareholders' rights,  $a$  is the investors' attention to the information about the extent of profit diversion,<sup>27</sup> and  $\gamma$  proxies the (unobserved) propensity of the manager to steal.

Assuming an interior solution for the manager's problem (2), it is straightforward to calculate the optimal level of diversion

$$d^* = \frac{1}{a\delta}(\gamma - \lambda(1 - t)).$$

A piece of information about corruption in a blog post might mean several things to shareholders. First, new information might change the market's prior about the manager's propensity to steal,  $\gamma$ .

Prior to a blog post, the value of the company is given by

$$V = \left(1 - \frac{E(\gamma) - \lambda(1 - t)}{a\delta}\right)(1 - t),$$

where  $E(\gamma)$  is the expected value of the manager's propensity to steal. Post-revelation, the expected value of the company is

$$E(V|post) = \left(1 - \frac{E(\gamma|post) - \lambda(1 - t)}{a\delta}\right)(1 - t)$$

where  $E(\gamma|post)$  is the expected value of  $\gamma$  conditional on the revealed information.

Using this expression we can formulate our first prediction:

**Prediction 1.** *If the expected propensity to steal conditional on new information is higher than its unconditional expected value ( $E(\gamma|post) > E(\gamma)$ ), the value of the firm,  $V$ , goes down following the revelation of information.*

The second channel of influence of the posted information on company value is through a change in the quality of shareholders' rights enforcement. Blog posts can foster enforcement of property rights, e.g., by drawing the attention of regulators or political authorities overseeing the management to problems in the companies. Revealed information can imply that  $\delta$ , as perceived by managers, goes up, similar to Dyck, Volchkova, and Zingales (2008) arguing that  $\delta$  goes up after publications in the international financial press. This mechanism suggests that the level of diversion should go down and the value of the company should increase following a release of new information.

**Prediction 2.** *If protection of minority shareholders strengthens as a result of the blog posts, i.e.,  $\delta$  goes up following a blog post, the value of the firm  $V$  increases.*

Next, it could be the case that the money diverted from the companies are used to pay for preferential treatment by government officials such as regulatory protection from

<sup>27</sup> See DellaVigna and Pollet (2009) for a more detailed model focused on investors' inattention.

competitors or firm-specific tax breaks.<sup>28</sup> As shown by Richter et al. (2009), political connections are associated with smaller effective tax rates even in countries with mature markets and strong political institutions such as the United States. If blog postings about corruption make it more difficult for a company to lobby the government, the result might be an effective increase in  $t$ . A corresponding change in the value of the firm is unambiguously negative:

**Prediction 3.** *If the effective tax rate  $t$  for the firm increases, i.e., it becomes more difficult for the firm to cut deals with the government after the information is revealed, the value of the firm  $V$  goes down.*

Finally, investors' attention can affect corporate accountability in the targeted companies. If the public's attention is drawn to corporate misbehavior, managers could be replaced or punished by political authorities. In our framework, that means that attention variable  $a$  is an important driver of punishment of the managers, i.e.

**Prediction 4.** *If public attention to managers' misbehavior increases as a result of a blog post, i.e. the value of parameter  $a$  goes up, the value of the firm  $V$  should increase.*

Empirically, we look at the impact of blog posts on stock returns. Though we cannot fully disentangle the different information channels and the attention channel, we are able to use additional tests to provide some evidence on their relative relevance.<sup>29</sup>

## 5. Causal Impact of Blog Posts

### 5.1 Within-day results

To study the impact of blog posts, we first focus on the within-day analysis. Specifically, we compute the abnormal return  $AR_{it}$  of company  $i$  in period  $t$ , estimated from the market model as a predicted residual from the equation  $r_{it} = \alpha + \beta_i r_{mt} + \gamma_i + \epsilon_{it}$ , where  $r_{mt}$  is the market return, and  $\gamma_i$  is a company fixed effect.<sup>30</sup> We then use five-minute abnormal return as a dependent variable (the five-minute return here is given by  $\frac{p_{it} - p_{it-5}}{p_{it-5}}$ , where  $p_{it}$  is a share's price of company  $i$  in minute  $t$ ).

<sup>28</sup> For example, the natural gas monopolist Gazprom has enjoyed the lowest effective profit tax rates in Russia for years. (See Desai, Dyck, and Zingales, 2007, on preferential tax treatment for Russian state-controlled oil companies.)

<sup>29</sup> An alternative mechanism that we do not discuss is that blog posts could impact higher-order beliefs about different parameters of the model. Our ability to isolate this particular mechanism remain limited: as long as market participants have budget constraints and limited time horizon, a post driving beliefs about a parameter will be observationally equivalent to a post changing higher-order beliefs about this parameter.

<sup>30</sup> Ideally, controls for four Fama-French factors in a market model should be included. However, this is nearly impossible to using within-day or daily data given the low liquidity of companies not included in the Russian stock market index and almost complete absence of small publicly traded companies. Usually, in this situation these factors are estimated monthly. Still, we can show that our results are robust to the inclusion of company-month fixed effects, which makes estimating monthly levels of Fama-French factors redundant.

For our baseline results, we estimate the following empirical specification:

$$AR_{it} = \gamma_0 + \gamma_1 post_{i,t-k,t} + \gamma_2 \delta_{cy} + \gamma_3 \delta_d + \gamma_4 \delta_h + \varepsilon_{it} \quad (1)$$

where  $post_{i,t-k,t}$  is a dummy variable equal to one if Navalny posted about company  $i$  in period  $[t-k, t]$ ;  $\delta_{cy}$  is a company-year fixed effect;  $\delta_d$  is a trading-day fixed effect; and  $\delta_h$  is a trading hour fixed effect. In this specification, coefficient  $\gamma_1$  captures cumulative abnormal return during the period of  $k$  five-minute intervals after a blog post.

We estimate equation (1) for different lengths of windows,  $k$ , before and after the blog posts, conditional on all time-invariant trading day characteristics. We assume that standard errors could be correlated both spatially and temporarily, and we compute standard errors clustered by trading day. Such clustering accounts for both cross-sectional and time-series variation, as there are 120 five-minute intervals per trading day.

Panel A of Table 1 presents the results of the estimation of the effect of blog posts on cumulative abnormal returns (CARs) before and after the posts, based on equation (1).<sup>31</sup> The first row shows the results for all posts pooled together, while the second row shows the results for the subsample of posts, which are more likely to be focused on a particular company (posts that mention companies at least five times). The results indicate that, on average, CARs were not significantly different from zero before blog posts, i.e. no significant pre-trends were detected. However, after the blog posts CARs gradually increase in both magnitude and statistical significance in the next several hours, so that the three-hour CAR is -0.14 p.p. and the eight-hour CAR is already -0.29 p.p. (both significant at 5% level). If we focus only on the blog posts with at least five mentions of companies, the average CAR is negative even within the first five minutes, with a magnitude of -0.06 p.p. (significant at the 10% level). The magnitude of CAR increases from -0.49 p.p. for the three-hour return up to -0.85 p.p. for the eight-hour return (both significant at 5% level).

Although these estimates use precise timing for identification, it is possible that some of the underlying events that happen just before the blog posts are triggering the reaction, and the traders do not learn about these events from the blog. In other words, what we observe might be endogenous to pre-existing coverage of companies in other blogs, newspapers, or traditional media. To deal with this possibility, we use data on precise timing of mentions of the companies in alternative news sources, including news agencies. Specifically, we report

<sup>31</sup> Note that we use (0; k) to denote the k-minutes (or k-day) period beginning with the minute (day) of the event, and we use (k; 0) to denote the k-minutes (or k-day) period ending with the minute (day) of the event.

the results only for blog posts about companies not preceded by *any* mention of these companies within two hours.<sup>32</sup>

Panel B of Table 1 presents the results of this estimation. The results are similar to the results in Panel A, but are always larger in magnitude, suggesting that, if anything, the results in Panel A are biased against our hypothesis. As before, we do not see any significant pre-trends. For blog posts not preceded by mentions of companies in any other news source, the three-hour CAR is equal to -0.23 p.p. (significant at 1% level) and the eight-hour CAR is already -0.46 p.p. (also significant at 1% level). After the important blog posts, CARs become statistically significant at the 5% level two hours after the post, with magnitude increasing from -0.40 p.p. for the two-hour return to -1.06 p.p. for the eight-hour return. Overall, the results in Panel B of Table 1 are consistent with our hypothesis that blog posts have a causal impact on abnormal returns of the companies in question.<sup>33</sup>

Figure 4 graphs our basic results. Specifically, it reports how cumulative abnormal returns change from 8 hours before a blog post to 8 hours after a blog post. Each point is a coefficient from a separate regression in the form (1) where the key independent variable is a dummy for a post happening  $5*k$  minutes before a blog post or  $5*k$  minutes after blog post.<sup>34</sup> In total, the figure shows the results of 336 different regressions. We also report 95% confidence intervals. We show these results for all the posts (Figure 4A) and for the posts, that have at least five mentions of a company in the body of a blog post (Figure 4B). These figures are consistent with the results of regression analysis and visually illustrate the absence of pre-trends.

## 5.2 Daily Results

Next, we examine whether the effect is limited to within-day changes in stock returns or it persists at longer time horizon. Panel C of Table 1 presents CARs based on daily abnormal returns between three days before the post and five days after the post. Specifically, we compute abnormal return  $AR_{id}$  of company  $i$  on day  $d$ , estimated from the market model as a predicted residual from the equation  $r_{id} = \alpha + \beta_i r_{md} + \gamma_i + \epsilon_{id}$ , where  $r_{md}$  is market return, and  $\gamma_i$  is a company fixed effect. We then use daily abnormal return as a dependent

<sup>32</sup> Our results are robust to excluding posts not preceded by mentions during longer time periods. However, such exclusion decreases the number of posts in our sample substantially. Two-hours threshold is chosen as 50% of reposts and retweets of Navalny's blog posts happen within the first two hours, as shown in Figure A3 in Appendix.

<sup>33</sup> Table A3 shows that our coefficients of interest are remarkably stable when controls such as trading-day or company-month fixed effects are added one by one.

<sup>34</sup> In constructing these figures, we follow methodology from Dube, Kaplan, and Naidu (2011).

variable (daily return here is given by  $\frac{p_{id}-p_{id-1}}{p_{id-1}}$ , where  $p_{id}$  is a share's price of company  $i$  in day  $d$ ). Hence, the estimated equation is:

$$AR_{id} = \gamma_0 + \gamma_1 post_{id} + \gamma_2 X_{id} + \gamma_3 \delta_{cy} + \varepsilon_{id} \quad (2)$$

where  $AR_{id}$  is the daily abnormal return of company  $i$  on day  $d$ , estimated from the market model;  $post_{id}$  is a dummy variable equal to one if Navalny posted about company  $i$  on day  $d$ ;  $X_{id}$  is the vector of controls for the information environment, which includes mentions of the company  $i$  in online newspapers, offline business newspapers, and in blogs, in addition to day of the week fixed effects; and  $\delta_{cy}$  is a company-year fixed effect. We consider two alternative ways of clustering: clustering by trading day, which accounts for potential interconnections among abnormal returns within the same trading day, especially important when one post mentions several companies; and clustering by company-month, which accounts for within-company correlation.<sup>35</sup>

The results indicate that the average daily CAR after a blog post was -0.43 p.p. (significant at the 10% level), but after the first day CARs are smaller in magnitude and stop being statistically significant. Daily CAR after an important blog post was -0.85 p.p. (significant at the 5% level), with CAR gradually increasing to 1.47 p.p. for the five-day return (significant at the 10% level). CARs for longer periods are smaller in magnitude and are not statistically significant. In the later section of the paper, we study whether blog posts can have longer-term effects.

In sum, the results reported in Table 1 suggest that blog posts about corruption negatively affect performance of the companies whose managers were accused of corruption.

### 5.3 DDoS results

Our identification of the short-term effect of blog posts on stock returns is based on the precise timing of the blog posts. A potential threat to this identification strategy is the possibility that something unobserved by other news sources happened to these companies precisely during the time Navalny wrote about them. To deal with this possibility, we exploit variation in the availability of Navalny's blog caused by the denial of service (DDoS) attacks. According to local and international press, these attacks were politically motivated but were unrelated to the state-controlled companies we are considering in this paper and, during the

<sup>35</sup> We do not report results with clustering by company because of the relatively small number of companies in our baseline sample. However, the results are robust to clustering by company.

period under consideration, to Navalny himself. In particular, the 2011 attacks were targeted to all top bloggers, most of whom were not writing about politics.<sup>36</sup>

A critical feature of DDoS attacks is that they affect the whole blog platform even if they target a specific blogger, with posting and reading of the blogs becoming problematic for all users of the platform, not only those who posted or read the targeted blogs. Figure 5 compares the audience and page loads of LiveJournal on days with and without DDoS attacks. There was a statistically significant decrease in the number of both LiveJournal daily page loads and LiveJournal daily visitors, implying that DDoS attacks substantially influenced the exposure to LiveJournal posts.<sup>37</sup>

Looking at the days of DDoS attacks allows us to separate episodes in which Navalny deliberately chose not to post from episodes in which Navalny was not able to post and his readers were not able to read. Even if a DDoS attack lasted for less than a trading day, Navalny, who tried to maximize his audience, could rationally abstain from writing during those days.<sup>38</sup> We compare days on which Navalny did not post because of the DDoS attacks, with days on which he did not post or posted about other issues (not companies). The omitted category in the regressions is the days on which Navalny posted about the companies. Thus, we estimate the following equation:

$$AR_{id} = \gamma_0 + \gamma_1 DDoS_d + \gamma_2 post\_no\_company_{id} + \gamma_3 no\_post_d + \gamma_4 X_{id} + \gamma_5 \delta_{cy} + \varepsilon_{id} \quad (3)$$

where  $AR_{id}$  is the daily abnormal return of company  $i$  on day  $d$ , estimated from the market model;  $DDoS_d$  is a dummy for a DDoS attack on day  $t$ ,  $post\_no\_company_{id}$  is a dummy variable equal to 1 if Navalny posted about something other than company  $i$  on day  $d$ ,  $no\_post_t$  is a dummy equal 1 if Navalny did not post on day  $d$  in the absence of DDoS attack;  $X_{id}$  is the vector of controls for information environment, which includes mentions of company  $i$  in online newspapers, offline business newspapers, and in blogs, in addition to day of the week fixed effects; and  $\delta_{cy}$  are company-year fixed effects.<sup>39</sup> Note that although on

<sup>36</sup> In February 2012, a group of anonymous hackers published a collection of private emails of leaders of Kremlin-related youth organizations and government officials, including the Minister for Youth Affairs, Vassily Yakemenko (e.g. [http://www.gazeta.ru/politics/2012/02/06\\_a\\_3990869.shtml](http://www.gazeta.ru/politics/2012/02/06_a_3990869.shtml)). The emails suggested that state-sponsored organizations were responsible for some of the DDoS attacks on websites belonging to Russian media during that period. However, there has been no evidence that Navalny's blog was an explicit target for DDoS attacks by these groups at that time.

<sup>37</sup> The number of visitors during DDoS attacks might not be equal to 0 for several reasons: (1) an attack might lasted only a few hours; (2) because of the peculiar structure of the LiveJournal's data storage, only Russian-language accounts might have been affected; (3) an attack might have been not strong enough to affect every single visitor, and a certain fraction of visitors was able to load the pages requested. These considerations should not substantially affect the power of the instrument, as Navalny preferred not to post when he expected his audience to be smaller for any reason.

<sup>38</sup> We can also show that, during DDoS attacks, unimportant posts were postponed by one day, whereas important posts were postponed for longer. There is no effect of DDoS attacks on information coming from other sources. These results are available upon request.

<sup>39</sup> Overall, we use data from 17 DDoS attacks. As our sample period ends in August 2011, it does not include pre- and postelection attacks in November and December of 2011. Though the total number of attacks is small, we test if they affect

most days Navalny did not post about the companies, he was more likely to write something else than not posting at all (unconditional probability of a post was 70%).

We expect the sign of coefficients  $\gamma_1$ ,  $\gamma_2$ , and  $\gamma_3$  to be positive, and similar in magnitudes, as all these events, including the DDoS attacks, imply that there was no negative information about the company from Navalny. If the readers of the blog are rational, but unable to perfectly observe the incidence of DDoS attacks, then we expect coefficient  $\gamma_1$  to be smaller than  $\gamma_2$  or  $\gamma_3$ .

Results in column (1) of Table 2 indicate that on the days on which Navalny could not post because of a DDoS attack, daily abnormal returns of the companies from the baseline sample (the companies Navalny ever wrote about) were higher by 0.36 p.p., as compared to the days on which Navalny wrote something about these companies (the difference is statistically significant at the 5% level). Results in column (2) demonstrate that the effect of a DDoS attack is similar to the effect of the absence of a post (0.49 p.p.) and to the effect of posts about anything except the company in question (0.43 p.p.), with F-statistics for a corresponding Wald test implying that the hypothesis of equality of the coefficients cannot be rejected. This finding is consistent with idea that investors interpret a DDoS attack as an event similar to the absence of posts about a company. An ideal test would be to isolate the set of days on which Navalny wanted to post and then make a comparison, but unfortunately it is not feasible.

Results in columns (3) and (4) indicate that the effect of DDoS attacks is especially significant (at the 1% level) in the “high-attention” sample (the sample of companies Navalny wrote about at least 70 posts each over 3.5 years). Numerically, the coefficients of both DDoS attacks (0.55 p.p.) and dummies for no posts about companies (0.56 p.p. and 0.57 p.p.) are larger than those for the baseline sample, as reported in column (2).

It is theoretically possible, however, that DDoS attacks provide the market with some sort of information about government policy, so they might indeed reveal some information about future returns of the companies Navalny was writing about. To cope with this possibility, we conduct two placebo tests. First, we look at the returns of the companies Navalny was not writing about (columns 5 and 6). Second, we look at the returns of the state-controlled companies Navalny was not writing about (columns 7 and 8).<sup>40</sup>

different companies differently, depending on how much Navalny wrote about these companies, so this analysis is based on 17\*28 (10\*28 for the baseline sample) points of nonzero attack-company pairs.

<sup>40</sup> Figure A4 in Appendix shows that lags and leads of DDoS attacks do not change abnormal returns of the companies. We also conducted a number of robustness tests to ensure that DDoS attacks do not coincide with any other important events. In addition, we can show that the impact of attacks is proportional to the number of Navalny’s posts about the attack in specifications with DDoS attack fixed effects. These results are available upon request.

The results in columns 5 and 6 show that abnormal returns of the companies Navalny did not write about were not significantly higher during DDoS attacks. The magnitude of the coefficient is 0.12, which is three times smaller than the coefficient in column (1), with the standard error approximately equal to the coefficient. Columns 7 and 8 report that for the state-controlled companies that Navalny did not write about, the coefficient for DDoS attacks is essentially equal to zero, with a standard error 15 times larger than the coefficient. This test allows us to reject the hypothesis that DDoS attacks were helpful for all state-controlled companies.

Overall, the results in Table 1 and Table 2 suggest that Navalny’s blog posts had, on average, a negative causal impact on the abnormal returns of the companies he was writing about.

## 6. Real Effects of Blog Posts

### 6.1 Long-term effects

In addition to looking at the short-term effects, we also examine the long-term effects of blog posts on stock prices. Specifically, we assess the performance of trading strategies based on Navalny’s blog posts. We consider three different zero-cost portfolios constructed by going short one unit of capital at the start of each calendar month on all stocks of companies that were mentioned in an important Navalny post in the previous quarter and going long one unit of capital on all stock of companies in a comparison groups about which there were no blog posts by Navalny in the previous quarter. The three portfolios differ with respect to the alternative comparison groups: (1) all the firms included in the MICEX stock index, (2) all the state-owned companies included in the MICEX stock index, and (3) the ten companies about which Navalny wrote. Portfolios are equally weighted, so that at any time, the strategy is short  $1/N_B$  units of capital across  $N_B$  companies Navalny blogged about and long  $1/N_{NB}$  units of capital across  $N_{NB}$  companies about which Navalny didn’t blog.

Figure 6 shows the performance of portfolios between June 1, 2008 (the month following the first important blog post) and December 1, 2011. For comparison, we also include the cumulative value of investing in the market, in excess of the risk-free rate. The results indicate that all of the three portfolios were noticeably outperforming the market throughout the whole period.

Table 3 reports results for different trading strategies using time-series regressions for a one-factor model that corresponds to the graphical evidence in Figure 6. The results indicate that all three strategies demonstrate significantly positive monthly alphas that range from

1.6% for the portfolio based on the ten companies Navalny wrote about (with insignificant beta of 0.55) to 5.0% for the portfolio of state-owned companies (with beta equal to 1.28, significant at the 1% level) and Sharpe ratios that vary from 0.27 to 0.47. To correct for serial correlation, standard errors are computed using Newey-West correction with five lags. Thus, from an investment perspective, all three strategies turn out to be more profitable than the market portfolio.<sup>41</sup> Overall, the results presented in Table 3 and Figure 6 show that Navalny's posts have, on average, a negative long-term impact on the stock performance of the companies he wrote about.

### *6.2 Effects on governance: evidence from popularity measures*

Next we examine whether blog posts produce any real-life changes in the target companies. Dyck, Volchkova, and Zingales (2008) suggest that Russian companies respond to publications in major international newspapers by improving their corporate governance. However, whether or not they react in a similar way to posts of an individual domestic blogger is a very different question. As demonstrated in Figure 3, which shows the evolution of Navalny's popularity, as measured by search volume through a Google Trends SVI, over time, Navalny became a popular blogger only toward the end of 2010, close to the end of our study period. It is natural to expect that the companies would have been more likely to react to Navalny's posts after Navalny gained popularity and his blog posts became a more popular information source.

To determine whether there is any evidence of the accountability effect, outlined in Proposition 2 of our theoretical framework, we analyze how the effect of blog posts depends on the popularity of particular posts. If blog posts affect stock performance only by lowering market perceptions of the quality of management, the negative effect should be stronger for more popular posts, which attract more attention of the general public. In addition, more popular posts are likely to contain more new information, which could explain why they attract more attention. However, if the accountability mechanism is also at work, the negative effect of blog posts on stock returns might be weaker or even reverse its sign for the most popular posts, since the most popular blog posts are most likely to attract attention by public officials and trigger accountability mechanisms.

To test whether the market indeed interprets blog posts by Navalny as a positive signal about future performance of the companies when these posts attract sufficient attention, we estimate the following equation:

<sup>41</sup> In the analysis, we ignore the transaction costs of rebalancing portfolios, but since rebalancing occurs only once per month, the effect of transaction costs is likely to be small.

$$AR_{id} = \gamma_0 + \gamma_1 post_{id} \cdot Navalny\_post\_popularity_{id} + \gamma_2 post_{id} + \gamma_3 X_{id} + \gamma_4 \delta_{cy} + \varepsilon_{id} \quad (4)$$

where  $post_{it}$  is a dummy for Navalny's blog posts about company  $i$  on day  $d$ ;  $Navalny\_post\_popularity_{it}$  is a proxy for the popularity of Navalny's posts;  $X_{id}$  is the same vector of controls as in equation (3); and  $\delta_{cy}$  are company-year fixed effects. As measures of popularity, we use proxies for the popularity of the Navalny's blog in general (as measured by the plain Google Trends SVI for Navalny or a dummy for SVI being more than 10) and of particular Navalny blog posts (as measured by dummies for whether a post belongs to a top decile in terms of reposts, retweets, or references in VK,<sup>42</sup> as well as the number of comments in the original LiveJournal posts).<sup>43</sup>

For the important posts all but one of the interaction terms are positive and statistically significant, whereas the direct effect of the posts is always negative and statistically significant (see Panel A of Table 4). The results suggest that the popularity of the posts does not increase the magnitude of the baseline negative effect (as we would expect based on the results in Engelberg and Parsons 2011, Engelberg, Sasseville, and Williams 2012, or Peress 2014), but rather decreases it, so that the composite effects are often positive, rather than negative. However, if we consider all the blog posts and not just the important ones, the significance of the interaction terms disappears (see Panel B of Table 4).

These results imply that for the posts that do not attract a sizable audience, only the negative information effect is at work, whereas for the posts that attract sufficient attention, the positive accountability effect is also at play, and these posts can trigger a reaction by company management or the government. These interaction effects, however, seem to be at work only for more informative posts (posts with more than five mentions of the company).<sup>44</sup>

### *6.3 Effects on governance: evidence from real changes in companies*

To examine whether Navalny's posts are indeed associated with some real-life changes in governance, we investigate whether the posts were associated with higher management turnover and with the probability of having a conflict with minority shareholders.<sup>45</sup> A positive relationship between these measures and blog posts would be consistent with our interpretation of the results in Table 4 and would suggest that the market is correct in expecting positive changes in these companies following blog posts.

In particular, we estimate the following specification:

<sup>42</sup> VK is the Russian analog of Facebook; in 2008-2011, it have been more popular in Russia than the Facebook itself.

<sup>43</sup> Our results remain very similar for other popularity thresholds.

<sup>44</sup> Table A5 in Appendix shows that similar results hold for five-minute data. We cannot use data on reposts in within-day analysis, as the precise timing of reposts is not available.

<sup>45</sup> Unfortunately, there are no better measures of corporate governance with sufficient time variation.

$$Governance_{iq} = \gamma_0 + \gamma_1 Nposts_{iq} + \gamma_2 X_{iq} [\gamma_3 Npost_{iq} \cdot SVI_{iq} + \gamma_4 SVI_{iq}] + \varepsilon_{iq} \quad (5)$$

where we use the management turnover and a dummy for a conflict with minority shareholders in the end of the quarter as proxies for the governance changes in company  $i$  in quarter  $q$ .  $Nposts_{iq}$  is the number of Navalny's posts about the company  $i$  in quarter  $q$ ; vector  $X_{iq}$  includes company and year fixed effects. In some specifications, we also report the results for the interaction with a measure of popularity of Navalny's blog,  $SVI_{iq}$ , specifically, a dummy for Google SVI for Navalny being larger than 10 (the corresponding terms are in brackets in equation (5)).

First, we test whether the probability of managerial turnover is higher following Navalny's blog posts about a company. Based on the quarterly reports of the companies, we collected data on actual changes in the top management throughout the period and use it as a dependent variable. We find that in quarters with more important blog posts about the company, the probability of a management turnover was 3.3% higher (see column (1) in Panel A of Table 5). The results in Column (2) show that the effect of Navalny's posts became significant only when his blog became sufficiently popular, i.e. when we include the dummy variable for a Google Trends SVI for Navalny being larger than 10, with 6.9% higher probability of turnover following the blog entries he posted as he grew more popular. If we consider all the blog posts, the coefficients for the average effect of the blog posts in column (3) and for the interaction with the measure of the popularity of Navalny's blog in column (4) are also positive, although not statistically significant.

While we do not observe the specific reasons for the management turnover and whether they were ultimately beneficial for companies, we can test whether or not the posts were associated with benefits for minority shareholders. Specifically, we look at the effect of posts on incidence of conflicts with minority shareholders. The results presented in Panel B of Table 5 indicate that one additional post from Navalny about a particular company decreased the probability of an ongoing conflict with minority shareholders in this company at the end of the quarter by 6% to 7%, depending on the specification. The effect is stronger for more popular posts, though the difference is not statistically significant. Thus, the results in Table 5 suggest that Navalny's posts are associated with tangible changes of corporate governance in the targeted companies.

Overall, the results in Tables 4 and 5 provide evidence that once blog posts attract enough attention, they can lead to improvements in corporate governance practices of the targeted companies. This positive impact, however, is limited to more informative posts, i.e. posts with at least five mentions of the companies.

## 6.4 Robustness checks

We estimate a number of alternative specifications to check the sensitivity of our results. First, we estimate our baseline results with bootstrapped, rather than clustered, standard errors. We also use clustered standard errors by company-year rather than by trading day in a daily sample. The results remain very similar. Second, we check that our results are robust to the inclusion of the lead of Google Trends' Search Volume Index (SVI), which Da, Engelberg, and Gao (2011) found to be related to stock performance. Third, we check that the results for daily abnormal returns hold if we use company-month instead of company-year fixed effects.

Finally, instead of regression-based estimation, we use a more traditional, "out-of-sample" event study design, where normal returns are computed for a time period before the blog posts, and abnormal returns are computed as an out-of-sample prediction. We find that for reasonable parameters (with the estimation window being one year before the start of blogging) this approach generates similar results. However, these results are quite sensitive to the choice of the estimation window and the event window parameters. For this reason we chose to report the results using in-sample methodology, as these results are robust to different specifications and changes in estimation procedures.

## 7. Mechanisms

### 5.1 Information channels

Our theoretical framework suggests that there are different potential ways through which information can affect the market performance of the companies. Unfortunately, we cannot separate the impact of negative information about diversion in a company and the impact of posts on the opportunities for future corruption, as they both imply negative impact on a firm's value (Predictions 1 and 3 from the theoretical framework). The results from Tables 4 and 5 suggest, however, that an accountability channel becomes important for the most informative and the most influential posts, which have a positive impact on the firm's value and trigger actual changes in management (Predictions 2 and 4 from the theoretical framework). Thus, our results are consistent with all theoretical mechanisms being at work and their relative importance changing over time.

### 5.2 Attention to alternative blogs

It is important to separate the information effects from the agenda-setting (attention) effect, as these effects might have different implications. In this section, we use data on the

popularity of blog posts by other bloggers that are unrelated to the companies to understand whether investor attention actually plays a role in how blog posts affect the stock market.

We employ two different measures of popularity of the alternative blog posts. The first measure is the largest number of comments on non-Navalny's blog posting on a given trading day. The second measure takes into account the fact that top ten posts on LiveJournal were specifically advertised on its main page every day. We cannot directly compare the popularity of blog posts in this top ten list between days (each day, ten most popular posts would appear in the list), so we create a dummy for whether the post with the largest number of comments (popularity according to the first measure) was at the same time a top ten post on a given day (popularity according to LiveJournal's own measure, which we do not directly observe). We use this dummy as a second measure of the popularity of the most popular alternative post in a given trading day.<sup>46</sup>

We estimate the following model:

$$AR_{id} = \gamma_0 + \gamma_1 post_{id} \cdot popularity_d + \gamma_2 post_{id} + \gamma_3 popularity_d + \gamma_4 X_{id} + \gamma_5 \delta_{cy} + \varepsilon_{id} \quad (6)$$

where  $post_{id}$  is a dummy for Navalny's blog posting about company  $i$  on day  $d$ ;  $popularity_d$  is one of two popularity measures for alternative posts, described above;  $X_{id}$  is the same vector of controls, as in equation (3); and  $\delta_{cy}$  are company-year fixed effects.

Table 6 reports the results of this estimation. Columns (1) and (2) show that the average impact of Navalny's blog posts was smaller on days with popular alternative posts. The result holds for both measures, and the magnitudes of the interaction coefficients are large enough to change the sign of the aggregate effect of the blog posts. These results suggest that when the attention of the readers is distracted from Navalny's blog, his posts no longer have an impact on the market. Results in column (3) and (4) demonstrate, however, that the distraction of attention does not happen for the more informative blog posts (posts with more than five mentions of the companies), i.e., posts that presumably had some informational content.

Note that Navalny's posting behavior was not significantly correlated with any of the popularity measures for alternative posts that we use (Online Appendix Table A4), so it is not the case that Navalny was checking for the presence of popular blog posts elsewhere before deciding to blog about the companies. It also does not seem to be the case that other bloggers took Navalny's behavior into account when making decisions about the timing of their posts.

<sup>46</sup> The construction of these measures is dictated by data availability; unfortunately, we do not have continuous data on the number of visits to different posts for the time-period preceding mid-2009.

Overall, these results suggest two implications. First, at least one of the mechanisms for the impact of Navalny’s blog posts is attention-based, and the readers of his blog are easily distracted by unrelated content. Second, traders affected by Navalny’s posts through the attention mechanism are not institutional investors, as their attention is not likely to be distracted by other Russian-language blogs.

## 5.2 Average Transaction Size

To better understand who are the investors affected by Navalny’s blog, we also investigate whether or not the average size of market transactions is different for the days with blog posts. Smaller market transactions point to trading by individual rather than institutional investors, consistent with the importance of behavioral, attention-based effect. Ideally, we would like to compare the whole distribution of transactions, but data availability allows us to use only the average size of trades. We estimate the following equation:

$$Average\_Size\_of\_Trade_{id} = \gamma_0 + \gamma_1 post_{id} + \gamma_2 X_{id} + \gamma_3 \delta_{cy} + \varepsilon_{id} \quad (7)$$

where  $Average\_Size\_of\_Trade_{id}$  is the daily trading volume for company  $i$  on day  $d$ , divided by the number of transactions;  $post_{id}$  is a dummy variable equal to one if Navalny posted about company  $i$  on day  $d$ ;  $X_{id}$  is the same vector of controls, as in equation (3); and  $\delta_{cy}$  are company-year fixed effects.

Table 7 presents the results of these estimations. Column (1) shows that the average size of trades was 6.3% smaller in the days with posts (significant at the 5% level), and column (2) shows that the average size of trade was 8.3% smaller in days with more informative posts (significant at the 10% level). In sum, these results suggest that individual shareholders are more likely to be affected by Navalny’s posts.

It is theoretically possible that the market transaction size goes down in specific periods for reasons unrelated to blog postings. To address this possibility, we test to see whether placebo posts (dummies for one and two days ahead of the posts) have any significant impact of the average size of transactions. The results, reported in columns (3)-(6), show that there are no significant pre-trends, and the size of transactions goes down during the days of the posts, but not before them.

Overall, the results of both Table 6 and Table 7 suggest that limited attention explains at least part of the effect of Navalny’s blog posts, identified in Table 1, and the traders most affected by the posts are individual traders reading other Russian-language blogs.

## 8. Conclusion

Do online social media change the way businesses and governments work? The existing literature provides conflicting arguments about the potential impact of new media. In this paper, we focus on the case of an influential Russian blogger to empirically demonstrate that an anticorruption blog can have a measurable, sizable impact on accountability. Specifically, we show that the anticorruption blog posts by Alexei Navalny, a popular blogger, shareholder activist, and future opposition leader, have affected the stock performance of companies whose wrongdoings he has exposed. We also provide indirect evidence that these blog posts were associated with an increase in accountability within state-controlled companies he was writing about.

While the existing literature demonstrates the impact of traditional mass media on corporate and political accountability in democratic countries, we show that similar effects seem to be present for online social media in countries with limited political competition, which are often plagued by information inefficiencies and corruption at many levels.. Thus, our results suggest that social media can improve the quality of governance in places that need it the most.

## References

- Acemoglu, Daron, Tarek Hassan, and Ahmed Tahoun (2015) “The Power of the Street: Evidence from Egypt’s Arab Spring,” *working paper*.
- Adena, Maja, Ruben Enikolopov, Maria Petrova, Veronica Santarosa, and Ekaterina Zhuravskaya (2015) “Radio and the Rise of Nazi in pre-War Germany,” *Quarterly Journal of Economics*, 130(4): 1885-1939.
- Barberá, Pablo (2015) “Birds of the Same Feather Tweet Together. Bayesian Ideal Point Estimation Using Twitter Data,” *Political Analysis*, 23 (1), 76-91
- Barone, Guglielmo and D’Acunto, Francesco and Narciso, Gaia (2015) “Telecracy: Testing for Channels of Persuasion,” *American Economic Journal: Economic Policy*, 7(2), 30-60.
- Besley, Timothy and Andrea Prat (2006) “Handcuffs for the Grabbing Hand? Media Capture and Government Accountability,” *American Economic Review*, 96(3), 720–736.
- Bhuller, Manudeep, Tarjei Havnes, Edwin Leuven, and Magne Mogstad (2013) “Broadband Internet: An Information Superhighway to Sex Crime?” *Review of Economic Studies*, 80 (4), 1237-1266.
- Black, Bernard, Kraakman, Reinier, and Tarassova, Anna (2000) “Russian Privatization and Corporate Governance: What Went Wrong?,” *Stanford Law Review*, 52(6), 1731–1808.
- Blinova, Marianna (2013) “Social Media in Russia: Its Features and Business Models,” in: *Handbook of Social Media Management. Value Chain and Business Models in Changing Media Markets*, Springer: Berlin.
- Cage, Julia (2013) “Media Competition, Information Provision and Political Participation,” *working paper*
- Campante, Filipe, Ruben Durante, and Francesco Sobbrío (2013) “Politics 2.0: The Multifaceted Effect of Broadband Internet on Political Participation,” *working paper*
- Chen, Hailiang, Prabuddha De, J. Hu, and Byoung-Hyoun Hwang. (2014) “Wisdom Of Crowds: The Value Of Stock Opinions Transmitted Through Social Media”, *Review of Financial Studies*, 27(5), 1367-1403.
- Chernykh, Lucy (2011) “Profit or Politics? Understanding Renationalizations in Russia,” *Journal of Corporate Finance*, 17(5), 1237–1253.
- Chiang, Chun-Fang, and Brian Knight (2011) “Media Bias and Influence: Evidence from Newspaper Endorsements,” *Review of Economic Studies*, 78(3), 795–820.

Chong, Alberto, Ana de la O, Dean Karlan, and Leonard Wantchekon (2015) “Does Corruption Information Inspire the Fight or Quash the Hope? A Field Experiment in Mexico on Voter Turnout, Choice and Party Identification,” *Journal of Politics*, 77(1), 55-71.

Czernich, Nina, Oliver Falck, Tobias Kretschmer, and Ludger Woessmann (2011) “Broadband infrastructure and economic growth,” *The Economic Journal*, 121(552), 505-532.

Da, Zhi, Joseph Engelberg, and Pengjie Gao (2011) “In Search of Attention,” *Journal of Finance*, 66(5), 1461–1499.

Deibert, Ronald, John Palfrey, Rafal Rohozinski and Jonathan Zittrain, eds. (2008) *Access Denied: The Practice and Policy of Global Internet Filtering* (Cambridge: MIT Press).

Deibert, Ronald, John Palfrey, Rafal Rohozinski and Jonathan Zittrain, eds. (2010) *Access Controlled: The shaping of power, rights, and rule in cyberspace* (Cambridge: MIT Press).

DellaVigna, Stefano and Ethan Kaplan (2007) “The Fox News Effect: Media Bias and Voting,” *Quarterly Journal of Economics*, 122(3), 807–860.

DellaVigna, Stefano and Gentzkow Matthew (2010) “Persuasion: Empirical Evidence,” *Annual Review of Economics*, 2, 643-669.

DellaVigna, Stefano, and Joshua Pollet (2009) “Investor Inattention and Friday Earnings Announcements,” *Journal of Finance*, 64, pp. 709-749.

Desai, Mihir A., Alexander Dyck and Luigi Zingales (2007) “Theft and taxes,” *Journal of Financial Economics*, 84(3), 591-623.

Djankov, Simeon, Caralee McLiesh, Tatiana Nenova, and Andrei Shleifer (2003) “Who Owns the Media?” *Journal of Law and Economics* 46 (2), 341–82.

Dougal, C., J. Engelberg, D. García, and C. A. Parsons (2012) “Journalists and the Stock Market,” *Review of Financial Studies*, 25 (3): 639-679.

Douligeris, Christos and Aikaterini Mitrokotsa (2004) “DDoS Attacks and Defense Mechanisms: Classification and State-of-the-art,” *Computer Networks*, 44(5), 643–666.

Drago, Francesco, Tommaso Nannincini, and Francesco Sobbrino (2014) “Meet the Press: How Voters and Politicians Respond to Newspaper Entry and Exit,” *American Economic Journal: Applied Economics*, 6(3), 159-188.

Durante, Ruben, Paolo Pinotti, and Andrea Tesei (2015) “The Political Legacy of Entertainment TV,” *Working Paper*.

Durnev, Art and Sergei Guriev (2011) “Expropriation Risk, Corporate Transparency, and Growth,” working paper

Dyck, Alexander, Natalya Volchkova, and Luigi Zingales (2008) “The Corporate Governance Role of the Media: Evidence from Russia,” *Journal of Finance*, 63(3), 1093–1135.

Edmond, Chris (2013). Information manipulation, coordination, and regime change. *The Review of Economic Studies*, 80(4), 1422-1458.

Eisensee, Tomas and David Strömberg (2007), “News Droughts, News Floods, and U.S. Disaster Relief,” *Quarterly Journal of Economics*, 122(2), 693–728.

Enikolopov, Ruben, Maria Petrova, and Ekaterina Zhuravskaya (2011) “Media and Political Persuasion: Evidence from Russia,” *American Economic Review*, 101(7), 3253–3285.

Engelberg, Joseph and Christopher A. Parsons (2011) “The Causal Impact of Media in Financial Markets,” *Journal of Finance*, 66(1), 67-97.

Esfandiari, Golnaz (2010) “The Twitter devolution,” *Foreign Policy*, 2, 27.

Faccio, Mara (2006) “Politically Connected Firms,” *American Economic Review*, 96(1), 369-386.

Falck, Oliver, Robert Gold, and Stephan Heblich (2014) "E-Lectons: Voting Behavior and the Internet", *American Economic Review*, 104 (7): 2238-2265

Fergusson, Leopoldo, Juan F. Vargas, and Mauricio Vela (2013) "Sunlight Disinfects? Free Media in Weak Democracies," *Cede Working Paper 2013-14*

Ferraz, Claudio and Frederico Finan (2008) “Exposing Corrupt Politicians: The Effects of Brazil’s Publicly Released Audits on Electoral Outcomes,” *Quarterly Journal of Economics*, 123(2), 703–745.

Ferraz, Claudio and Frederico Finan (2011) “Electoral Accountability and Corruption: Evidence from the Audits of Local Governments,” *American Economic Review*, 101(4): 1274-1311.

Fisman, Raymond (2001) “Estimating the Value of Political Connections,” *American Economic Review*, 91(4), 1095-1102.

Fisman, Raymond and Y. Wang (2015) “Mortality Costs of Political Connections,” *Review of Economic Studies*, 82(4), 1346-1382.

- Gavazza, Alessandro, Mattia Nardotto, and Tommaso Valletti (2015) "Internet and Politics: Evidence from UK Local Elections and Local Government Policies," *working paper*.
- Gehlbach, Scott (2010) "Reflections on Putin and the Media," *Post-Soviet Affairs*, 26(1), 77–87.
- Gehlbach, Scott and Konstantin Sonin (2014) "Government Control of Media," *Journal of Public Economics*. 118,163-171.
- Gentzkow, Matthew, and Jesse M. Shapiro (2006) "Media Bias and Reputation." *Journal of Political Economy* 114, (2), 280-316.
- Gentzkow, Matthew, and Jesse M. Shapiro (2011) "Ideological Segregation Online and Offline," *Quarterly Journal of Economics*. 126(4), 1799-1839.
- Gentzkow, Matthew, Edward Glaeser, and Claudia Goldin. 2006. "The Rise of the Fourth Estate: How Newspapers Became Informative and Why It Mattered." In *Corruption and Reform: Lessons from America's Economic History*, eds. E. L. Glaeser, and C. Goldin. Cambridge, MA: NBER.
- Gentzkow, Matthew, Jesse Shapiro, and Michael Sinkinson (2011) "The Effect of Newspaper Entry and Exit on Electoral Politics," *American Economic Review*, 101(7), 2980-3018.
- Guriev, Sergei, and Daniel Treisman (2015) "How Modern Dictators Survive: Cooptation, Censorship, Propaganda, and Repression," *working paper*
- Halberstam, Yosh, and Brian Knight (2015) "Homophily, Group Size, and the Diffusion of Political Information in Social Networks: Evidence from Twitter," *working paper*
- Healy, Paul M. and Karthik Ramanna (2013) "When the Crowd Fights Corruption," *Harvard Business Review*, 91(1/2), 122–129.
- Jaitner, Margarita (2013) "Exercising Power in Social Media," in: *The Fog of Cyber Defense*, Jari Rantapelkonen and Mirva Salminen, eds., National Defense University, Helsinki.
- King, Gary, Jennifer Pan, and Margaret E Roberts (2013) "How Censorship in China Allows Government Criticism but Silences Collective Expression," *American Political Science Review*, 107(2), 1–18.
- King, Gary, Jennifer Pan, and Margaret E Roberts (2014) "Reverse-engineering censorship in China: Randomized experimentation and participant observation" *Science*, vol. 245 (6199)
- Larcinese, Valentino and Luke Miner (2012) "The Political Impact of the Internet on US Presidential Elections," *Working Paper*.

- Larson, Jennifer (2014) "Twitter, the Unambiguous Liberator?" working paper
- Lorentzen, Peter (2014) "China's Strategic Censorship," 58 (2), pp. 402–414
- Lotan, Gilad, Erhardt Graeff, Mike Ananny, Davin Gaffney, Ian Pearce, and Danah Boyd (2011) "The Revolutions Were Tweeted: Information Flows During The 2011 Tunisian And Egyptian Revolutions," *International Journal of Communications*, 5, 1375–1405.
- Malesky, Edmund, Paul Schuler, and Anh Tran (2012) "The Adverse Effects of Sunshine: Evidence from a Field Experiment on Legislative Transparency in an Authoritarian Assembly," *American Political Science Review*, 106(4): 762-786.
- McCombs, Maxwell (2004) *Setting the Agenda: The Mass Media and Public Opinions*. Cambridge: Polity Press.
- McCombs, Maxwell, and Donald Shaw (1972) "The Agenda setting Function of Mass Media." *Public Opinion Quarterly* 36:176–87.
- McMillan, John and Pablo Zoido (2004) "How to Subvert Democracy: Montesinos in Peru," *Journal of Economic Perspectives*, 18(4), 69-92.
- Miner, Luke (2012) "The Unintended Consequences of Internet Diffusion: Evidence from Malaysia," *Working Paper*.
- Mozorov, Evgeny (2011) *The Net Delusion: The Dark Side of Internet Freedom*. New York: Public Affairs.
- Nazario, Jose (2009) "Politically Motivated Denial of Service Attacks," in *The Virtual Battlefield: Perspectives on Cyberwarfare*, Christian Czosseck and Kenneth Geers, eds., IOS Press
- Peress, Joel (2014) "The Media and the Diffusion of Information in Financial Markets: Evidence from Newspaper Strikes," *Journal of Finance* 69(5): 2007–2043.
- Prat, Andrea and David Strömberg (2011) "Political Economy of Mass Media," *Working Paper*.
- Qin, Bei, David Strömberg, and Yanhui Wu (2016) "The Political Economy of Social Media in China," *Working Paper*.
- Richter, Brian Kelleher, Krislert Samphantharak, and Jeffrey Timmons (2009) "Lobbying and Taxes," *American Journal of Political Science* 53 (4), 893–909.

Sabadelo, Markus (2011) "The Role of New Media in Democratization Processes in the Arab World," in: *The Arab Revolutions*, Zsolt Sereghy, Sarah Bunk, and Bert Preiss, eds., Austrian Study Center for Peace and Conflict Resolution.

Snyder, James and David Strömberg (2010) "Press Coverage and Political Accountability," *Journal of Political Economy*, 118(2), 355–408.

Strömberg, David (2004) "Radio's Impact on Public Spending," *Quarterly Journal of Economics*, 119(1), 189–221.

Tetlock, Paul (2011) "All the news that's fit to reprint: Do Investors React To Stale Information?" *Review of Financial Studies*, 24 (5): 1481-1512.

Treisman, Daniel (2011). *The Return: Russia's Journey From Gorbachev To Medvedev*. Free Press, New York.

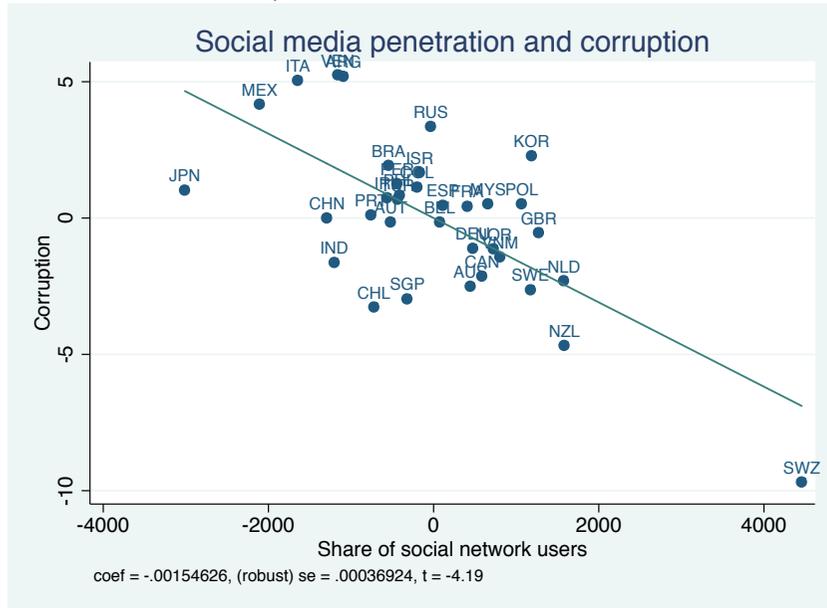
Tufekci, Zeynep and Christopher Wilson (2012) "Social Media and the Decision to Participate in Political Protest: Observations From Tahrir Square," *Journal of Communication*, 62(2), 363-379.

Yanagizawa-Drott, David (2014) "Propaganda and Conflict: Theory and Evidence from the Rwandan Genocide," *Quarterly Journal of Economics*, 129(4), pp.1947-1994

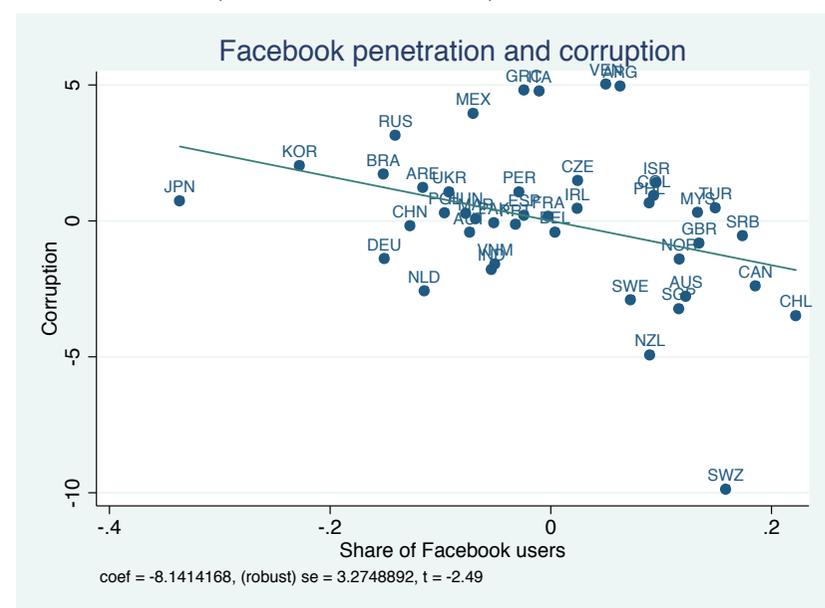
Zuckerman, Ethan, Hal Roberts, Ryan McGrady, Jillian York, and John Palfrey (2010) "Distributed Denial of Service Attacks Against Independent Media and Human Rights Sites," *Working Paper*.

Figure 1. Social Media Penetration and Corruption

A: Social network users, comScore 2011

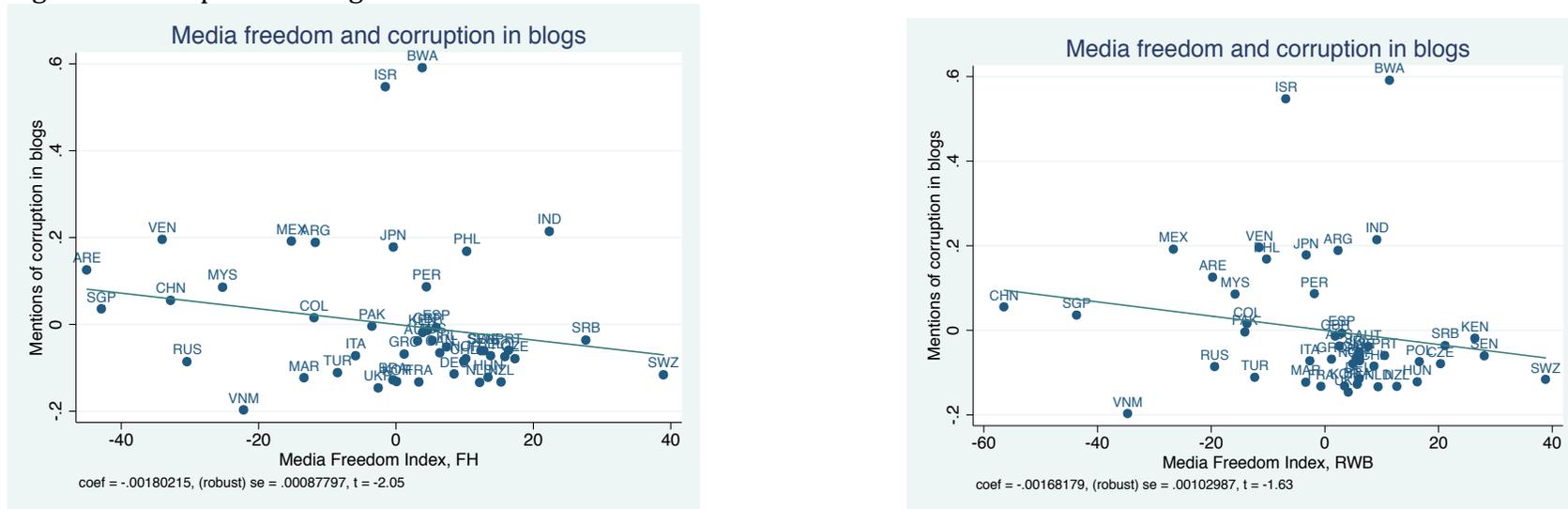


B: Facebook users, Nick Burcher Statistics, 2010



Note: added variable plots, GDP per capita is controlled for. Corruption is from Transparency International 2004-2012. Corruption index is transformed so that higher values mean higher corruption.

Figure 2. Corruption in Blogs and Media Freedom.



Note: added variable plots, GDP per capita is controlled for. Media Freedom is from Freedom House 2004-2012, index is inverted so that higher value means more media freedom. Corruption mentions in blogs are adjusted by politician mentions in blogs, data is from Google Blogs searches in *local* languages, 2004-2012.

Figure 3. Google Trends Search Volume Index for Navalny as a Measure of Navalny's Popularity, Jan 2008 – Sep 2011.

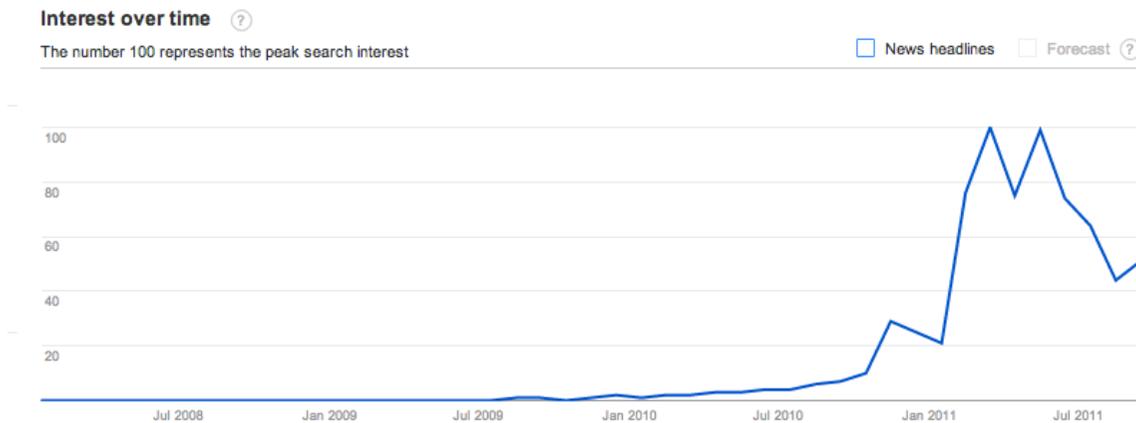
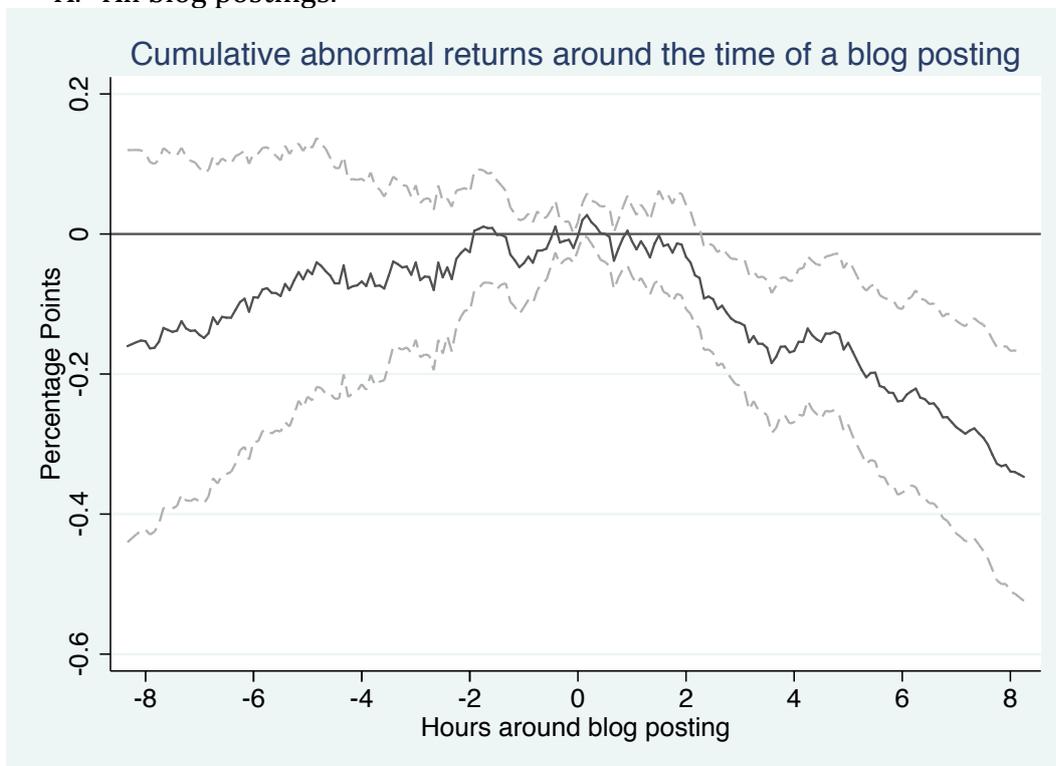
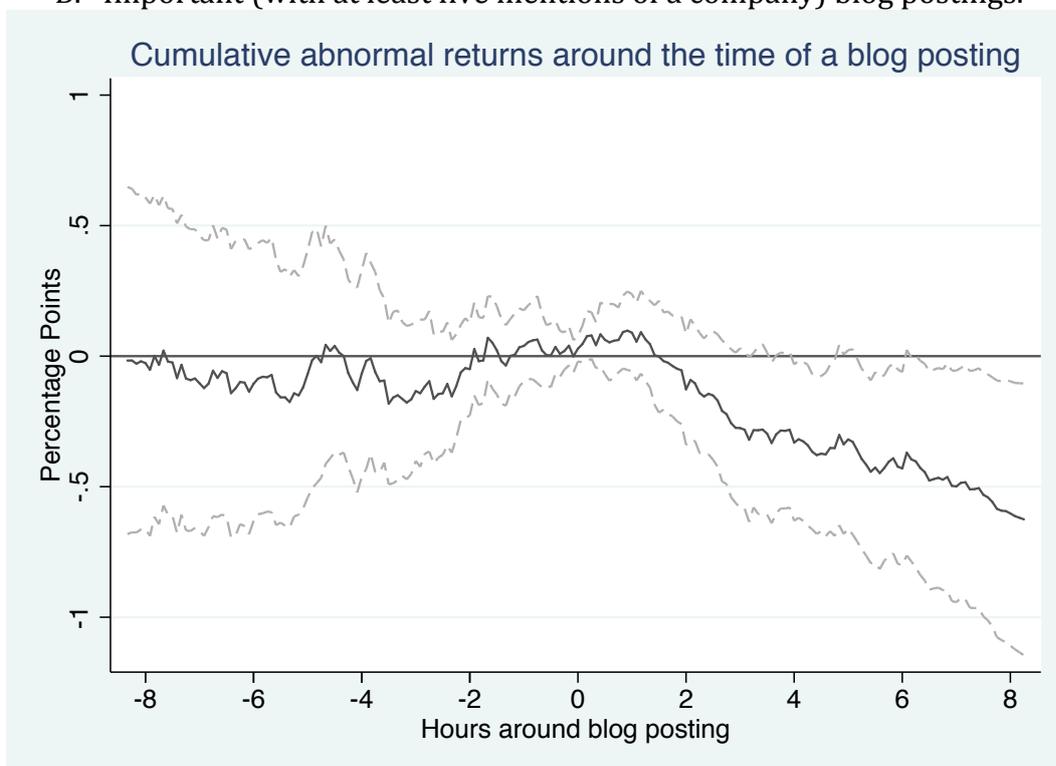


Figure 4. Five-minute Cumulative Abnormal Returns and Navalny's Blog Postings. Trading day, hour, and company-month fixed effects are controlled for. Non-trading time (evenings and weekends) is excluded. Posts with preceding mentions of companies in online or offline media are excluded.

A. All blog postings.



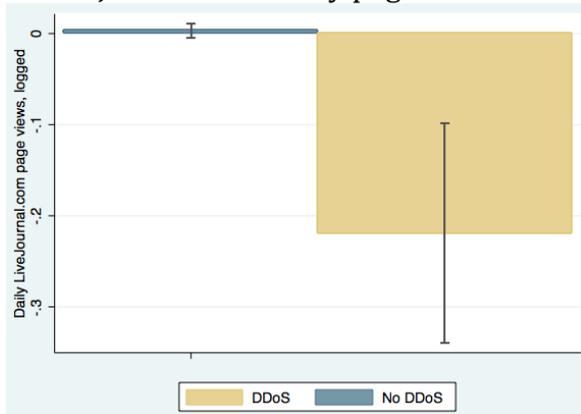
B. Important (with at least five mentions of a company) blog postings.



Note: 95% confidence intervals are in light grey.

Figure 5. LiveJournal statistics and DDoS attacks

A. LiveJournal.com daily page views .

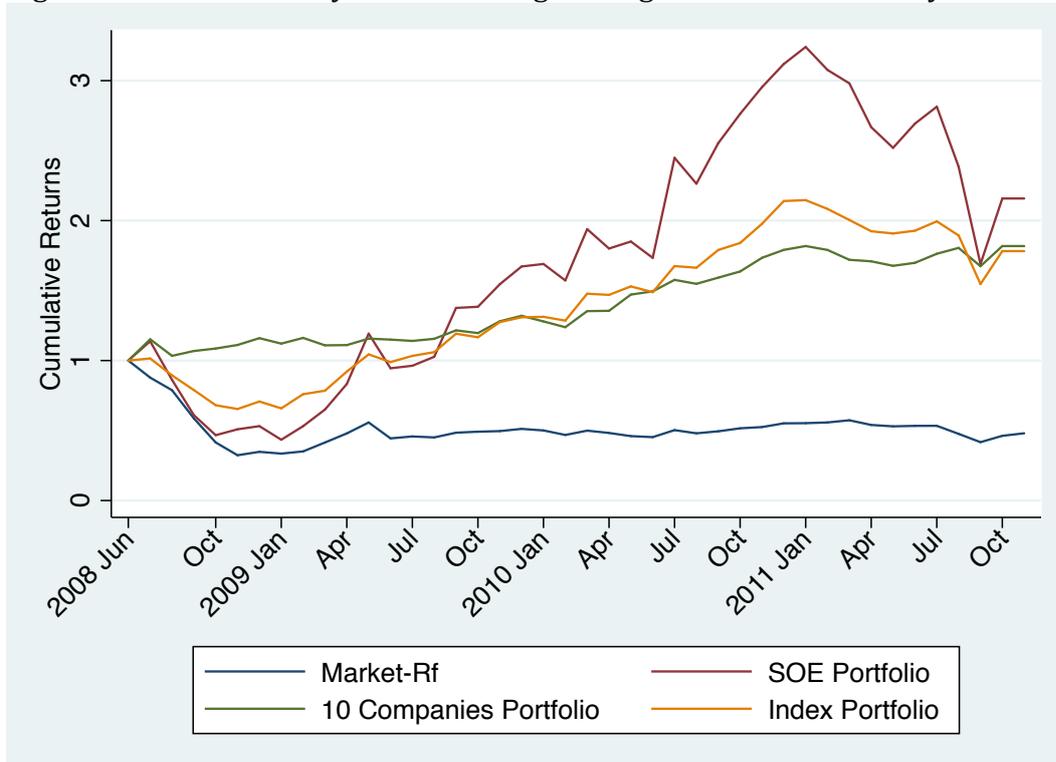


B. LiveJournal.com daily visitors.



Note: we report numbers after controlling for year-month and day of the week fixed effects

Figure 6. Cumulative Payoffs to Trading Strategies Based on Navalny's Postings



The figure plots cumulative returns over the sample period of zero-cost trading strategies that on the first day of each calendar month go short one unit of capital across all stocks of companies that were mentioned in Navalny's blog in the previous quarter and go long one unit of capital across all stock of companies in a comparison groups, about which there were no blog postings by Navalny in the last quarter. Three alternative comparison groups include: (1) all the firms included in the MICEX stock index; (2) all the state-owned companies included in the MICEX stock index; (3) ten companies Navalny wrote about. Portfolios are equally weighted. For comparison, we include the cumulative market excess returns.

**Table 1. Blog postings and abnormal returns. Baseline results.**

<b>Panel A: Intraday evidence. Cumulative abnormal returns.</b>									
	Minutes around blog postings	(-240,0)	(-120,0)	(0,5)	(0,120)	(0,180)	(0,240)	(0,360)	(0,480)
All blog postings, fixed effects for company-year and trading day included	-0.131 [0.089]	-0.073 [0.057]	-0.002 [0.010]	-0.043 [0.056]	-0.145** [0.062]	-0.167** [0.068]	-0.209** [0.090]	-0.291** [0.115]	
Important (5+) blog postings, fixed effects for company-year and trading day included	-0.276 [0.258]	-0.112 [0.119]	-0.058* [0.032]	-0.257 [0.154]	-0.491** [0.210]	-0.524** [0.191]	-0.666** [0.258]	-0.846** [0.365]	
Observations	884,557	884,557	884,557	884,557	884,557	884,557	884,557	884,557	884,557
<b>Panel B: Intraday evidence. Cumulative abnormal returns EXCLUDING posts with preceding mentions of the companies</b>									
	Minutes around blog postings	(-240,0)	(-120,0)	(0,5)	(0,120)	(0,180)	(0,240)	(0,360)	(0,480)
All blog postings, fixed effects for company-year and trading day included	-0.089 [0.106]	-0.063 [0.069]	0.000 [0.015]	-0.089 [0.064]	-0.235*** [0.078]	-0.262*** [0.083]	-0.339*** [0.100]	-0.464*** [0.136]	
Important (5+) blog postings, fixed effects for company-year and trading day included	-0.183 [0.227]	-0.000 [0.134]	-0.072 [0.053]	-0.400** [0.173]	-0.771** [0.294]	-0.857*** [0.293]	-0.854*** [0.298]	-1.061** [0.429]	
Observations	884,557	884,557	884,557	884,557	884,557	884,557	884,557	884,557	884,557
<b>Panel C: Daily evidence. Mean abnormal returns.</b>									
	Days around blog postings	(-3,-1)	(-1,-1)	(0,0)	(0,1)	(0,2)	(0,3)	(0,4)	(0,5)
All blog postings, fixed effects for company-year and day of the week included	-0.408 [0.393]	-0.215 [0.249]	-0.428* [0.2281]	-0.254 [0.3182]	-0.319 [0.4059]	-0.410 [0.4769]	-0.406 [0.5389]	-0.436 [0.6223]	
Observations	(0.374) 9,248	(0.186) 9,258	(0.171) 9,271	(0.269) 9,268	(0.322) 9,265	(0.408) 9,262	(0.486) 9,259	(0.505) 9,256	
Important blog postings, fixed effects for company-year and day of the week included	-0.216 [0.6035]	-0.099 [0.3370]	-0.849** [0.3374]	-0.971** [0.4906]	-1.099* [0.6018]	-1.310* [0.6910]	-1.470* [0.7661]	-1.245 [0.8430]	
Observations	(0.762) 9,241	(0.436) 9,251	(0.263) 9,271	(0.519) 9,268	(0.524) 9,265	(0.590) 9,262	(0.580) 9,259	(0.519) 9,256	

**Notes:** Abnormal returns are measured in percentage points. Robust standard errors adjusted for clusters by trading day in square brackets. Robust standard errors adjusted for clusters by company-month in round brackets. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Cumulative abnormal returns are computed from a standard market model with company-specific betas. Abnormal returns are winsorized at 1st and 99th percentile. Our results are very similar in terms of statistical significance and magnitudes if we do not use winsorizing.

**Table 2. Blog posts and DDoS attacks**

Omitted category: days *with* Navalny's posts about the companies.

	Daily Abnormal Returns							
	Companies Navalny wrote about		Companies of primary interest of Navalny		Companies Navalny did NOT write about		State-owned companies Navalny did NOT write about	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
DDoS attack	0.3568**	0.3484**	0.5663***	0.5480***	0.1276	0.1246	0.0140	0.0130
	(0.1710)	(0.1711)	(0.1715)	(0.1708)	(0.1313)	(0.1317)	(0.1748)	(0.1746)
Days w/o Navalny's posts		0.4897*		0.5642**		0.0497		0.0165
		(0.2523)		(0.2406)		(0.1047)		(0.1316)
Navalny's posts w/o mentioning a company		0.4332*		0.5742***				
		(0.2250)		(0.2093)				
Controls + Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,018	9,018	3,708	3,708	14,374	14,374	5,187	5,187
R-squared	0.0589	0.0596	0.0449	0.0468	0.0486	0.0487	0.0621	0.0621

**Notes:** Abnormal returns are measured in percentage points. All specifications include company-year and day of the week fixed effects together with controls for mentions in online news, business newspapers, newswires, and other blogs. Robust standard errors adjusted for clusters by trading day in brackets. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Cumulative abnormal returns are computed from a classic market model with company-specific betas. Abnormal returns are winsorized at 1st and 99th percentile. Our results are very similar in terms of statistical significance and magnitudes if we do not use winsorizing.

**Table 3. Long-term portfolio returns to blog posts-based strategies**

	Index Portfolio (1)	SOE Portfolio (2)	10 Companies Portfolio (3)
Alfa	0.026*** [0.008]	0.050*** [0.017]	0.016** [0.007]
Mkt-Rf	0.606*** [0.084]	1.281*** [0.218]	0.055 [0.069]
Observations	42	42	42
R-squared	0.59	0.58	0.02
Sharpe Ratio	0.47	0.39	0.27

**Note:** Newey-West standard errors in brackets. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Returns on one unit of capital are reported.

**Table 4. Abnormal returns and Popularity of Postings in Social Media. Difference-in-difference estimation**

Panel A: Important Blog Postings	Daily Abnormal Returns					
	(1)	(2)	(3)	(4)	(5)	(6)
Dummy for Posting x Google SVI for Navalny	0.0199*					
	[0.0112]					
Dummy for Posting x (SVI>10) (after October 2010)		1.0095*				
		[0.5477]				
Dummy for Posting x top 90% reposts in VK (Russian Facebook)			0.9363*			
			[0.5626]			
Dummy for Posting x top 90% reposts in LiveJournal				1.2667		
				[0.7891]		
Dummy for Posting x top 90% reposts in Twitter					1.2441**	
					[0.6242]	
Dummy for Posting x top 90% comments						1.2682**
						[0.5368]
Dummy for Posting	-1.1327***	-1.1677***	-1.0565***	-0.9678***	-1.0839***	-1.1480***
	[0.4298]	[0.4451]	[0.3954]	[0.3528]	[0.3855]	[0.4063]
Controls + Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,818	9,018	9,018	9,018	9,018	9,018
R-squared	0.0130	0.0130	0.0129	0.0129	0.0130	0.0131
<b>Panel B: All Blog Postings</b>						
Dummy for Posting x Google SVI for Navalny	0.0091					
	[0.0064]					
Dummy for Posting x (SVI>10) (after October 2010)		0.4081				
		[0.3565]				
Dummy for Posting x top 90% reposts in VK (Russian Facebook)			0.2373			
			[0.3825]			
Dummy for Posting x top 90% reposts in LiveJournal				0.3511		
				[0.4943]		
Dummy for Posting x top 90% reposts in Twitter					0.2883	
					[0.3837]	
Dummy for Posting x top 90% comments						0.2970
						[0.3706]
Dummy for Posting	-0.5424**	-0.5272*	-0.4698*	-0.4629*	-0.4748*	-0.4772*
	[0.2746]	[0.2772]	[0.2486]	[0.2363]	[0.2492]	[0.2505]
Controls + Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,818	9,018	9,018	9,018	9,018	9,018
R-squared	0.0125	0.0124	0.0124	0.0124	0.0124	0.0124

**Notes:** All specifications include company-year and day of the week fixed effects together with controls for mentions in online news, business newspapers, newswires, and other blogs. Robust standard errors adjusted for clusters by trading day in brackets \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Cumulative abnormal returns are computed from a standard market model with company-specific betas. Abnormal returns are winsorized at 1st and 99th percentile. Our results are very similar in terms of statistical significance and magnitudes if we do not use winsorizing. Abnormal returns are measured in percentage points.

**Table 5. Blog Postings and Real-Life Changes in Target Companies**

<b>A. Managerial turnover</b>					
VARIABLES	Type of blog posting:	<i>Dummy for management changes</i>			
		Important blog postings		All blog postings	
		(1)	(2)	(3)	(4)
Number of Navalny's postings		0.0332* [0.0177]	0.0087 [0.0233]	0.0038 [0.0244]	-0.0093 [0.0199]
Number of postings*Navalny popularity dummy			0.0693** [0.0290]		0.0534 [0.0673]
Navalny popularity dummy (SVI>10)			[0.1004]		-0.2373 [0.1403]
Company and year fixed effects	Yes	Yes	Yes	Yes	Yes
Observations		157	157	157	157
R-squared		0.1508	0.1722	0.1432	0.1603
<b>B. Conflicts with Minority Shareholders</b>					
VARIABLES	Type of blog posting:	<i>Dummy for ongoing conflict with minority shareholders</i>			
		Important blog postings		All blog postings	
		(1)	(2)	(3)	(4)
Number of Navalny's postings		-0.0703* [0.0342]	-0.0595* [0.0317]	-0.0215** [0.0084]	-0.0172* [0.0079]
Number of postings*Navalny popularity dummy			-0.0311 [0.0622]		-0.0355 [0.0303]
Navalny popularity dummy (SVI>10)			0.0197 [0.0330]		-0.0073 [0.0375]
Company and year fixed effects	Yes	Yes	Yes	Yes	Yes
Observations		157	157	157	157
R-squared		0.1034	0.1253	0.1009	0.1168

**Notes:** Robust standard errors in brackets. Standard errors are clustered by quarter. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Ongoing conflict (Panel B) is computed for the end of the quarter. SVI is Google Trends Search Volume Index, and SVI>10 means the number of searches for Navalny during the quarter is at least 10% of the maximum number of searches.

**Table 6. Abnormal returns and popularity of alternative posts. Information vs Attention.**

	Daily Abnormal Returns			
	(1)	(2)	(3)	(4)
Dummy for posting x Popularity of alternative blog postings	0.4208*			
	(0.2511)			
Dummy for posting x Popularity of alternative blog postings (alternative measure)		1.0707***		
		(0.3703)		
Dummy for posting	-3.3406*	-0.4635**		
	(1.8908)	(0.2029)		
Dummy for important posting x Popularity of alternative blog posting			0.1190	
			(0.8459)	
Dummy for important posting x Popularity of alternative blog postings (alternative measure)				0.2293
				(1.0187)
Dummy for important posting			-1.4262	-0.6017
			(6.2619)	(0.4860)
Popularity of alternative blog posting	0.0043		0.0088	
	(0.0514)		(0.0509)	
Dummy (alternative popular post in the list of top10)		-0.1438		-0.1203
		(0.1223)		(0.1213)
Controls + Fixed Effects	Yes	Yes	Yes	Yes
Observations	3,790	3,790	3,790	3,790
R-squared	0.0136	0.0147	0.0131	0.0136

**Notes:** All specifications include company-year and day of the week fixed effects together with controls for mentions in online news, business newspapers, newswires, and other blogs. Popularity of alternative blog posting is measured as  $\log(1+\text{number of comments to the most popular alternative posting})$  during the trading day. An alternative measure of popularity is a dummy for most commented alternative posts belonging to top10 list during the trading day, i.e. it indicates that the post with the largest number of comments was in the list of 10 most visited posts during the trading day. Important postings are postings with at least 5 mentions of the company. Robust standard errors adjusted for clusters by trading day in brackets \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Cumulative abnormal returns are computed from a standard market model with company-specific betas. Abnormal returns are winsorized at 1st and 99th percentile. Abnormal returns are measured in percentage points.

**Table 7. Average size of market transactions and Blog postings.**

	Log (Average Size of Trade Transaction)					
	(1)	(2)	(3)	(4)	(5)	(6)
Dummy for posting	-0.0639** (0.0294)					
Dummy for important posting		-0.0834* (0.0460)				
Dummy for posting tomorrow (placebo)			-0.0422 (0.0293)			
Dummy for important posting tomorrow (placebo)				0.0206 (0.0767)		
Dummy for posting day after tomorrow (placebo)					-0.0272 (0.0452)	
Dummy for important posting day after tomorrow (placebo)						-0.0490 (0.0525)
Controls + Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6,988	6,988	6,988	6,988	6,988	6,988
R-squared	0.7583	0.7582	0.7581	0.7581	0.7581	0.7581

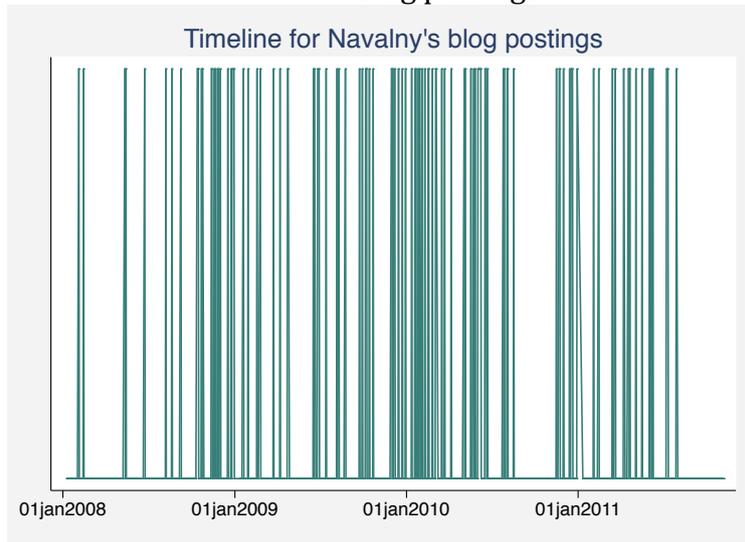
**Notes:** All specifications include company-year and day of the week fixed effects together with controls for mentions in online news, business newspapers, newswires, or other blogs, and the total trading volume for other companies. The unit of observation is company-trading day. Important postings are postings with at least 5 mentions of the company. Robust standard errors adjusted for clusters by trading day in brackets \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

# Social Media and Corruption

## Online Appendix

Figure A1. Timeline for Navalny's Blog Postings.

A. All blog postings.



B. Important (with at least five mentions of a company) blog postings.

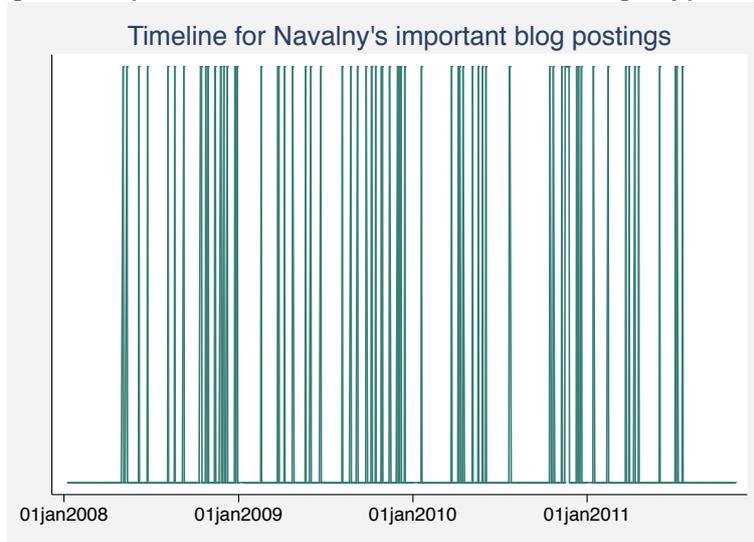
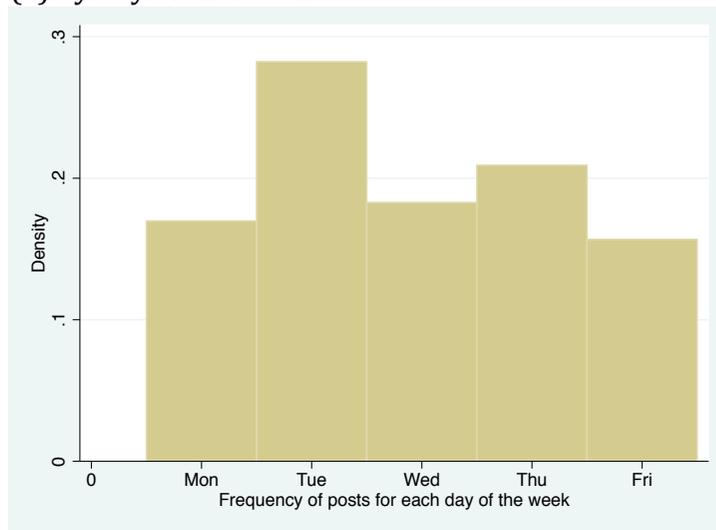
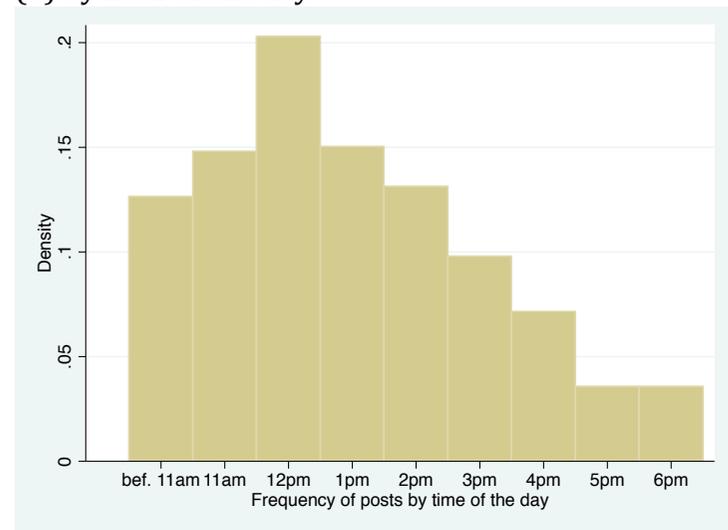


Figure A2. Histograms of frequencies of Navalny's posts  
(a) by day of the week



(b) by hour of the day

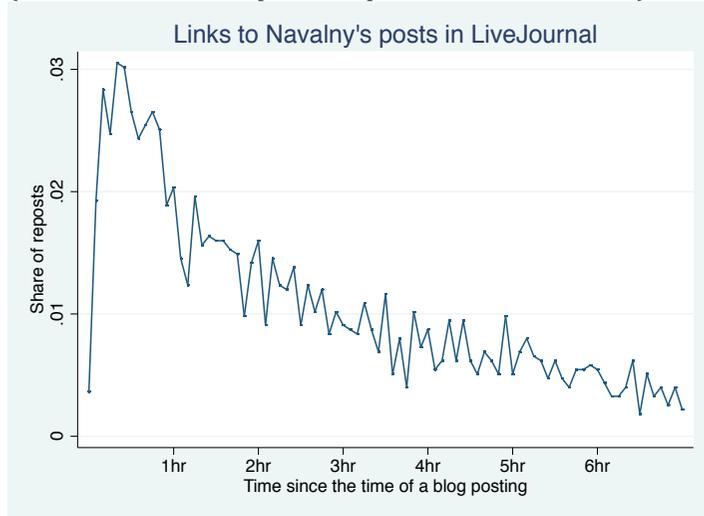


(posts outside trading hours are counted as happening at 10:30am, when stock exchange opens)

Figure A3. Same-day Reposts of Navalny's Blog Postings in Different Social Media.

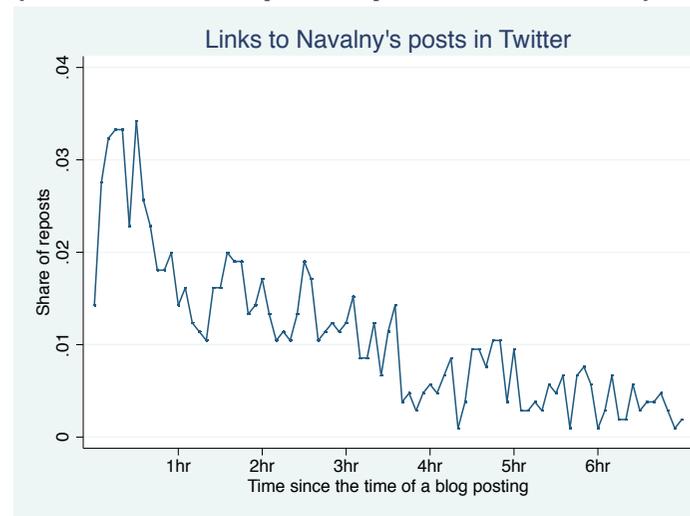
A. Reposts in LiveJournal

(median number of reposts: 25 per five-minute interval)



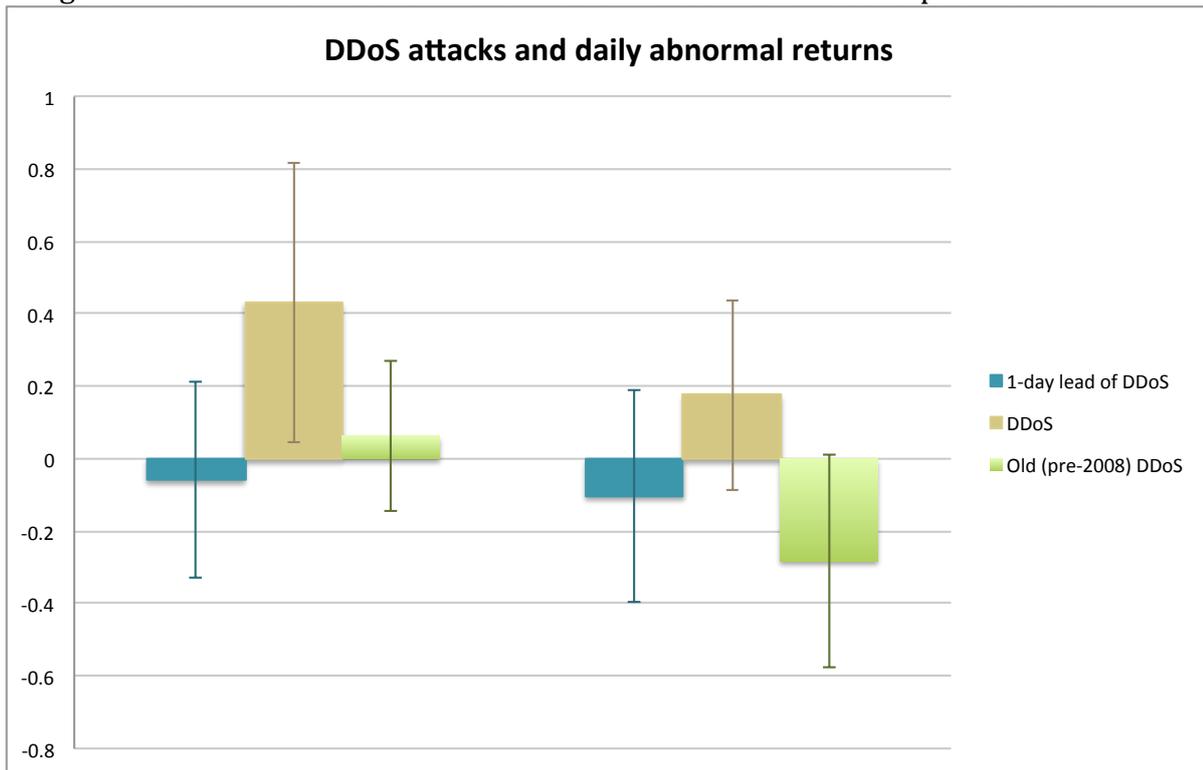
B. Reposts in Twitter.

(median number of reposts: 36 per five-minute interval)



Note: In both cases,  $\approx 50\%$  of reposts happens within first two hours after a blog posting.

Figure A4. Stock returns and DDoS attacks. A baseline result and placebo tests.



**Table A1. Variables and sources.**

Variable	Source
Shareholder meeting	<a href="http://rosneft.ru/Investors/shareholdersinfo/shareholdersmeeting/">http://rosneft.ru/Investors/shareholdersinfo/shareholdersmeeting/;</a> <a href="http://www.vtb.ru/we/ir/governance/meeting/">http://www.vtb.ru/we/ir/governance/meeting/;</a> <a href="http://www.surgutneftegas.ru/ru/press/news/">http://www.surgutneftegas.ru/ru/press/news/;</a> <a href="http://www.lukoil.ru/static_6_5id_2128_.html">http://www.lukoil.ru/static_6_5id_2128_.html;</a> <a href="http://ir.gazprom-neft.ru/general-shareholders-meeting">http://ir.gazprom-neft.ru/general-shareholders-meeting;</a> <a href="http://gazprom.ru/press/news/shareholders-meeting/">http://gazprom.ru/press/news/shareholders-meeting/;</a> <a href="http://sberbank.ru/moscow/ru/investor_relations/shareholders_meetings/">http://sberbank.ru/moscow/ru/investor_relations/shareholders_meetings/</a>
Court hearings	<a href="http://kad.arbitr.ru/">http://kad.arbitr.ru/</a> ,
Court applications	<a href="http://kad.arbitr.ru/">http://kad.arbitr.ru/</a> ,
Blog postings	navalny.livejournal.com. Classification was done with the help of several research assistants.
Stock returns	Raw data from export.rbc.ru. Authors' calculations.
DDoS attacks	<a href="http://webplanet.ru/news/security/2008/10/27/cyxymu.html">http://webplanet.ru/news/security/2008/10/27/cyxymu.html;</a> <a href="http://www.xakep.ru/post/45763/">http://www.xakep.ru/post/45763/;</a> <a href="http://lj-maintenance.livejournal.com/120360.html">http://lj-maintenance.livejournal.com/120360.html</a> <a href="http://www.pcmag.com/article2/0,2817,2351296,00.asp">http://www.pcmag.com/article2/0,2817,2351296,00.asp;</a> <a href="http://lj-maintenance.livejournal.com/125027.html">http://lj-maintenance.livejournal.com/125027.html;</a> <a href="http://www.nytimes.com/2009/08/08/technology/internet/08twitter.html">http://www.nytimes.com/2009/08/08/technology/internet/08twitter.html;</a> <a href="http://bits.blogs.nytimes.com/2009/08/06/twitter-overwhelmed-by-web-attack/">http://bits.blogs.nytimes.com/2009/08/06/twitter-overwhelmed-by-web-attack/</a> <a href="http://www.prohitec.ru/news_hard-2011-03-31-109735.html">http://www.prohitec.ru/news_hard-2011-03-31-109735.html</a> <a href="http://512kb.ru/content/view/48364/53/">http://512kb.ru/content/view/48364/53/</a> <a href="http://512kb.ru/content/view/50304/53/">http://512kb.ru/content/view/50304/53/</a> <a href="http://lj-maintenance.livejournal.com/55754.html">http://lj-maintenance.livejournal.com/55754.html;</a> <a href="http://brad.livejournal.com/1873967.html">http://brad.livejournal.com/1873967.html</a> <a href="http://lenta.ru/news/2007/05/24/zhzh/">http://lenta.ru/news/2007/05/24/zhzh/;</a> <a href="http://lj-maintenance.livejournal.com/117288.html">http://lj-maintenance.livejournal.com/117288.html;</a> <a href="http://www.livejournal.ru/themes/?id=398&amp;rel_posts=1">http://www.livejournal.ru/themes/?id=398&amp;rel_posts=1;</a> <a href="http://www.securitylab.ru/news/296507.php">http://www.securitylab.ru/news/296507.php</a> <a href="http://lj-maintenance.livejournal.com/117288.html">http://lj-maintenance.livejournal.com/117288.html</a>

	<a href="http://globalvoicesonline.org/2007/06/05/russia-livejournal-ddos-attacked/">http://globalvoicesonline.org/2007/06/05/russia-livejournal-ddos-attacked/</a> ; <a href="http://community.livejournal.com/sup_ru/171891.html">http://community.livejournal.com/sup_ru/171891.html</a> <a href="http://news.netcraft.com/archives/2006/05/03/ddos_on_blue_security_blog_knocks_typepad_livejournal_offline.html">http://news.netcraft.com/archives/2006/05/03/ddos_on_blue_security_blog_knocks_typepad_livejournal_offline.html</a> ; <a href="http://lj-maintenance.livejournal.com/112766.html">http://lj-maintenance.livejournal.com/112766.html</a> ; <a href="http://net.compulenta.ru/267174/?r1=yandex&amp;r2=news">http://net.compulenta.ru/267174/?r1=yandex&amp;r2=news</a> supplemented by data from <a href="http://cyber.law.harvard.edu/sites/cyber.law.harvard.edu/files/DDoS%20Public%20Media%20Reports_0.xls">http://cyber.law.harvard.edu/sites/cyber.law.harvard.edu/files/DDoS%20Public%20Media%20Reports_0.xls</a>
Mentions in Yandex-searchable news	news.yandex.ru
Mentions in blogs	Blogs.yandex.ru
Mentions in offline business newspapers	Vedomosti and Kommersant archives at securities.com
List of state-controlled companies where Navalny is a minority shareholder	<a href="http://www.forbes.ru/column/45506-protokoly-korporativnyh-mudretsov">http://www.forbes.ru/column/45506-protokoly-korporativnyh-mudretsov</a>
MICEX index	micex.ru
State ownership of companies	Standard and Poors

**Table A2. Navalny's blog postings. Some summary statistics.**

Panel A. Postings by company				
Transneft	VTB	Gazprom	Rosneft	Sberbank
103	86	83	77	37
Surgutneftegaz	Lukoil	Gazpromneft	Inter RAO UES	RusHydro
10	7	6	3	3
Panel B. Postings by type				
Ordinary posts (less than 5 mentions)	Important posts (5+ mentions)	Post about court hearings	Posts about court applications	Posts about shareholder meetings
281	82	17	5	11
Calls for action	Leters from Prosecutor's office			
39	32			

**Table A3. Blog postings and abnormal returns. Robustness.**

**Panel A: Intraday evidence. 5-minute abnormal returns. All blog postings.**

	5-minute abnormal returns					
	(1)	(2)	(3)	(4)	(5)	(6)
Dummy for 3 hours after a blog posting	-0.127**	-0.133**	-0.149**	-0.155***	-0.237***	-0.145**
	[0.053]	(0.054)	(0.058)	(0.058)	(0.080)	(0.061)
Fixed effects	Company	Company-month	Company-month, trading day	Company-month, trading day, hour of the day	Company-month, trading day, hour of the day	Company-month, trading day, hour of the day
Observations	884,557	884,557	884,557	884,557	725,435	859,534

**Panel B: Daily evidence. Daily abnormal returns. All blog postings.**

	Daily abnormal returns					
	(1)	(2)	(3)	(4)	(5)	(6)
Dummy for a blog posting	-0.3868*	-0.3900*	-0.4056*	-0.4054*	-0.4163*	-0.4102*
	[0.2237]	[0.2337]	[0.2325]	[0.2326]	[0.2320]	[0.2309]
Mentions in online news			0.1296	0.1291	0.1135	0.1067
			[0.0950]	[0.0950]	[0.1024]	[0.1043]
Mentions in business newspapers				0.0124	0.0005	0.0248
				[0.1062]	[0.1074]	[0.1108]
Mentions in blogs					0.0426	0.0471
					[0.0707]	[0.0721]
Mentions in news from news agencies						-0.0787
						[0.1193]
Fixed effects	Company	Company-month, day of the week				
Observations	9,271	9,268	9,018	9,018	9,018	9,018
R-squared	0.0005	0.0006	0.0007	0.0011	0.0037	0.0591

**Notes:** Abnormal returns are measured in percentage points. Robust standard errors adjusted for clusters by trading day in brackets. For panel A, such clustering accounts for both cross-sectional and time-series variation. For panel B, results with standard errors clustered by company-month are reported in Table A in Appendix (significance level is always at least the same for two types of clustering). \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Cumulative abnormal returns are computed from a standard market model with company-specific betas. Abnormal returns are winsorized at the 1st and 99th percentile. Our results are very similar in terms of statistical significance and slightly larger in magnitude if we do not use winsorizing.

**Table A3. Blog postings and abnormal returns. Robustness (continued)**

**Panel C: Intraday evidence. 5-minute abnormal returns. Important blog postings (with 5+mentions).**

	5-minute abnormal returns					
	(1)	(2)	(3)	(4)	(5)	(6)
Dummy for 6 hours after an important (5+) blog posting	-0.470** [0.184]	-0.483*** (0.184)	-0.459** (0.190)	-0.465** (0.190)	-0.749*** (0.259)	-0.489** (0.204)
Fixed effects	Company	Company-month	Company-month, trading day	Company-month, trading day, hour of the day	Company-month, trading day, hour of the day	Company-month, trading day, hour of the day
Observations	9,271	9,268	9,018	9,018	9,018	

**Panel D: Daily evidence. Daily abnormal returns. Important blog postings (with 5+mentions).**

	Daily abnormal returns					
	(1)	(2)	(3)	(4)	(5)	(6)
Dummy for an important (5+) blog posting	-0.8682*** [0.3314]	-0.8472** [0.3492]	-0.8724** [0.3482]	-0.8722** [0.3483]	-0.9013*** [0.3486]	-0.8964** [0.3487]
Mentions in online news			0.1314 [0.0952]	0.1309 [0.0953]	0.1120 [0.1023]	0.1053 [0.1042]
Mentions in business newspapers				0.0138 [0.1062]	0.0011 [0.1074]	0.0254 [0.1108]
Mentions in blogs					0.0512 [0.0708]	0.0562 [0.0723]
Mentions in news from news agencies						-0.0807 [0.1196]
Fixed effects	Company	Company-month, day of the week				
Observations	9271	9271	9268	9018	9018	9018
R-squared	0	0.012	0.012	0.012	0.059	0.059

**Notes:** Notes: Abnormal returns are measured in percentage points. Robust standard errors adjusted for clusters by trading day in brackets. For panel A, such clustering accounts for both cross-sectional and time-series variation. For panel B, results with standard errors clustered by company-month are reported in Table A in Appendix (significance level is almost always the same for two types of clustering, and it is never below 5% level for the key coefficient). \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Cumulative abnormal returns are computed from a standard market model with company-specific betas. Abnormal returns are winsorized at the 1st and 99th percentile. Our results are very similar in terms of statistical significance and slightly larger in magnitude if we do not use winsorizing.

**Table A4. Navalny's posts and popularity of alternative posts.**

	Dummy for post mentioning a company		Dummy for important (5+) post mentioning a company	
	(1)	(2)	(3)	(4)
Popularity of alternative blog posting	-0.0035 (0.0047)		-0.0024 (0.0016)	
Dummy (alternative popular post in the list of top10)		-0.0015 (0.0110)		-0.0020 (0.0039)
Controls + Fixed Effects	Yes	Yes	Yes	Yes
Observations	3,790	3,790	3,790	3,790
R-squared	0.0136	0.0147	0.0131	0.0136

Notes: All specifications include company-year and day of the week fixed effects together with controls for mentions in online news, business newspapers, newswires, and other blogs. Popularity of alternative blog posting is measured as  $\log(1+\text{number of comments to the most popular alternative posting})$  during the trading day. An alternative measure of popularity is a dummy for most commented alternative posting belonging to top10 list during the trading day, i.e. it indicates that post with the largest number of comments was in the list of 10 most visited posts during the trading day, in other words it was especially interesting for the audience. Important postings are postings with at least 5 mentions of the company. Robust standard errors adjusted for clusters by trading day in brackets \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

**Table A5. Blog postings and abnormal returns. Intraday evidence. Interaction with Navalny's popularity**

Minutes around blog postings	(-240,0)	(-120,0)	(0,5)	(0,120)	(0,180)	(0,240)	(0,360)	(0,480)
All blog postings, fixed effects for company-month and trading day included	-0.102 [0.319]	-0.004 [0.130]	-0.074** [0.037]	-0.359** [0.182]	-0.714*** [0.237]	-0.743*** [0.236]	-0.840*** [0.284]	-1.084*** [0.375]
All blog postings*(SVI>10)	-0.088 [0.443]	-0.187 [0.272]	0.069 [0.045]	0.469* [0.255]	0.914*** [0.325]	0.879** [0.377]	0.937** [0.402]	1.258** [0.488]
Observations	800,806	800,806	800,806	800,806	800,806	800,806	800,806	800,806

Notes: Abnormal returns are measured in percentage points. Robust standard errors adjusted for clusters by trading day in brackets. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Cumulative abnormal returns are computed from a standard market model with company-specific betas. Abnormal returns are winsorized at the 1st and 99th percentile. Our results are very similar in terms of statistical significance and slightly larger in magnitude if we do not use winsorizing.