

Manuscript Details

Title The Internet Ecosystem and Net Neutrality Regulation: Taking It to the Edge

Article type Full Length Article

Abstract

The FCCs decision to repeal Net Neutrality governance of Internet traffic has not ended the debate over whether such protections are needed. This paper investigates the effects of changes in Net Neutrality regulation through an event study that estimates the market model with event dummies. The results are striking: the biggest impact of Net Neutrality policy changes is on shareholders in the New Media grouping of firms, rather than the ISPs. Our statistical analysis suggests that the repeal of Net Neutrality regulation is not associated with changes in investor expectations that signal increases in total investment across the Internet ecosystem.

Keywords Net Neutrality; broadband; two-sided markets; event study

Corresponding Author David Gabel

Order of Authors David Gabel, joan nix, Bruce McNevin

The Internet Ecosystem and Net Neutrality Regulation: Taking It to the Edge^{*}

Joan Nix, Bruce McNevin, and David Gabel

March 3, 2019

^{*}Corresponding Author: David Gabel is a Professor of Economics at Queens College and the Graduate Center of the City University of New York. Contact info: David.Gabel@qc.cuny.edu. Bruce McNevin is a Director in the Quantitative Strategy Group at an investment bank, and an Adjunct Assistant Professor of Economics at New York University. Contact info: Bm76@Nyu.edu. Joan Nix, is an Associate Professor of Economics at Queens College and the Graduate Center of the City of New York. Contact info: Joan.Nix@qc.cuny.edu. The views expressed in this paper are solely those of the authors, and do not in any way represent the views of Bank of America, Queens College, or the City University of New York.

The Internet Ecosystem and Net Neutrality Regulation: Taking It to the Edge

March 3, 2019

Abstract

The FCC's decision to repeal Net Neutrality governance of Internet traffic has not ended the debate over whether such protections are needed. This paper investigates the effects of changes in Net Neutrality regulation through an event study that estimates the market model with event dummies. The results are striking: the biggest impact of Net Neutrality policy changes is on shareholders in the New Media grouping of firms, rather than the ISPs. Our statistical analysis suggests that the repeal of Net Neutrality regulation is not associated with changes in investor expectations that signal increases in total investment across the Internet ecosystem.

1 Introduction

Net Neutrality, broadly speaking, is associated with a set of principles that supports open access to the Internet. While open access sounds pure and simple, there has been considerable debate about this policy.¹ Different groups, such as consumers and investors are affected by this broad and sweeping regulatory regime in different ways. Proponents of Net Neutrality contend that the rules are needed because the content market would be harmed if Internet Service Providers (ISPs) were let loose to charge what they determine are profit-maximizing prices for terminating traffic transmitted by edge providers. Opponents of Net Neutrality contend that the ISPs do not have market power in the provision of terminating traffic and therefore are constrained by competition from charging welfare reducing prices. Furthermore, they believe that ISPs do not have an incentive to provide access that harms competitive content providers since such actions would reduce household demand for broadband connectivity. Instead, Net Neutrality opponents contend ISPs will have the incentive to make investments in innovations that will benefit content providers and consumers.

Arguably the primary issue in the Net Neutrality debate is on the policy's effect on investment and innovation. Indeed, the causal relationship between policy changes and capital expenditures serves as the current Federal Communication's gold standard for evaluating Net Neutrality policy changes. The Commission's recent vote to eliminate Net Neutrality governance was heavily influenced by "economic theory, empirical data, and even anecdotal evidence" of the alleged harmful impact of Net Neutrality policy on investment.[25] pars. 1-5, 20 (quote), 86-88.

The casual relationship between capital expenditures and Net Neutrality governance faces high econometric and theoretical hurdles. One explanation for the theoretical hurdles is that equilibrium solutions to the question of investment incentives under Net Neutrality governance are sensitive to model assumptions. As

¹A summary of the debate can be found at Federal Communications Commission, *In the Matter of Protecting and Promoting the Open Internet*, Report and Order on Remand, Declaratory Ruling, and Order, 30 FCC Rcd 5601 (Title II Order).

Faulhaber explains " Net neutrality governs relationships between broadband, ISPs, and application/content providers, and is therefore, a vertical issue." ² Since models of vertical integration provide very different answers depending on parameter values and the type of model developed, he cautions against giving the final word to " models without empirical verification."

Empirical hurdles are also present. One hurdle is that Net Neutrality regulation applies to all states, and, therefore, there is no variation in its application among states that could be used to estimate the impact of different regulatory policies. Finding variation among countries also faces problems in that there are significant challenges in controlling for relevant variables in cross-country comparisons. Finding within country data on Internet investment levels is difficult to implement for many reasons, including separating broadband related investments from other expenditures.

An event study of firms' market valuations is a methodology that gets around these hurdles. There are obvious limitations in drawing inferences from stock price changes to capital investment plans. The analysis does not involve the direct measurement of investment. One potential remedy that we employ rests on the classic Modigliani and Miller [48] market valuation model, where market value depends on future earnings that are generated both by assets in place and future investment opportunities. It is not a stretch to argue, as we do, that investors' expectations of future earnings are based partly on anticipated capital investment changes. At the very least, increases or decreases in equity values provide an indication of how investors view the future profitability of the affected firms. In this way, equity value changes serve as a signal of how investors' view future investment plans and therefore, provide an indirect estimate or measure of such investments.

Much of the debate about the impact of Net Neutrality policy on Internet investment has focused on the ISPs. The Internet ecosystem is larger than the ISPs. As Litan and Singer comment: " ' The Internet ecosystem' ... [is] populated by...' edge providers,' who supply the content, devices and apps that arguably drive broadband subscriptions, and ' core' providers, [ISPs], who build the infrastructure over which these apps operate." [45], p.2. Collectively, as found in Crandall [11], the Internet ecosystem is composed of three groups: ISPs, traditional media companies, such as Disney, and new digital media companies, such as Google. In terms of conducting an event study, these three groups of firms make sense for various reasons. An important one is that of shared firm characteristics that correlate with return exposures to events involving Net Neutrality regulation. Our event study employs these three groupings of firms and focuses on investors' reaction to three well-defined events on the road towards Net Neutrality regulation, and one associated with its repeal.

The market model serves as our benchmark model of returns. We estimate the market model with event

²Faulhaber(2011) p.11

date dummy variables added to represent events of interest. There are two critical features of our analysis that sets it apart from the existing literature. One is that instead of looking at each firm separately, we focus on the average response within three subsets of firms that share similar characteristics. An analysis based on three groupings of firms makes sense since information affecting groups of firms is more helpful for the formulation of public policy than one focused on only individual firms. In addition, grouping of firms into portfolios dampens some of the noise that idiosyncratic or firm specific risk creates for parameter estimates. [57], [5] The second critical feature is that we evaluate the significance of each event using the simple but rigorous SQ test of Gelbach, Helland, and Klick (HLK) [31] that was designed to satisfy evidentiary thresholds in a litigation context.. The SQ test provides an alternative to OLS-t statistics. One reason for an alternative methodology is that dummy variable tests using OLS t statistics are not robust to non-normal residuals, even for large samples. Another desirable property of the SQ test is that allows for asymptotically valid inference, therefore, the asymptotic Type 1 error rate is equal to the desired level of significance.

Prior researchers³ and policy makers have largely focused on how public policy impacts ISPs, and have given little attention to the Edge providers. A noted exception is Crandall' s research on the impact of Net Neutrality on shareholders in the larger Internet ecosystem. His research found that the rules effectively had no impact on the value of edge equities, and more generally that Net Neutrality governance changes did not matter to investors. [11] Our study also focuses on the immediate wealth effects on shareholders of both new and Old Media, as well as, ISPs. However, our results stand in sharp contrast to Crandall' s study in that we find using single day returns that investors take notice of Net Neutrality regulatory changes.⁴ We extend the analysis to include the expected repeal of Net Neutrality and find that the biggest impact of the expected policy shift from Net Neutrality governance to no Net Neutrality is on New Media shareholders.

Our results support a very different policy conclusion from existing empirical research. We find that equity values of New Media Edge providers increased under events where Net Neutrality governs. The opposite also holds in that the expected repeal of Net Neutrality is associated with significant equity losses for New Media shareholders. Our main conclusion is that changes to Net Neutrality governance significantly matters to Edge-equity holders in New Media companies. In terms of the broader policy position of maximizing investment across the entire Internet ecosystem⁵ our results suggest that such a goal is better served under Net Neutrality governance of Internet traffic.

³See, [28], for example.

⁴Our use of a single day window captures the immediate effect of the event on returns. Given that a large body of empirical evidence in finance has established that stock prices react immediately to incorporate new information, a one day window makes sense and estimates are less likely to be confounded by the presence of other factors that may become known as the window length increases.

⁵Litan and Singer

The paper is organized as follows: Section two discusses the arguments involving the effects of Net Neutrality on investment in the larger Internet ecosystem. Section three discusses the theoretical impact of Net Neutrality on investment, Section four provides a discussion of why disagreement prevails about the impact of Net Neutrality regulation on investment. Sections five and six present our empirical approach, and section seven provides a description of the four events that are the focus of our paper. Section eight contains a description of our data and in section nine we discuss our results. Concluding comments follow in section ten.

2 Regulation and Investment: What Should Investors Expect?

Our analysis considers whether actions in the regulatory arena change investors' expectations. We assume shareholders are rational, and, therefore, in the analysis that follows we associate increases in equity values with expectations that the firm's future profitability will increase. Our focus is on the direction of change for three specific groupings of firms. A significant event may be associated with either an increase or decrease in equity values.

Investors, when forming expectations, must weigh very different arguments as to what if anything may happen to future cash flows as a result of regulatory changes. Whether investments will be increased or harmed by specific regulatory changes depends critically on whose shoes, that of an ISP or Edge provider, a shareholder stands in. There are good reasons why walking the last mile as an investor in an ISP offers a different perspective than walking that last mile as an investor in an Edge provider.

In 2015, when the Net Neutrality principles were adopted by the Federal Communications Commission, an important goal was the regulation of how ISPs delivered data between Edge providers and end-users. The FCC's Title II Order established rules that prohibited ISPs, such as Verizon or Comcast, from throttling or blocking data that was transmitted by non-affiliated firms. It also prevented them from charging a rate for paid prioritization⁶ of data packets.[23] (para. 110-132, and Appendix A, Final Rules, §8.5, 8.7, and 8.9) These rules were adopted because of the Commission's perception of the divergence of interests between the ISPs and edge providers. The Commission was concerned that the ISPs would use their control over access to end-users to harm edge competitors. For example, an ISP could block or throttle Netflix's service, in order to increase the demand for its own video-on-demand products.[23], pars. 80-82.

Collectively these rules resulted in a mandate that enabled Edge providers to access their end users without being charged a termination fee. Since the FCC's rules prohibited charges for prioritized service,

⁶The FCC rule stated "Paid prioritization refers to the management of a broadband provider's network to directly or indirectly favor some traffic over other traffic either (a) in exchange for consideration (monetary or otherwise) from a third party, or (b) to benefit an affiliated entity.[23] Appendix A, Final Rules, §8.9. Some small edge providers contended that paid prioritization would be a significant barrier-to-entry because they could least afford the payment. See, for example, [14]

it was only necessary for an edge provider and an ISP to reach an arrangement for best effort service.⁷ When negotiating this rate, the edge provider could refuse to pay for transport. The ISP could not refuse a zero price, because failure to provide service would violate the rule that a service could not be blocked.⁸ Consequently, a content provider, such as Netflix, would not need to pay for its transmission of data over an ISP's network.

Although the zero-price directive may suggest a divergence of interests since one party is getting something of value for nothing, it simply codified a long-standing Internet practice of not charging Edge providers for transmitting data to end-users.⁹ In 2010 the Commission observed, " Since the beginning of the Internet, Internet access providers have typically not charged particular content or application providers fees to reach the providers retail service end users or struck pay-for-priority deals, and the record does not contain evidence that U.S. broadband providers currently engage in such arrangements." [21], par. 76. Contrary to first impressions the FCC asserted that the zero termination rate reflected the convergence of interests among ISPs and Edge providers. In 2010 the FCC conjectured that providing edge providers with free access to end-users drives a 'virtuous cycle' in which innovations at the edges of the network enhance consumer demand, leading to expanded investments in broadband infrastructure that, in turn, sparks new innovations at the edge.[23], par. 7.

The convergence of interests postulated by the FCC was not accepted by all parties. While the FCC saw compatibility of interests among ISPs and Edge providers regarding investment, Verizon filed a suit in which it asked the court to rule that the Commission lacked a factual basis for its virtuous cycle theory. The District Court of Columbia found that the FCC had a factual basis for concluding that zero transport price stimulates ISP investment: " [T]he Commission has more than adequately supported and explained its conclusion that edge-provider innovation leads to the expansion and improvement of broadband infrastructure." ¹⁰

The court ruling did not put to rest the controversy over whose investment interests were served by a zero termination price. One reason is that the zero price was established when text constituted the majority of traffic. Today, most traffic is video, consequently, latency is less tolerated by end-users. This change in demand has increased the cost of termination, which has, in turn, increased the economic efficiency of non-zero termination fees.[27], pp. 2-4.

The nation's leading ISPs made it clear that they do not share the view that a zero-transport price stimulates ISP investments. Instead, they contend that Net Neutrality policy is unnecessary and disruptive.

⁷Best effort delivery describes a network service in which the network does everything it can do to deliver the data packets, but does not guarantee a level of service.

⁸Dissenting Statement Of Commissioner Ajit Pai, Title II Order, 30 FCC Rcd 5601, 5922.

⁹It is not unusual for one side of a two-way market to pay a zero, or even a negative price because their increased activity, due to the low price, stimulates activity on the other side of the market. For example, Rysman (2009) [56] observes that Microsoft may charge a negative price to video program developers in order to stimulate purchases of the Xbox

¹⁰Verizon v. FCC, 740 F.3d 623, 643-4.

Companies, such as AT&T, have argued that, in light of the absence of systemic market failure prior to the adoption of the Net Neutrality rules, there is no need for prescriptive federal regulation of the ISP industry. It added that the historical record prior to the adoption of the rules was one in which “ the open Internet prospered, and the broadband ecosystem reached heights of unparalleled investment and innovation.” [3]

Especially troubling to the ISPs was the FCC’ s 2015 Net Neutrality decision which reclassified broadband access as a common carrier service.¹¹ Common carriers have a legal obligation to provide service at “ just and reasonable” rates and to physically interconnect with other carriers, including competitors, on reasonable terms.¹² Between 2005 and 2015 wireline Internet broadband access had been classified as an information service. Therefore, they were not treated as common carriers.¹³ During those years, the FCC tried to mandate Net Neutrality. Those attempts were twice found to be in violation of the statute by the District United States Court of Appeals “ [b]ecause the Commission has failed to establish that the anti-discrimination and anti-blocking rules do not impose *per se* common carrier obligations.” ¹⁴

In 2015, the Commission reclassified broadband access from an information service to a telecommunications service, thus giving it the authority to impose Network Neutrality as a common carrier obligation. The District Court of Appeals upheld this action.[63]

While subjecting the ISPs to common carrier regulation, the Commission declared that it would forbear from some forms of common carrier regulation. In its Title II Order, the Commission stated that it had adopted a “ ‘light-touch approach. . .include[ing] no unbundling of last-mile facilities, no tariffing, no rate regulation, and no cost accounting rules” [23], par. 37.

The FCC’ s claim that it adopted “ light-handed” regulation provided little comfort to the ISPs. They shared a concern that regulatory creep would occur. This threat, along with the alleged vagueness of the FCC’ s general conduct rule,¹⁵ according to the ISPs, increased the risk that regulatory mandates would prove costly to implement and discourage capital investments in the Internet infrastructure needed to provide high quality connections in the face of consumers increasing data demands. See, for example, [24], p.34, and [42].

While the ISPs stated that Net Neutrality will unambiguously reduce their profits and investments, Edge providers saw a divergence of interests. They countered that their own capital investments would increase because Net Neutrality would reduce the risk of being charged monopoly termination prices or having their products blocked or degraded by ISPs. See, for example, [2], pp. 2-5; [47], p. 9.

From the perspective of investors, one takeaway is that investors had solid ground for seeing changes in

¹¹See, for example, [42]

¹²47 U.S.C. 201

¹³See *In re Appropriate Framework for Broadband Access to the Internet Over Wireline Facilities*, 20 F.C.C.R. 14853, 14862 par. 12 (2005) (“ 2005 Wireline Broadband Order”); *In re Appropriate Regulatory Treatment for Broadband Access to the Internet Over Wireless Networks*, 22 F.C.C.R. 5901, 5901-02 par. 1 (2007) (“ Wireless Broadband Order”).

¹⁴*Comcast Corp. v. FCC*, 600 F.3d 642; and *Verizon v. FCC*, 740 F.3d 623, 628 (quote).

¹⁵Title II Order, Appendix A, Final Rules, 8.11 .

Net Neutrality regulations as materially meaningful for the affected firms' profitability. Investors would need to weigh the arguments carefully to determine how policy changes impacted future profitability. Of course, the expectations that could be reasonable held would depend on whose shareholder shoes they were in, that is, whether they were investors in New Media, Old Media, or ISPs.

3 Theoretical Impact of Net Neutrality on Investment

Investors who turn to the Net Neutrality theoretical literature for guidance will find that it offers ambiguous results regarding the effect of Net Neutrality on investment incentives. For example, Choi and Kim,[9] find that investment incentives differ in a discriminatory versus a non-discriminatory regime. In their model, capacity increases by the ISPs may lead to a decrease in the sale price of "fast lane" access and therefore, contrary to many arguments made about freeing the ISPs from burdensome regulation, there may be a disincentive for ISP investment under a no Net Neutrality regime. In addition, without Net Neutrality, content providers face an increase risk of expropriation of investment benefits under a discriminatory regime and this may also decrease investment.

A 2014 paper by Gans finds equilibria where Net Neutrality rules may have a positive effect on edge providers' investment because it reduces the costs they incur reaching end-users and the risk that a vertically integrated ISP will throttle or block their transmissions.[29] A more recent paper by Gans and Katz illustrate that the theoretical impact of Net Neutrality regulation, in the presence of consumer heterogeneity regarding content quality, is based on very specific model configurations. They conclude, "However, we have also shown other effects of net neutrality quickly arise as one generalizes the model, making it very difficult to reach general theoretical conclusions about the effects of net neutrality." [30], p.14.

Nicholas Economides recently reviewed the literature and concluded: "one cannot claim that network neutrality should result in lower investment by ISPs. It is equally possible that Network Neutrality will prompt ISPs to invest more." ¹⁶ A similar sentiment was expressed in a recent submission to the FCC by a group of economic scholars. They concluded that "[t]he literature gives mixed results because the investment incentive is sensitive to how content providers and consumers respond to prices and how consumers value content." [12] p. 6. In summary, the theoretical uncertainty about the impact of Net Neutrality on ISP and Edge investment is consistent with Faulhaber's warning that models alone will not resolve policy disagreements.

In 2010 the FCC posited that Net Neutrality has a positive impact on ISP investment due to a virtuous cycle of innovation: "openness enables a self-reinforcing cycle of investment and innovation in which new

¹⁶Comments of Prof. Nicholas Economides, In the Matter of Restoring Internet Freedom, FCC WC Docket No. 17-108, July 17, 2017, pp. 6-7. [13]

uses of the network lead to increased adoption of broadband, which drives investment and improvements in the network itself, which in turn lead to further innovative uses of the network and further investment in content, applications, services, and devices.” [23] par.2 (first quote) and [21] par. 3 (second quote). However, at least theoretically it is hardly clear that openness will result in increased network, that is, ISP investment. It is possible that openness will stimulate ISP investment, but the degree to which this has or will occur is something that has to be resolved empirically.¹⁷

4 Regulation and Investment: Disagreements Prevail

The view that Net Neutrality and common carrier regulation will harm investments in the larger Internet ecosystem is a major concern of the new, Republican controlled FCC. In January 2018 the FCC eliminated Title II regulation in part because of its concern that the regulation will suppress ISP investment. In support of its conclusion, regarding suppressed investment, the FCC cited studies that found that ISPs reduced their investments in response to the threat, and eventual approval, of Title II regulation. [25], pars. 88-106. One study observed that aggregate ISP investments declined after Title II regulation was adopted. The Commission concluded that this type of analysis to be informative, but not determinative, because it ” fail(s) to control for other factors that may affect investment (such as technological change, the overall state of the economy, and the fact that large capital investments often occur in discrete chunks rather than being spaced evenly over time), and companies may take several years to adjust their investment plans.” [25], par. 92.

The Commission gave greater weight to studies that used regression analysis to estimate the causal impact of policy changes. It placed great reliance on studies by Hazlett and Wright that found that broadband subscription increased when government regulation was reduced or eliminated, and a paper by Ford that estimated a significant decline in ISP investment in response to the threat of common carrier regulation.[25], pars. 94-5,98.

The FCC’ s 2018 decision did not estimate the magnitude of decline in the ISP investment as the ” record [did] not provide sufficient evidence to quantify the size of the effect of Title II on investment [25], footnote 347.¹⁸

While the FCC concluded that the record evidence suggested that the end of common carrier regulation would ” likely...increase ISP investment and output,” it was unable to reach a conclusion with regards to how its policy change would impact investments made at the edge. [25], par. 98. Edge investment had been highlighted by Net Neutrality advocates because they believe that proper policy analysis should include the

¹⁷Even if Net Neutrality reduces ISP investment, total incremental investment could be positive if the increase in edge investment more than offsets the decline in ISP capital expenditures.

¹⁸According to Hazlett and Wright, p.490 [33], the Commission’ s Open Internet Order does not include any empirical estimates of the impact of Net Neutrality on Internet ecosystem investments.

entire ecosystem, not just ISPs. These proponents noted that edge investment increased with the adoption of Net Neutrality rules. The Commission concurred with Net Neutrality advocates that conceptually the impact of policy on edge providers merited consideration. However, noting that correlation does not prove causality, it gave no weight to the edge investment data provided by the Net Neutrality advocates: "the evidence presented does not show the imposition of Title II regulation on Internet access service providers caused recent edge provider investment. That requires an estimate as to what would have happened in the absence of Title II regulation (e.g., analysis following the methods employed in the studies of Ford, and of Hazlett and Wright)." [25], par. 107.¹⁹

One way around what appears as insurmountable challenges to the direct measurement of capital investment by ISPs and Edge providers is to econometrically estimate the impact of policy and court decisions on the equity values of Edge and ISP firms. This approach recognizes that at least intrinsically a stock price reflects the expected discounted value of a firm's future earnings. Investors' expectations of future earnings depend on two sources, earnings in place and future investment opportunities. Our analysis assumes that at least some future investment opportunities will require additional capital investments.

5 Standard Market Model and Effects of Net Neutrality Regulation

Econometrically estimating the impact of the FCC's policy on investment is challenging. One reason is that there is no variation in Network Neutrality policy across states. This lack of variation makes it difficult to statistically compare the impact of a change in policy since all areas of the United States are similarly impacted by the policy. Obtaining econometric estimates would be simpler if it were possible to compare investments in areas that concurrently operated with and without Title II regulation. Whereas this type of variation is not available, there are alternative data sources that can be used to analyze the impact of policy on investments. One is to conduct cross-country comparisons. But this type of analysis is also challenging due to the difficulty of controlling for the different relevant variables, and obtaining data on Internet investment levels.

One approach for resolving the debate over whether regulatory changes are value-increasing, value-decreasing, or are simply too unimportant to the future profitability of the firms to matter, is to employ an event study. There is a rich history of using event studies to measure the impact of regulatory policy. For example, the financial impact of banking rules, product liability, and product recalls are topics that

¹⁹The Commission added that "there is no convincing evidence of increased investment in the edge that would compensate for the reduction in network investment." [25], par. 88

have been fruitfully explored using event study methodology.[5] Event studies of regulatory changes continue the tradition in finance and economics of measuring the financial impact of an event on a firm's expected profits. [57] It is a tradition rooted in the efficient-markets hypothesis that information flows quickly into stock prices. As a result, stock prices reflect all available public information.²⁰ Schwert observed that consequently, "unanticipated changes in regulation result in a current change in security prices, and the price change is an unbiased estimate of the value of the change in cash flows to the firm." [57], pp. 121-22.

There are caveats to employing an event study to measure the financial impact of regulatory changes. One is that due to the imprecise dating of the change in expectations, statistical tests of regulatory actions are often characterized as having low power. Another is that it is challenging to identify statistically significant regulatory actions because the actions are often anticipated by the market.[6], pp. 168, 181. Although issues with dating and finding unanticipated events are important for any event study of regulatory change to address, as Bhagat and Romano (2001) comment, "Despite these caveats; researchers have been able to identify regulatory changes that can be profitably examined through the lens of the event study methodology." [5] p.28

The four events chosen for our analysis are, to a large degree, events that possess both new information and clear dates that identify when the new information became public. Two of the chosen events are federal court decisions for which parties did not know the decision in advance of the date in which the order was released. One event, a letter from President Obama in support of reclassifying broadband as a telecommunication service, also surprised the market. The last event is the election of President Trump, an outcome that was not anticipated by the market with a date that is easily identifiable.

Our analysis estimates if any of the events either individually or jointly produces a statistically significant change in realized returns, beyond what can be explained by the standard Capital Asset Pricing Model (CAPM). The events are all potentially significant in terms of providing information that investors may use to reassess future earnings.

Our analysis employs the standard market model that is based on the CAPM developed by Sharpe[58], Lintner[43] and Mossin (1966)[49]. In the standard market model, the beta of an asset is the risk measure that does the heavy lifting in terms of explaining returns; beta measures the market exposure of an asset. As Bollerslev et.al.[7] comment, "Even though numerous studies over the past half-century have called into question the ability of the capital asset pricing model(CAPM) to fully explain the cross-section of expected stock returns, the beta of an asset arguably remains the most commonly used systematic risk measure in financial practice."

We estimate the impact of events on the stock market returns for a sample of firms affected by Net

²⁰There is vast literature on this topic. See for example, [16] pp.383-417.

Neutrality regulation. If an event results in an abnormal positive return, this implies an increase in the discounted present value of the firm's future free cash flows that comes from either earnings in place or future investment opportunities. Of course the increase in discounted present value may also be associated with a decrease in the firm's discount rate. But for the timing of the events in our study there is no evidence that would support a decrease in the weighted average cost of capital as an explanation for abnormal returns.

In order to determine the impact an event has on equity values, a "dummy" variable that has a value of one when the new information becomes available and zero for all other dates is added to the market model. The information, or "news", associated with a statistically significant dummy variable is consistent with investors using the information to reassess the future cash flows of the firm.

We are not the first to use event analysis to study the impact of Net Neutrality policy on the stock returns of investors. Robert Crandall used event analysis to evaluate the impact of *Verizon v. FCC*, as well as, a number of subsequent regulatory events, leading to Title II regulation, on the stock prices of ISPs and Media companies. He found, "surprising[ly]," that the regulatory developments had little economic or statistical impact on the return of these firms.[11], p. 555. We reach different conclusions.

Following Crandall, we introduce dummy variables to reflect variation in returns not captured by beta. This allows our analysis to determine whether the returns of our three groupings of firms, ISPs, as well as Old and New Media, were impacted significantly by the events beyond what is captured by simple market exposure captured through beta.

$$r_{it} = \beta_{0i} + \beta_{1i}r_{mt} + \sum \gamma_j D_j + a_{it} \quad (1)$$

Where r_{it} is the daily return on index i on day t ; r_{mt} is the return on the overall market on day t ; D_j , $j=1,...,4$ are dummy variables that take the value of unity on the day of the event and zero otherwise; and a_{it} is the error term, or it can be viewed as the abnormal return.²¹

6 Empirical Approach

As in Crandall's research, we present estimation results based on the market model that uses excess returns over the risk free rate for twenty eight firms. Twenty seven of our twenty eight firms were included in Crandall's analysis. We added one firm to the study, Microsoft. The firms have been divided into the same three categories employed by Crandall: New Media companies, ISPs, and Traditional Media companies. The New Media companies, such as Facebook and Google, operate platforms that are used to distribute content. ISPs are primarily telephone and cable companies that provide the "last mile" data connection to Internet

²¹—The returns are in excess of the risk-free rate.—

end-users. Traditional Media companies, such as Viacom and Disney, are primarily focused on producing content.

There are a number of important differences between our empirical analysis and Crandall's. The time period of our analysis is longer, we consider a more recent event that sets a different agenda for regulation, and employ portfolios of the three categories of firms, where the coefficients for each category of companies are estimated as a separate portfolio. Undertaking an analysis based on a value-weighted index for each category eliminates some of the noise dummies may capture from the presence of idiosyncratic risk that a portfolio approach reduces, and also weights beta by relative firm size.²² We have created the value-weighted index for each category by weighting the price of the companies in each group. The observations were weighted by their daily market capitalization. Another important difference is the use of a methodology that does not assume a specific distribution of returns. Lastly, our estimates include joint test results.

We use daily data as this is the *de facto* standard in corporate finance. Kothari and Warner reviewed thirty years of corporate finance event studies and concluded that "the use of daily (and sometimes intraday) rather than monthly security return data has become prevalent, which permits more precise measurement of abnormal returns and more informative studies of announcement effects." [40] p.8; see, also, [1], p. 470. We also employ a one day window for estimating whether any of the dummy parameters are significant. A one day window captures the immediate response of investors to news of the event. Much financial research has established the efficiency with which news is incorporated into stock prices, employing a one day window captures the immediacy of this movement. In addition, apart from the factors that move the larger market, there may be additional information revealed when longer windows are applied. The use of a one day window makes it less likely confounding influences caused by information that becomes known as the window length increases will affect our estimates.

We evaluate the significance of each event using the sample quantile (SQ) Test of Gelbach, Helland, and Klick (GHK, 2013) [31], rather than using the OLS t-statistics. As noted by Hein and Westfall [34], dummy variable tests for event studies using multivariate regression analysis are not robust to non-normal residuals even for a large sample size. As GHK note, when estimating event dummies in a regression model, the SQ Test has properties that make it more desirable than the standard OLS approach. First, it has ample asymptotic power for distributions of abnormal returns. Secondly, it allows for asymptotically valid inference, meaning that the asymptotic Type I error rate is equal to the desired level of significance. Thirdly, it is asymptotically equivalent to various bootstrap approaches that have been proposed.²³ As explained in

²²There is a long tradition in event studies of estimating the significance of regulatory changes by analyzing portfolio returns of companies hypothesized to be impacted by the changes rather than the individual stocks. See Schwert for a discussion of the statistical reasons for basing the analysis on a portfolio, rather than individual stock returns.[57], pp. 129-32.

²³The Hein and Westfall approach is a bootstrap method

GHK (2013) the test grew out of concerns that in legal cases evidentiary thresholds were not consistently applied when event studies were used to establish cause of harm. The need for the same standard of proof requires both adjusting critical values for estimating joint tests of event dates and a method that does not assume that abnormal returns follow a normal distribution.

The SQ Test is explained most easily using a single firm, single event version of the market model (equation 1). However, as discussed below, it can easily be applied to a single firm, or portfolio of firms, multiple event model.

Assume that pre-event date returns are independent and identically distributed conditional on the full set of regressors. In this case the matrix of regressors other than the event dummies consists of a constant (column of ones) and a column containing the (excess) returns on the market portfolio. Let F_0 denote the cumulative distribution of abnormal returns. Then for any y ,

$$Pr(a_t \leq y | \{X\}_{t=1}^T) = F_0(y) \quad t = 1, \dots, T. \quad (2)$$

where the matrix X contains a column of 1's and a column with r_m . Equations 1 and 2 form the basis for the SQ test.

The SQ test for a single event with a null hypothesis of H_0 , and a lower tailed alternative hypothesis H_1 is implemented as follows:

- Estimate β_0 and β_m in market model (equation 1) using ordinary least squares.
- Calculate the abnormal returns, $a_t = r_t - \beta_0 - \beta_m r_{mt}$, for each non-event day.
- Sort a_t from least to greatest.
- Denote the order statistic of the abnormal returns $a_{[n\alpha]}$, where α is the asymptotic type I error rate.
- The order statistic is the sample α -quantile. As an example, assume that the sample of abnormal returns has 100 observations after removing the event days, and assume that $\alpha = 0.05$. Then, the sample quantile is observation 5.
- The null hypothesis, $H_0 : \gamma = 0$, can be tested against lower-tailed, two-tailed, or upper tailed alternative hypothesis by comparing $a_{[n\alpha]}$ to the critical value determined by the order statistic.

The SQ Test can also be applied to multiple events by adjusting the quantile for a given α . Consider the case of two events. Under the assumption that returns are conditionally independent the asymptotic joint distribution of (γ_1^1, γ_2^2) is the product of the two marginal distributions,

$$F_{00} = F_0(y_1)F_0(y_2) \quad (3)$$

Following GHK, let y_{δ_1} and y_{δ_2} denote the δ_1 and δ_2 quantiles that satisfy $F_0(y_{\delta_1}) = \delta_1$ and $F_0(y_{\delta_2}) = \delta_2$. Under the assumptions that (y^1, y^2) are asymptotically independent,

$$\lim_{n \rightarrow \infty} Pr(y^1 > y_{\delta_1} \text{ and } y^2 < y_{\delta_2}) = [1 - F_0(y_{\delta_1})]F_0(y_{\delta_2}) = (1 - \delta_1)\delta_2 \quad (4)$$

For an α level test, δ_1 and δ_2 are selected so that $\alpha = (1 - \delta_1)\delta_2$. Assuming that the α is the same for the two parameters, $(1 - \delta_1) = \delta_2 = \delta$, in which case, $\delta = \sqrt{\alpha}$.

Equation 5 defines the sample $\sqrt{\alpha}$ and $(1 - \sqrt{\alpha})$ quantiles of the estimated abnormal returns.

$$y_{\alpha}^{\sqrt{\alpha}} \text{ and } y_{(1-\alpha)}^{\sqrt{\alpha}} \quad (5)$$

Given two events, and the joint null hypothesis, $H_0 : y^1 > 0$ and $y^2 < 0$, the rule proposed by GHK is only reject the null hypothesis if both critical values are exceeded. That is, $y^1 > y_{\alpha}^{\sqrt{\alpha}}$ and $y^2 < y_{(1-\alpha)}^{\sqrt{\alpha}}$.

The same logic can be applied to joint tests of more than two parameters. It is important to note the difference in the critical values for the joint tests compared with the test of a simple null hypothesis. Applying the unadjusted α of the simple null hypothesis to the joint test would lead to a serious under rejection of the null hypothesis.

7 Description of Four Events

Our description of each event includes reasons why each event has at least the potential to produce a change in equity values. We estimate whether the events are statistically significant. When there are reasons for predicting a specific sign for the abnormal return of the event date dummy variable we do so, and for all three groupings of firms, we hypothesize a specific direction for three out of four events.²⁴ This informs our empirical analysis in that when a specific direction is hypothesized a one tail test is employed. We interpret a significant positive abnormal return for the event date dummy variable as reflecting "good news" and associate "bad news" with a negative abnormal return for the event date dummy variable.

As previously discussed, there is controversy over whether ISP or Edge Providers investments increase or decrease when Net Neutrality regulations change. Assuming such investments are associated with positive net present value projects implies that increasing investment results in an increase in firm value. Rather than attempting an independent assessment of the arguments on either side of the controversy, we simply base

²⁴Two of our four events were included in Crandall's study: The District Court's 2014 ruling and Obama's endorsement of Title II regulation. We did not estimate the impact of his other two events, the Netflix-Comcast Carriage Deal, and the FCC's 2015 Net Neutrality rules, in order to keep the number of events tractable, as we focus on more recent events, and because these two events were more likely developments that were known to the market prior to their announcements.

our hypotheses on what the firms themselves have argued. Net Neutrality governance is value-enhancing for Edge providers and value-decreasing for ISPs. Conversely, no Net Neutrality is value-increasing for ISPs, and value-decreasing for Edge providers. Events may or may not turn out to be significant, or have the direction of change we hypothesized. Only one of our events, the Verizon court case, is associated with a complex message that does not reduce to a single direction of change.

Our analysis includes the following four events:

Event 1: Verizon v. FCC—January 14, 2014

In 2010 the Federal Communications Commission issued its Open Network Order. The Order established rules that prohibited ISPs from throttling or blocking data transmitted by non-affiliated firms, or for charging a rate for prioritized delivery of data packets (paid prioritization).²⁵ Collectively these rules resulted in a mandate that Edge providers be able to reach end users without having to pay a termination charge.

Verizon filed an appeal to the decision in the District Federal Appeals Court. The law suit was not actively pursued by all of the ISPs. According to the Wall Street Journal, Comcast and AT&T, two of the nation's largest ISPs, as early as 2010, advised Verizon to not challenge the rules in court. The two ISPs were concerned that if Verizon won the challenge, the FCC would make the rules more comprehensive. [38] The threat of increased ISP regulation would reduce expected ISP earnings, and, in turn, investment. On the other hand, the increased protections could have a positive effect on the Edge providers profitability, which may require increases in capital investment. The combined effect of a court victory by Verizon, along with the possibility of increased regulation, leaves us with the alternative hypothesis that the net impact could be positive or negative on the equity values of the three types of firms.

The Court's January 14, 2014 ruling vacated the rules on the grounds that the Communications Act prohibits the Commission from imposing common-carriage-type regulation on information services. Since 2005 the FCC had classified broadband access as an information service.

Event 2: Obama Advocates for Title II Regulation—November 10, 2014

Later in 2014 the FCC again initiated a rule making proceeding in which it considered how to maintain an Open Internet. The FCC received some unexpected guidance on this matter from the President. On November 10, 2014, President Obama announced his support for Title II, also known as common carrier, regulation. It is highly unusual for a President to publicly offer advice on the outcome of this type of administrative proceeding.

Obama's endorsement of Title II regulation differed from his earlier positions insofar as he supported a specific administrative process. Obama had supported Network Neutrality as early as the 2008 presidential campaign. [51] and [52]

²⁵Title II Order, paras. 110-132.

As Title II regulation was perceived as potentially more intrusive relative to the earlier rules, Obama’ s intervention is a ” bad news” event for ISPs because the proposed rules would reduce their ability to charge a termination rate, or to throttle the data transmission of edge providers, and would potentially impose significant regulatory burdens. Whereas the rules were designed to protect Edge content providers it should be a ” good news” event for them.

Event 3: United States Telecom Assn v. FCC–June 14, 2016 On March 12, 2015 the FCC reclassified broadband Internet access as a telecommunications service. This decision made the ISPs subject to the Net Neutrality rules. The United States Telecom Association challenged the decision in court. On June 14, 2016, the District Court of Appeals upheld the FCC’ s Title II decision.[63]

Since the Court approved the FCC’s reclassification of Internet access as a common carrier service, and upheld the Net Neutrality rules, investors would likely see the Court’ s approval of Title II regulation as bad news for the stocks of ISPs, and good news for Media companies.

Event 4: Election of Donald Trump–November 9, 2016

Donald Trump was elected President of the United States on November 8, 2016. According to ” Industry analysts at New Street Research there has not been a lot of detail in Mr. Trump’ s [campaign] pronouncements regarding telecom and media policy, with the exceptions of a statement that he would reverse the FCC’ s Title II reclassification of broadband services and that he would remove unspecified libel protections.” ²⁶ Investors would see the election of President Trump as a good news event for ISPs because of his opposition to Title II regulation, and a bad news event for Edge providers.

The following Table summarizes our expectations regarding the impact of each event:

| Event | New Media | ISPs | Old Media |
|--|------------------|-------------|------------------|
| (1) Verizon v. FCC, 2014 | $\neq 0$ | $\neq 0$ | $\neq 0$ |
| (2) Obama endorses Title II regulation, 2014 | > 0 | < 0 | > 0 |
| (3) United States Telecom, 2016 | > 0 | < 0 | > 0 |
| (4) Election of Trump, 2016 | < 0 | > 0 | < 0 |

Table 1: Expected Signs on Dummy Coefficients

Note, we do not extend our analysis to the actual date of the repeal of Net Neutrality by the FCC. The repeal should be considered part of the broad deregulatory efforts Trump promoted as a candidate for President. Investors would have anticipated this move from the surprise election of Trump to the Presidency.

²⁶Telecommunications Reports , November 15, 2016, Vol. 82, No. 22.

8 Data

We obtained daily adjusted closing prices for our twenty-eight stocks from CRSP. The market rate and the risk free rate are from the Kenneth French Data Library.²⁷ The market rate is the market return in excess of the risk-free rate, where the market is represented as a value-weighted return of all CRSP firms incorporated in the US and listed on the NYSE, AMEX, or NASDAQ. The risk free rate is the one-month Treasury bill rate from Ibbotson Associates and provided by K. French.

Our sample of daily returns begins on January 3, 2013 and ends on June 30, 2017. This creates a sample size of 1,131 observations. Summary statistics are shown in Table 2. There are a total of 28 companies divided into 3 groups, ISPs, traditional or "old" media companies, and New Media companies.

The average daily return of the value weighted indexes for the ISPs and the traditional media companies are about the same as the market. The New Media companies have an average daily return that is twice the market return.

The New Media companies have the highest standard deviation of returns among the three groups and the ISP's have the lowest. The standard deviation of market returns is roughly one half that of the New Media companies.

The market and Old Media company returns have a negative skewness, while the returns for the New Media group has a positive skewness. The ISP index has almost no skew.

Figures 1 to 3 compare density plots of portfolio returns with the normal density.²⁸ The plots illustrate the extent of the non-Normality of the portfolio returns and therefore, the importance of applying a methodology that does not assume normal returns. All of three portfolios exhibit greater peakedness than the Normal density. In addition, a Normal QQ plot is provided for the returns of each portfolio. As is typical of equity returns, the returns for these three portfolio are not Normally distributed. There are a greater number of tail observations. Based on the Shapiro-Wilk test, the null hypothesis of Normality is rejected for the returns of each portfolio.

| Portfolio | Mean | Std.Dev. | Skew | Ex. Kurt |
|------------------|-------------|-----------------|-------------|-----------------|
| Market | 0.06 | 0.80 | -0.39 | 2.17 |
| New Media | 0.12 | 1.49 | 0.89 | 7.57 |
| ISP | 0.07 | 1.03 | 0.04 | 3.70 |
| Old Media | 0.07 | 1.08 | -0.82 | 6.85 |

Table 2: Summary Statistics for Portfolio Returns in Percent

²⁷http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

²⁸Each Normal density has the same mean and variance as the returns of the portfolio.

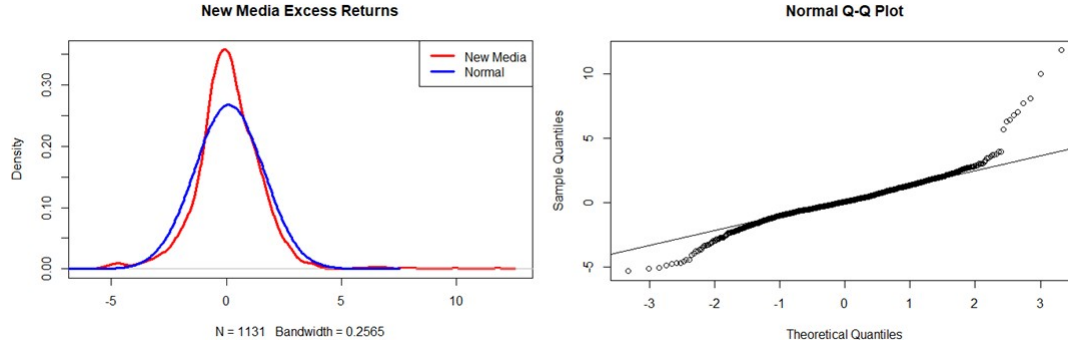


Figure 1: New Media Firms - Non-Normality of Returns

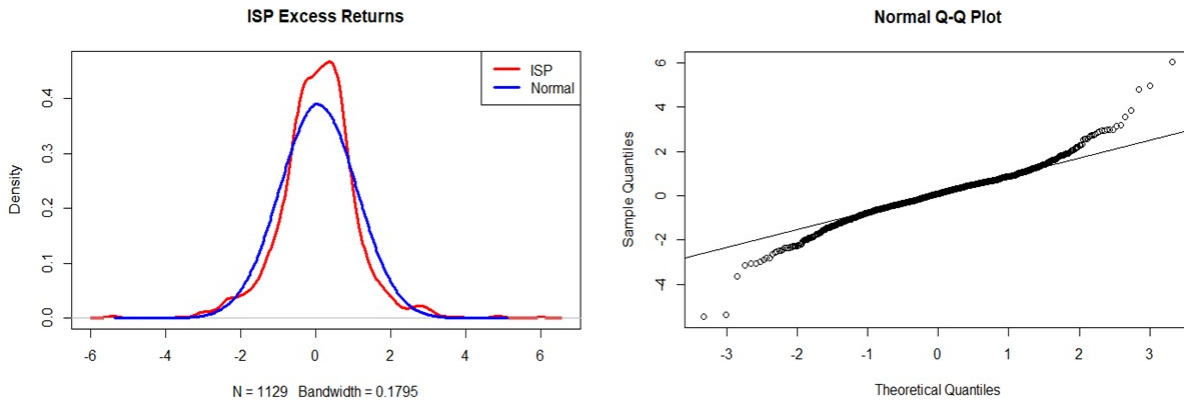


Figure 2: ISP Firms - Non-Normality of Returns

9 Discussion of Results

We created a value weighted index of returns for each of the portfolios, and estimated the parameters using OLS. Employing value weighted portfolios for model estimation is a well researched approach in the finance literature. The use of a weighted portfolio beta eliminates some of the noise that comes from single firm estimates of beta, especially for short windows.²⁹

We apply the SQ test to the individual parameter estimates, as well as, three joint hypotheses. The alternative hypotheses for the joint tests are found in Table 3. The numbers (1)to(4) in Table 3 refer to the events that are tested. The inequalities for each event are the alternative hypotheses. The alternative hypotheses are the same as the expected signs summarized in Table 1. The null hypothesis for each joint test is that the parameter estimates are jointly equal to zero.³⁰

²⁹As argued by Schwert, it is not possible to make statements about the group, based on the individual estimates, "probability statements based on the analysis of several individual asset returns for the same time period are not independent, and there is no simple way to combine the single-asset tests into a joint probability statement about the entire set of assets." [57] p. 130. Therefore, our analysis of the results is based on the three groupings of firms.

³⁰The critical values are for an $\alpha = 5\%$ one tailed test, or in the case of VZ, an $\alpha = 5\%$ two tailed test.

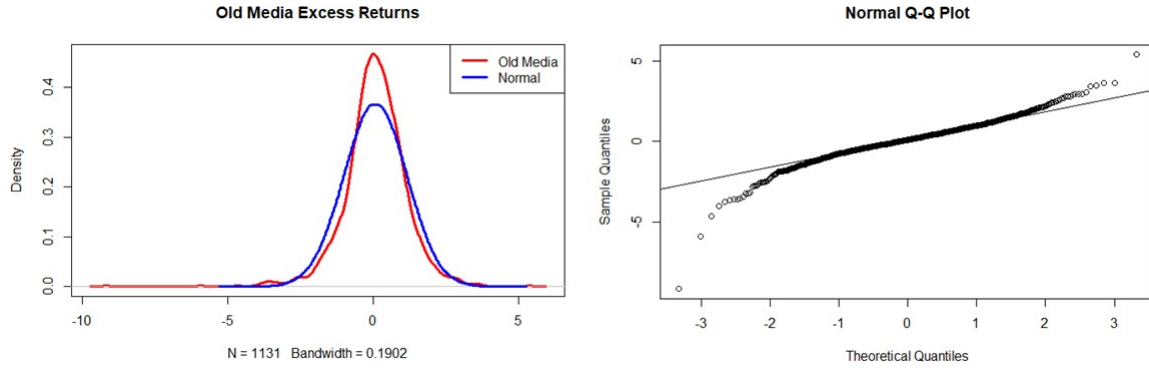


Figure 3: Old Media Firms - Non-Normality of Returns

Joint hypotheses B is particularly relevant since it reflects a Net Neutrality regime, while event 4, the Trump election, reflects a no Net Neutrality regime. That is, joint hypotheses B reflects three events leading to Net Neutrality governance while event 4 reflects its anticipated repeal. Joint hypothesis A is also of special interest since it reflects both a move towards stronger Net Neutrality regulation and a move away from Net Neutrality governance. That is, Obama's letter was in favor of a greater regulatory burden on the ISPs, while the Trump election is associated with a deregulatory agenda. The repeal of Net Neutrality was part of that agenda.

| Joint Hypothesis | New Media | ISP | Old Media |
|--|-------------------------------|-------------------------------|-------------------------------|
| A) Obama-Trump | (2) > 0 and (4) < 0 | (2) < 0 and (4) > 0 | (2) > 0 and (4) < 0 |
| B) VZ v. FCC, Obama, US Telecom | (1) /= 0, (2)>0, (3)>0 | (1) /= 0, (2)>0, (3)<0 | (1) /= 0, (2)>0, (3)>0 |
| where C) All | | | |
| (1) Verizon v. FCC, 2014 (vzfcc) | (1) /= 0, (2)>0, (3)>0, (4)<0 | (1) /= 0, (2)<0, (3)<0, (4)>0 | (1) /= 0, (2)>0, (3)>0, (4)<0 |
| (2) Obama endorses Title II regulation, 2014 (obama) | | | |
| (3) United States Telecom, 2016 (dac) | | | |
| (4) Election of Trump, 2016 (trump) | | | |

Table 3: Joint Hypotheses for Each Portfolio

9.1 New Media

Table 4 provides the test results for the New Media portfolio. It contains the parameter estimates along with the critical values based on the SQ test. An asterisk is used to denote parameter estimates where the null hypothesis is rejected.³¹

Of the 4 single hypotheses, the only significant parameter is the Trump election which had a large negative impact on the New Media portfolio. The other 3 events are positive, which is consistent with expectations³²,

³¹The regression and density plots of the residuals for each portfolio are shown in Appendix C.

³²Hypothesis 1 is a two tailed test.

but they are not significant, so we are unable to reject the null hypothesis that these three coefficients are equal to zero.

The joint tests, however, tell a very different story with statistically significant parameter estimates for all three hypotheses (A to C). Joint test A rejects the null that the positive abnormal returns on 11/14/2014 and the negative abnormal return on 11/09/2016 were jointly equal to zero. Test B rejects the null hypothesis that the 3 events expected to positively impact New Media (A,B and C) are jointly equal to zero, against the alternative that they are greater than zero. Test C rejects the hypothesis that all four of the Net Neutrality events had a joint effect of zero.

If we consider the regime of Net Neutrality governance as captured by hypothesis B, and the no neutrality regime reflected in hypothesis 4, the results show that a Net Neutrality regime adds value for the New Media companies, while there is a loss of value under a no neutrality regime. The results for joint test A are consistent with arguments that stronger Net Neutrality regulation benefits Edge providers, in this case, New Media investors, while its anticipated repeal is harmful for such investors. Our results call into question arguments that investors in New Media companies simply shrug at changes to Net Neutrality governance. New Media investors are aware of regulatory changes and clearly see Net Neutrality governance as impacting profitability. Whether the gain on one hand for the New Media investors is taken away by the other hand from ISP investors must await discussion until section 9.4, where the financial impact of all four events is presented.

| Hypothesis | Event | Parameter Estimate | Critical Value $\alpha = 0.05$ |
|-------------------|--------------|---------------------------|--|
| 1 | vzfcc | 0.7011 | 1.9492 |
| 2 | obama | 0.7739 | 1.6176 |
| 3 | dca | 0.5453 | 1.6176 |
| 4 | trump | -3.3820* | -1.5372 |
| A | obama | 0.7739* | 0.5743 |
| | trump | -3.3820* | -0.5950 |
| B | vzfcc | 0.7011* | 0.3695 |
| | obama | 0.7739* | 0.1785 |
| | dca | 0.5453* | 0.1785 |
| C | vzfcc | 0.7011* | 0.1241 |
| | obama | 0.7739* | -0.0016 |
| | dca | 0.5453* | -0.0016 |
| | trump | -3.3820* | -0.1143 |

Table 4: New Media Parameter Estimates and Hypothesis Tests

9.2 ISP's

The test results for the ISP portfolio are found in Table 5. We see that Obama' s declaration of support for Title II regulation had a big impact on their equities. The coefficient for the event was approximately -2.5%, the largest change in the ISPs returns for the four events. In addition, the individual tests for the other three events are not statistically significant at the 95% level of confidence.

| Hypothesis | Event | β | Critical Value $\alpha = 0.05$ |
|------------|-------|----------|--------------------------------|
| 1 | vzfcc | 0.4373 | 1.4716 |
| 2 | obama | -2.4953* | -1.1687 |
| 3 | dca | 0.1189 | -1.1687 |
| 4 | trump | 1.0557 | 1.1697 |
| A | obama | -2.4953* | -0.4924 |
| | trump | 1.0557* | 0.4762 |
| B | vzfcc | 0.4373 | 0.3142 |
| | obama | -2.4953 | -0.2090 |
| | dca | 0.1189 | -0.2090 |
| C | vzfcc | 0.4373 | 0.1482 |
| | obama | -2.4953 | -0.0492 |
| | dca | 0.1189 | -0.0492 |
| | trump | 1.0557 | 0.0242 |

Table 5: ISP Parameter Estimates and Hypothesis Tests

The Trump and Obama coefficient estimates both have the anticipated signs. However, the 2015 District Court of Appeals decision has a positive sign, which differs from the expected impact. The positive response on the part of ISP investors to the court' s findings may reflect that this was an expected outcome,³³ and, given this expectation, investors may have viewed the wording of the decision favorably. Another possible explanation is the FCC' s theory of the Virtuous Cycle of Innovation and Investment. The positive Court ruling could have encouraged Edge investment, and this, in turn, could have increased ISP investment, and expected future earnings. Alternatively, the gain may have been driven by one or more independent events that occurred the same day the Court' s decision was released. On that day, Sprint claimed it became " the first U.S. carrier to demonstrate 5G at a large scale public event." [60]

The market reacted positively to the election of Donald Trump. The dummy variable coefficient for November 9, 2016 was 1.05%. Firms' returns are shown in Table 6. We associate this positive reaction as being related to candidate Trump' s opposition to Net Neutrality. However, an anticipated change in anti-trust policy may also have played a role. *Fortune* observed that Sprint' s and T-Mobile' s stock increased

³³A leading trade paper characterized the judges at the oral arguments as being receptive to many of the key pro-Net Neutrality arguments made by the FCC. Telecommunications Reports, " D.C. Circuit Questions Title II Challenge, Appears More Open on Interconnection," January 1, 2016, v.82, no. 1, p.1.

significantly the day after Trump’ s victory in anticipation that there would be greater acceptance of mergers among telecommunications firms. [55]

| Percent Return: November 9, 2016 | | | |
|---|-------------|---------------------|----------------------|
| Company | Type | Stock Return | Market Return |
| Apple | New Media | -0.16 | 1.46 |
| Amazon | New Media | -2.02 | 1.46 |
| Facebook | New Media | -0.84 | 1.46 |
| Google | New Media | -0.66 | 1.46 |
| Microsoft | New Media | -0.50 | 1.46 |
| Netflix | New Media | -1.73 | 1.46 |
| Starz | New Media | -0.39 | 1.46 |
| Twitter | New Media | 4.08 | 1.46 |
| Yahoo | New Media | 0.12 | 1.46 |
| Charter | ISP | 2.89 | 1.46 |
| Comcast | ISP | 1.49 | 1.46 |
| Century | ISP | 0.54 | 1.46 |
| Dish | ISP | 2.20 | 1.46 |
| Frontier | ISP | -0.93 | 1.46 |
| Sprint | ISP | 13.40 | 1.46 |
| AT&T | ISP | 1.22 | 1.46 |
| T-Mobile | ISP | 5.05 | 1.46 |
| Verizon | ISP | 0.44 | 1.46 |
| CBS | Old Media | -0.54 | 1.46 |
| Disney | Old Media | 0.27 | 1.46 |
| FOX | Old Media | 0.92 | 1.46 |
| Sony | Old Media | -1.44 | 1.46 |
| Time Warner | Old Media | -1.45 | 1.46 |
| Viacom | Old Media | 1.69 | 1.46 |

Table 6: Firm and Market Returns – November 9, 2016

Joint test A, rejects the null hypothesis that the impact of the Obama Title II letter, and the election of Trump, were jointly equal to zero. However, we are unable to reject the null hypothesis for joint tests B and C because the District Court of Appeal’ s (DCA) coefficient estimate has a positive sign.

The significance of these results suggest that the ISPs were adversely affected by Obama’ s call for Title II regulation. These results are consistent with the findings that stricter regulation is associated with less investment by the ISPs. ISP investors do take notice of Presidential actions as shown in the results of joint test A. But when it comes to court cases, it does not appear that the ISP investors take notice that results in statistically significant abnormal returns. A possible explanation is that when it comes to Net Neutrality regulation, ISP investors are less concerned that court decisions will change the regulatory landscape.

9.3 Traditional Media

The test results for the traditional media companies are shown in Table 7. When it comes to Net Neutrality regulation, it appears that investors in traditional media do respond with a whimper. The Net Neutrality

regime captured by joint hypothesis B was not found significant. However, the no Net Neutrality regime capture by Event 4 was significant and resulted in a loss of value. The asymmetry in the protections of Net Neutrality governance in that they only matter when it is anticipated they will be removed is consistent with an alternative explanation. Old media will be subject to a great deal of disruption under a no Net Neutrality regime. They will need to carve out a content creation path and delivery system to compete in the new environment. These concerns swamp investors' concerns about Net Neutrality governance.

| Hypothesis | Event | β | Critical Value $\alpha = 0.05$ |
|-------------------|--------------|---------------------------|--|
| 1 | vzfcc | -0.2517 | 1.4378 |
| 2 | obama | -0.4233 | 1.0887 |
| 3 | dca | 0.8242 | 1.0887 |
| 4 | trump | -1.6456* | -1.0543 |
| A | obama | -0.4233 | 0.4508 |
| | trump | -1.6456 | -0.4548 |
| B | vzfcc | -0.2517 | 0.3181 |
| | obama | -0.4233 | 0.1886 |
| | dca | 0.8242 | 0.1886 |
| C | vzfcc | -0.2517 | 0.1457 |
| | obama | -0.4233 | 0.0269 |
| | dca | 0.8242 | 0.0269 |
| | trump | -1.6456 | -0.0363 |

Table 7: Traditional Media Parameter Estimates and Hypothesis Tests

9.4 The Market Impact of All Four Events

As illustrated in Table 8 the sheer dollar value of the market value changes on the day of the events is startling. One striking aspect of the results is that the change for the ISPs is not the complement of the change for the edge companies. One hand is not taking away what the other hand gave. For example, where the regression analysis implies that the value of the ISPs equity increased by \$7,935m following Trump's election, there is not a corresponding decrease of \$7,935m in the equity value of the Media stocks. This suggests that the changes reported in the table are not merely being driven by the expected change in termination payments, but likely reflect changes in future investment opportunities.

A second implication of Table 8 is that the decline in the value of the Edge equities exceeded the change in value of the ISPs. This result is consistent with the relative size of the three sectors. On November 9, 2016, the ISPs, Old and New Media comprised 24, 9, and 67 percent, respectively, on the value of the traded equities analyzed in this study. This fact was well understood by the FCC when it eliminated common carrier regulation of the ISPs in 2017. In its *Internet Freedom* decision, the Commission noted that "the

market capitalization of Google alone is greater than every cable company in America combined.” [24], par. 134.

The estimated impact on election day was -\$4.6 billion for the Old Media, and -\$70.8 billion³⁴ for the New Media.³⁵ This drop in value is even more surprising considering that it was the election of a reality television star, and expectations that Trump would continue to seek the limelight with controversial statements that would attract viewers to New Media websites.

Net Neutrality was not the only issue that candidate Trump addressed that would be of special interest to the firms considered here. During the campaign, Trump also announced his opposition to AT&T’s proposed acquisition of old-media company Time-Warner Incorporated. His comment was heavily discounted because of the widely held view that vertical mergers were not anti-competitive and therefore not in violation of the antitrust laws. [39] [37]

While candidate Trump had criticized AT&T’s proposed acquisition of Time Warner, he had not criticized the larger group of Edge companies. The New Media companies experienced a large decline the day after the election, despite, with the exception of Amazon, not having been the direct target of Trump’s criticism during the campaign. On November 9th, eight of the ten New Media stocks declined in value (see Table 6). Furthermore, within the group of Old Media companies, Sony experienced the largest decline. Sony’s largest operating divisions are Ericsson, a manufacturer of telecommunications equipment, Columbia Pictures, CBS records, and a video game developer, Gaikai. These four entities were not targets of candidate Trump.

| | VZ FCC | v. Obama Supports Title II Regulation | US Telecom Ass’n v. FCC | Trump | Total |
|------------------|-------------------|--|--|------------------|--------------|
| Group | 1/14/2014 | 11/10/2014 | 6/14/2016 | 11/9/2016 | |
| ISP | - | (17,330) | - | 7,935 | (9,395) |
| Old Media | - | - | - | (4,613) | (4,613) |
| New Media | 9,406 | 12,662 | 10,177 | (70,799) | (38,555) |
| Total | 9,406 | (4,668) | 10,177 | (67,477) | (52,562) |

Table 8: Market Impact of Significant Events (\$mm)

The empirical findings associated with the joint tests for New Media are that all four events mattered to —³⁴—The -\$70.8 billion New Media loss reported on Table 8 is the loss relative to what have occurred if on November 9th the New Media index maintained its average relationship to the market. The -\$70.8 B estimate was obtained by multiplying the market value of the New Media stocks by the coefficient estimate for the November 9, 2016 dummy variable, -3.38%. The large loss reflects that on November 9th, the market increased 1.46%, and given the market beta, on an average day the New Media companies would have experienced a larger gain.

³⁵We do not think the decline in Old and New media returns was due to the other policy issue discussed by Trump during the campaign – his interest in changing the libel laws. For, among other reasons, making a libel claim is challenging in light of the media’s first amendment rights, and because libel law is a state law. The President’s influence over state law is limited or non-existent. [44]

New Media investors. Investors in New Media companies responded favorably to the 2014 District Court' s decision in *Verizon v. FCC*. It is possible that the investors had a positive reaction because they felt that the Court provided a road map for implementing Net Neutrality.[66] Furthermore, investors may have believed that the FCC' s response would be a more aggressive form of regulation, in light of the Court' s action. The market valued the news of the decision at +\$9.4 billion for the New Media firms.

New and Old Media investors reacted differently to Obama' s call for common carrier regulation. This divergence may be attributable to the Old Media investors being initially less focused on the impact that the Internet could have on their future operations, and a concern that openness could lead to more content competition.

The response of Edge investors in New Media to Obama' s announcement might have reflected how investors in these companies viewed the effects of Title II regulation. The large, New Media companies were strong advocates of Net Neutrality.³⁶

The investors in New Media stocks had a much stronger reaction to the election of Trump relative to Obama' s endorsement of Title II regulation. This difference is likely due to Obama' s endorsement took place at a time when the FCC was already considering Title II regulation in a Notice of Proposed Rule Making Proceeding. [22], par. 4. Obama let the FCC know that of the two statutory bases of legal authority being considered by the agency for maintaining its Network Neutrality policy and goals, he preferred Title II regulation, rather than reliance on Section 706 of the Communications Act. The Trump election likely had a larger impact on New Media equity since it was expected to lead to an end of Network Neutrality, a more radical change relative to Obama' s advocacy position.

Based on joint hypotheses B and C the District Court' s 2016 ruling, upholding the reclassification of the ISPs as common carriers, had a positive, statistically significantly positive effect on the returns of New Media companies. The Court' s decision to uphold common carrier regulation was treated as " good news" , an unsurprising outcome since New media generally supported Net Neutrality.

Our analysis argues that the negative return the day after President Trump' s election was driven primarily by the expectation that under President Trump, Net Neutrality would be repealed. In Table (9), we use an alternative methodology to calculate a loss of-\$61.8, to the New Media portfolio following the November 8th election. The method involves comparing the performance of the New Media stocks with the performance of the technology 500 stocks (stock ticker XLK). On November 9th, the technology 500 stocks had a weak day, barely ending in the red (down -0.13%), while the overall market increased 1.46%. As shown on Table 9, the New Media companies declined -3.38% relative to the market, resulting in a net loss of -1.73% relative to their

³⁶~~Fears that Title II might hinder the innovation~~ process [46] and [41] did not seem strong enough to offset the positive impact of this event on returns.

prior day closing values.³⁷ The market model predicted that the New Media companies would have typically increased in value by 1.65% if the market increased 1.46%. Four New Media companies, Apple, Microsoft, Facebook, and Google constituted 41.5% of the technology 500 assets. This implies that the remaining 496 technology assets increased in value by 1.22% on the same day that the New Media companies declined in value by -1.73%, relative to their prior day closing values. Therefore, the total difference in returns between New Media and other tech equities on November 9th was $-1.72\% - 1.224\% = -2.952\%$. This under performance of the New Media, relative to the other Tech 500 firms, corresponds to a loss in value of -\$61.8B.

| OLS Regression | | | |
|---|--|---|--|
| Alpha New Media | 0.06065 | (a) | |
| Beta New Media | 1.09114 | (b) | |
| market return | 1.46 | (c) | |
| Predicted return | 1.6537144 | (d) = (a) + (b)*(c) | |
| new media coefficient 11.9.16 | -3.38199 | (e) | |
| decline new media relative to prior day closing | -1.7282756 | (f)=(d) + (e) | |
| XLK change 11.9.16 | -0.13% | (g) | |
| New Media share of XLK (minimum) | 41.5% | (h) | |
| index | $-.0013 = .415 * -1.72827616 + (1-.415) * x$ | decline weighted average of new media and non-new media | |
| x=increase remainder tech 500 | 1.224 | (i) = [(g)-(h)*(f)]/(1-(h)) | |
| New media relative to remainder tech 500 | -2.952 | (j) = (f) - (i) | |
| delta NPV | -\$61,802,090,891 | New Media capitalization * (j) | |

Table 9: Calculating the Impact to Edge Providers, 11/9/2016

There are other reasons that may also account for the decline in the value of New Media equities on November 9th. The Tech sector had provided significant financial support to Hillary Clinton and their investors may have feared that Trump would punish the companies for not supporting him. Tech investors would have also likely been concerned about Trump's declared intention to reduce the number of H1-B work permits, and his concern that American firms were manufacturing too many goods abroad. [8] But these concerns would have been shared by the entire tech industry. Nevertheless, while the tech industry generally experienced an increase in the value of their equities on November 9th, large losses were experienced by the New Media firms. Hence we infer that Trump's opposition to Net Neutrality had a significant impact on the Media stocks on November 9th, but we recognize that other factors were in play.

9.5 Net Neutrality and the Virtuous Cycle of Innovation and Investment

We have associated the election of President Trump with a change in policy that would lead to the end of common carrier regulation of the ISPs. The econometric results for the Trump election are inconsistent

³⁷While Table 9 shows how the -1.73% value can be derived from the regression results, this is also the data input value for the percent loss on November 9, 2016.

with the " virtuous cycle of investment and innovation" hypothesis. Trump' s victory in November 2016 is correlated with a statistically significant decrease in Media expected cash-flows, while the event had a positive, statistically significant impact on the ISP equity. The negative impact of the election on Media companies' returns associated with a loss in equity value does not bode well for encouraging investment by the Edge firms.

Table 8 highlights the benefits of an empirical investigation of the events from the perspective of the larger Internet ecosystem. The events generally had a converse impact on the edge and ISP investors, which is contrary to the Virtuous Cycle of Innovation and Investment Hypothesis.³⁸ If these converse impacts did not exist, that is if the virtuous cycle hypothesis was true, policies that encouraged ISP investment would also stimulate edge investment.

The issue of whether the specific groupings of firms into New versus Old media may be an explanation for the difference in test results that are found significant is approached through sensitivity analysis found in Appendix D. Our sensitivity analysis does not provide support for such an explanation.

10 Concluding Comments

Our analysis of whether specific changes to Net Neutrality regulation affects investors' expectations of future earnings of companies offers some surprising results. When it comes to New Media investors, there are no inconclusive results. In contrast to the results on this topic found by Crandall, New Media investors do care about Net Neutrality regulation. The results of our study suggest that New Media shareholders are adversely impacted by the repeal of Net Neutrality regulation, and benefit from a Net Neutrality regime. Our results for ISPs are consistent with what the firms themselves have argued, Net Neutrality governance harms firm value, and its repeal is good news for investors in ISPs. When it comes to Old Media, with the exception of the Trump election the lack of significant events for Old Media is also informative. Any argument that investors simply do not care enough about Net Neutrality for such concerns to impact valuations deserves to be backed by an empirical investigation. This is especially relevant given that professional investors are always looking for an advantage for the firms on their radar screen and scrutinize every piece of information that may be relevant to their firms' future prospects. A great deal of empirical research in finance has established that stock prices quickly reflect available public information. That for Old Media the events with the exception of the Trump election did not show up merits discussion. The non-significance of most events for Old Media simply tells us that these events do not matter for the firms' future earnings. But they

³⁸The inconsistency exists for the events we studied. It is possible that the " virtuous cycle of innovation" is empirically supported for an earlier era when the market was less mature and the introduction of new content, such as Netflix' s video-on-demand service, could have stimulated ISP investment.

do matter for investors in New Media and ISPs. One explanation is that investors in Old Media have other concerns that swamp their concerns with changes to Net Neutrality governance.

Our results for New Media offer convincing evidence that changes affecting Net Neutrality regulation must be evaluated from the perspective of the larger Internet ecosystem. Indeed, if our evaluation of policy changes had been limited to the ISPs, our conclusions regarding the expected impact of a no Net Neutrality regime versus a Net Neutrality regime would be different. Viewed from this narrower perspective abandoning Net Neutrality governance would be consistent with increasing the valuation of ISPs. However, the results of our analysis provide empirical findings as to why this narrower approach should be avoided. It ignores significant effects on Edge providers. Our empirical findings support the position taken by Litan and Singer (2014) that policy changes regarding Internet governance should be evaluated based on their effects on the larger Internet ecosystem that includes both ISPs and Edge providers.

Our empirical results are derived from an event study where model estimates of value-weighted portfolios are found. Our use of portfolio estimates eliminates some of the noise associated with single firm estimates employing the market model. Our results are based on an applications of a technique for determining significance that provides a theoretically sound approach that does not require the assumption of normality of returns. The SQ test developed to satisfy evidentially thresholds for proof of damages in a court of law speaks to its relevance for event studies. Our event study offers a reasonable set of empirical findings that should help inform the debate over governance of Internet traffic through principles of Net Neutrality. A broader perspective suggests caution in concluding that policy changes eliminating Net Neutrality increase investments that will lead to greater firm values. Although our empirical investigation does not directly measure capital expenditures, increasing equity values are consistent with investments in positive NPV projects. More time must pass before changes in capital expenditures can inform an empirical investigation that causally links such changes to the repeal of Net Neutrality governance. Our main conclusion is that the repeal of Net Neutrality regulation, when taken to the Edge, appears to be value decreasing. When all three groupings of firms are considered together, the statistical analysis suggests that repeal is not a policy move that is consistent with changes in investor expectations that signal increases in total investment across the Internet ecosystem.

References

- [1] Ahern, Kenneth, "*Sample Selection and Event Study Estimation*," Journal of Empirical Finance, 16 (2009), pp. 466-82.
- [2] Amazon, *Comments of Amazon, In the Matter of Restoring Internet Freedom*, FCC WC Docket No. 17-108, July 17, 2017.
- [3] AT&T, *Comments of AT&T, In the Matter of Restoring Internet Freedom*, FCC WC Docket No. 17-108, July 17, 2017.
- [4] Comcast Corp. v. FCC, *United States Court of Appeals for the District of Columbia*, 600 F.3d 642, 2010.
- [5] Bhagat, Sanjai, and Robera Romano, *Event Studies and the Law: Part I: Technique and Corporate Litigation*, John M. Olin Center for Studies in Law, Economics, and Public Policy Working Papers, 2001, paper 259.
- [6] Binder, John, *Measuring the Effects of Regulation with Stock Price Data*, Rand Journal of Economics, 1985 Vol. 16, pp. 167-183)
- [7] Bollerslev, Tim, Robert F. Engle and Jeffrey M. Wooldridge, *A Capital Asset Pricing Model with time-varying covariances*, Journal of Political Economy, 1988, Vol. 96.1, pp. 116-131.
- [8] Chideya, Farai *Nearly All Of Silicon Valley's Political Dollars Are Going To Hillary Clinton*, fivethirtyeight.com, October 25, 2016.
- [9] Choi, Jay P. and Byung-Chao Kim *Net Neutrality and Investment Incentives*, Rand Journal of Economics, 2010. Vol.41, No. 3, pp.150-192.
- [10] Comcast, *10K Filing* 2016.
- [11]Crandall, Robert, *The FCC's Net Neutrality Decision and Stock Prices* , Review of Industrial Organization, 2017 Vol. 50,
- [12]Economic Scholars , *Economic Scholars Summary of Economic Literature Regarding Title II Regulation of the Internet, In the Matter of Restoring Internet Freedom*, FCC WC Docket No. 17-108, July 15, 2017.
- [13]Economides, Nicholas, *Comments of Prof. Nicholas Economides, In the Matter of Restoring Internet Freedom*, FCC WC Docket No. 17-108, July 17, 2017.
- [14]Etsy, *Comments of Etsy, Inc., In the Matter of Open Internet Remand*, FCC GN Docket 14-28, July 18, 2014.

- [15]Faulhaber, Gerald R., *Economics of Net Neutrality: A Review*, Communications & Convergence, 2011, Vol.3, No. 1, pp.53-60.
- [16]Fama, Eugene, *Efficient Capital Markets: A Review of Theory and Empirical Work*, Journal of Finance, 1970 Vol. 25, pp.383-417.
- [17]Fama, Eugene F. and French, K. R. *Common risk factors in the returns on stock and bonds*, Journal of Financial Economics, 33 (1993), 3-56,
- [18]Federal Communications Commission, *Inquiry Concerning High-Speed Access to the Internet Over Cable and Other Facilities*, March 15, 2002, FCC 02-77.
- [19]Federal Communications Commission, *In re Appropriate Framework for Broadband Access to the Internet Over Wireline Facilities ("2005 Wireline Broadband Order")*, FCC Record, 2005, Vol. 20, PP. 14853.
- [20]Federal Communications Commission, *In re Appropriate Regulatory Treatment for Broadband Access to the Internet Over Wireless Networks ("Wireless Broadband Order ")* , FCC Record, 2007, Vol.22, pp. 5901.
- [21]Federal Communications Commission, *Preserving the Open Internet (Open Internet Order)* , FCC Record, December 23, 2010, FCC 10-201.
- [22]Federal Communications Commission, *Protecting and Promoting the Open Internet*) , 29 FCC Rcd 5561, May 15, 014, FCC 14-61.
- [23]Federal Communications Commission, *In the Matter of Protecting and Promoting the Open Internet, Report and Order on Remand, Declaratory Ruling, and Order (Title II Order)*, FCC Record, 2015 Vol. 30, pp. 5601-6000.
- [24]Federal Communications Commission, *In the Matter of Restoring Internet Freedom: Notice of Proposed Rulemaking*, April 27, 2017, FCC WC Docket No. 17-108.
- [25]Federal Communications Commission, *In the Matter of Restoring Internet Freedom: Declaratory Ruling, Report And Order*, January 4, 2018, FCC WC Docket No. 17-108.
- [26]Finley, Klint, *Here's How the End of Net Neutrality Will Change the Internet*, Wired, November 22, 2017.
- [27] Federal Trade Commission, " Broadband Connectivity Competition Policy," FTC Staff Report, 2007.

- [28]Ford, George, *Reclassification and Investment: A Counterfactual Analysis* , Phoenix Center for Advanced Legal & Economic Public Policy Studies, 2017.
- [29]Gans, Joshua S.,*Weak versus Strong Net Neutrality* ,Rotman School of Management Working Paper, 2014, Vol. 2439360.
- [30]Gans, Joshua S. and Michael Katz,*Net Neutrality, Pricing Instruments and Incentives* ,National Bureau of Economic Research Working Paper 22040, 2016.
- [31]Gelbach, Jonah B., Eric Helland, and Jonathan Klick, *Valid Inference in Single-Firm, Single Event Studies*, American Law and Economics Review, 2013.
- [32] Greene, William, Econometric Analysis, Pearson, 2018, 15(2): 495-541 (2013).
- [33]Hazlett ,Thomas W., and Joshua D. Wright, *The Effect of Regulation on Broadband Markets: Evaluating the Empirical Evidence in the FCC's 2015 "Open Internet" Order*, Review of Industrial Organization, 2017 Vol. 50, 2017.
- [34]Hein, Scott E., and Peter Westfall, *Improving Tests of Abnormal Returns by Bootstrapping the Multivariate Regression Model with Event Parameters*, Journal of Econometrics, 2004, Vol. 2, No. 3, pp. 451-471.
- [35]Jordan, Scott, *Evaluating Zero-Rating and Associated Throttling Practices Under the Open Internet Order*, Journal of Information Policy, 2017, 7:450-507.
- [36]Kim, E. Han and Vijay Singal, *Mergers and Market Power: Evidence from the Airline Industry*, American Economic Review, 1993.
- [37] Koblin, John, *Coming Soon to a Court Near You*, New York Times, March 18, 2018.
- [38] Knutson, Ryan, , *Did Verizon's Net Neutrality Win Backfire?* Wall Street Journal, November 11, 2014.
- [39]Knutson, Ryan, *Trump Says He Would Block AT&T-Time Warner Deal*, Wall Street Journal, October 22, 2016.
- [40]Kothari, S.P., and Jerold B. Warner, *Econometrics of Event Studies*, Handbook of Corporate Finance: Empirical Corporate Finance, vol. 1, ed. B. Espen Eckbo, 2007: Elsevier, Amsterdam, pp. 3-36.
- [41]Krause, Reinhardt, *Could Frisky FCC Regulate Facebook, Microsoft, Apple Under Title II?*, Investor's Business Daily, June 15, 2016.

- [42]Lerner, Andres V. and Janusz A. Ordover, *An Economic Analysis of Title II Regulation of Broadband Internet Access Providers (Economic Analysis of Title II Regulation), Appendix A, Comments of Verizon, In the Matter of Restoring Internet Freedom*, FCC WC Docket No. 17-108, July 17, 2017.
- [43]Lintner, John, *Security prices, risk, and maximal gains from diversification*, The Journal of Finance, 1965, Vol. 20.4, pp. 587-615.
- [44] Liptak, Adam, *Can Trump Change Libel Laws?* New York Times, 2017.
- [45]Litan, Robert and Hal Singer, *The Best Path Forward on Net Neutrality*, Progressive Policy Institute: Policy Brief, December 2014.
- [46]Manjoo, Farhad *In Net Neutrality Push, Internet Giants on the Sidelines*, New York Times, November 11, 2014.
- [47]Microsoft, *Comments of Microsoft, In the Matter of Restoring Internet Freedom*, FCC WC Docket No. 17-108, July 17, 2017.
- [48]Miller, Merton H., and Franco Modigliani, *Dividend Policy, Growth, and the Valuation of Shares*, The Journal of Business, 1961, Vol. 34, No. 4. pp. 411-433.
- [49] Mossin, Jan, *Equilibrium in a capital asset market* , Econometrica, 1966, Vol. 34.3, pp. 125-43.
- [50]McConnell, John and Chris Muscarella, *Corporate Capital Expenditure Decisions and the Market Value of the Firm*, Journal of Financial Econometrics, 1985, Vol. 14, pp. 399-422.
- [51]Nagesh, Gautham, *Obama Net-Neutrality Stance May Spur Fight With GOP* , Wall Street Journal, November 11, 2014.
- [52]Nelson, Colleen McCain, *President Obama Wades Aggressively Into Net Neutrality Debate* , Wall Street Journal, November 19, 2014.
- [53]Pai, Ajit, *Dissenting Statement Of Commissioner Ajit Pai, Title II Order* , FCC Record, 2015 Vol. 30, pp. 5922.
- [54]Pai, Ajit, *Statement of FCC Commissioner Ajit Pai: On the FCC's Continued Rush Towards Midnight Regulation*, December 2, 2016.
- [55]Pressman, Aaron , *Why Sprint Stock Is Skyrocketing on Donald Trump's Surprise Victory*, Fortune, November 9, 2016.

- [56] Rysman, Marc, *The Economics of Two-Sided Markets*, , Journal of Economic Perspectives, 2017, pp. 125-43.
- [57] Schwert, G. William, *Measuring the Effects of Regulation: Evidence from the Capital Markets*, , Journal of Law and Economics, 1981 Vol. 24: 121-145.
- [58] Sharpe, William, *Investors and Markets: Portfolio Choices, Asset Prices, and Investment Advice*, Princeton University Press, Princeton, 2007.
- [59] Singel, Ryan, *Filtering Out the Bots: What Americans Actually Told the FCC About Net Neutrality Repeal*, The Center for Internet and Society: Working Paper, October 2018.
- [60] *Sprint Kicks Off 5G Demonstration at Copa America Centenario in Philadelphia with Speeds Up to 4 Gbps*, June 14, 2016.
- [61] Stock, James and Mark Watson, Introduction to Econometrics, 3rd edition, 2011.
- [62] Telecommunications Reports, November 15, 2016 Vol. 82.
- [63] *United States Telecom. Assn. v. FCC*, 825 F. 3d 674, *US Court of Appeals*, 2016.
- [64] *Verizon v. FCC*, *United States Court of Appeals for the District of Columbia*, 740 F.3d 623, 2015.
- [65] Verizon, *Comments of Verizon, In the Matter of Restoring Internet Freedom*, FCC WC Docket No. 17-108, July 17, 2017.
- [66] Werbach, Kevin, *The Court's Net-Neutrality Ruling Isn't Actually That Bad* The Atlantic, January 15, 2014.

11 Appendix A - Company Return Statistics

| Mkt | Mean | Std. Dev. | Skew | Ex. Kurt |
|-------------------------|-------------|------------------|-------------|-----------------|
| | 0.06 | 0.80 | -0.39 | 2.17 |
| ISP | | | | |
| Charter (CHTR) | 0.13 | 1.66 | 0.71 | 4.26 |
| Comcast (CMCSA) | 0.07 | 1.17 | -0.01 | 1.74 |
| Century (CTL) | -0.03 | 1.70 | -2.24 | 33.41 |
| Cablevision (CVC) | 0.11 | 1.82 | 1.52 | 14.60 |
| Dish (DISH) | 0.06 | 1.71 | 0.10 | 2.60 |
| Direct (DTV) | 0.10 | 1.14 | 1.06 | 6.98 |
| Frontier (FTR) | -0.09 | 2.50 | -0.28 | 6.40 |
| Sprint (S) | 0.08 | 3.13 | 0.50 | 10.19 |
| AT&T (T) | 0.01 | 0.94 | -0.36 | 2.09 |
| T-Mobile (TMUS) | 0.13 | 1.85 | -0.51 | 7.45 |
| Time Warner Cable (TWC) | 0.10 | 1.42 | 0.39 | 10.25 |
| Verizon (VZ) | 0.01 | 1.01 | -0.08 | 1.39 |
| ISP Index | 0.07 | 1.03 | 0.04 | 3.70 |
| Old Media | | | | |
| CBS (CBS) | 0.05 | 1.48 | 0.24 | 1.40 |
| Disney (DIS) | 0.07 | 1.15 | -0.47 | 6.90 |
| Fox (FOX) | 0.03 | 1.40 | -0.11 | 3.95 |
| Sony (SNE) | 0.13 | 2.08 | 0.84 | 6.89 |
| Time Warner (TWX) | 0.08 | 1.41 | 0.60 | 26.96 |
| Viacom (VIAB) | -0.03 | 1.91 | -1.63 | 20.04 |
| Old media index | 0.07 | 1.08 | -0.82 | 6.85 |
| New Media | | | | |
| Apple (AAPL) | 0.07 | 1.54 | -0.48 | 6.49 |
| Amazon (AMZN) | 0.13 | 1.86 | 0.47 | 10.32 |
| America on Line (AOL) | 0.11 | 2.40 | 0.04 | 16.51 |
| Facebook (FB) | 0.17 | 2.10 | 2.97 | 38.08 |
| Google (GOOG) | 0.09 | 1.43 | 2.15 | 22.54 |
| Microsoft (MSFT) | 0.09 | 1.45 | 0.02 | 10.71 |
| Netflix (NFLX) | 0.26 | 3.10 | 3.14 | 38.51 |
| Starz (STRZA) | 0.11 | 1.99 | -1.97 | 22.35 |
| Twitter (TWTR) | -0.04 | 3.49 | -0.55 | 9.17 |
| Yahoo (YHOO) | 0.10 | 1.85 | 0.07 | 3.03 |
| New Media | 0.12 | 1.49 | 0.89 | 7.57 |

Table 10: Summary Statistics for Returns in Percent

12 Appendix B - PCA bi-plots

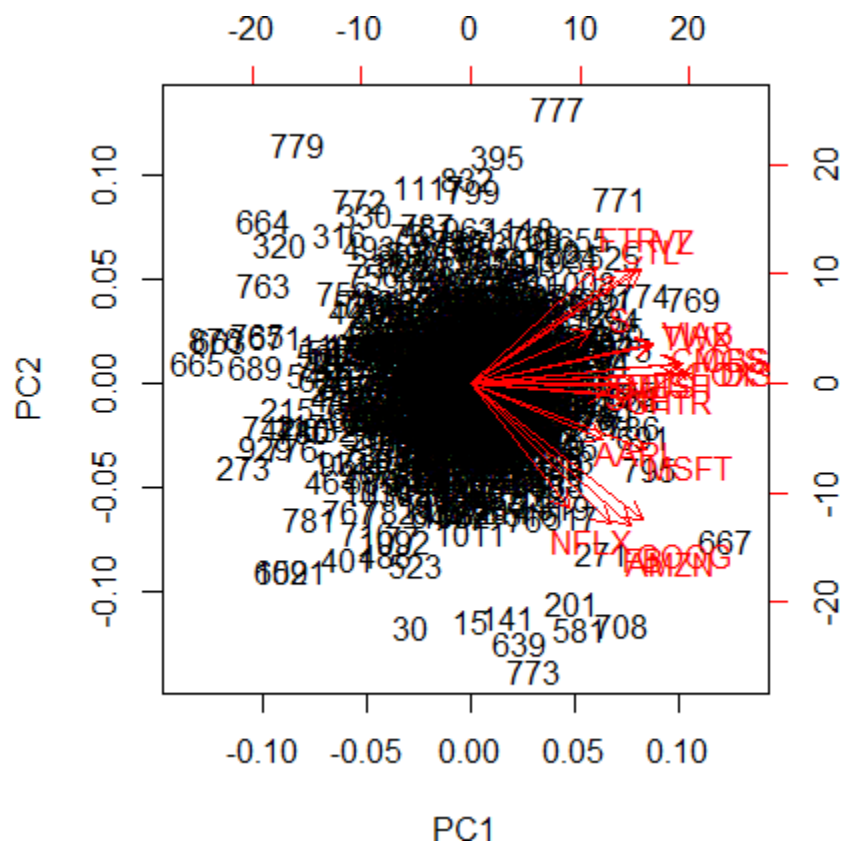


Figure 4: PCA Biplot: All Firms



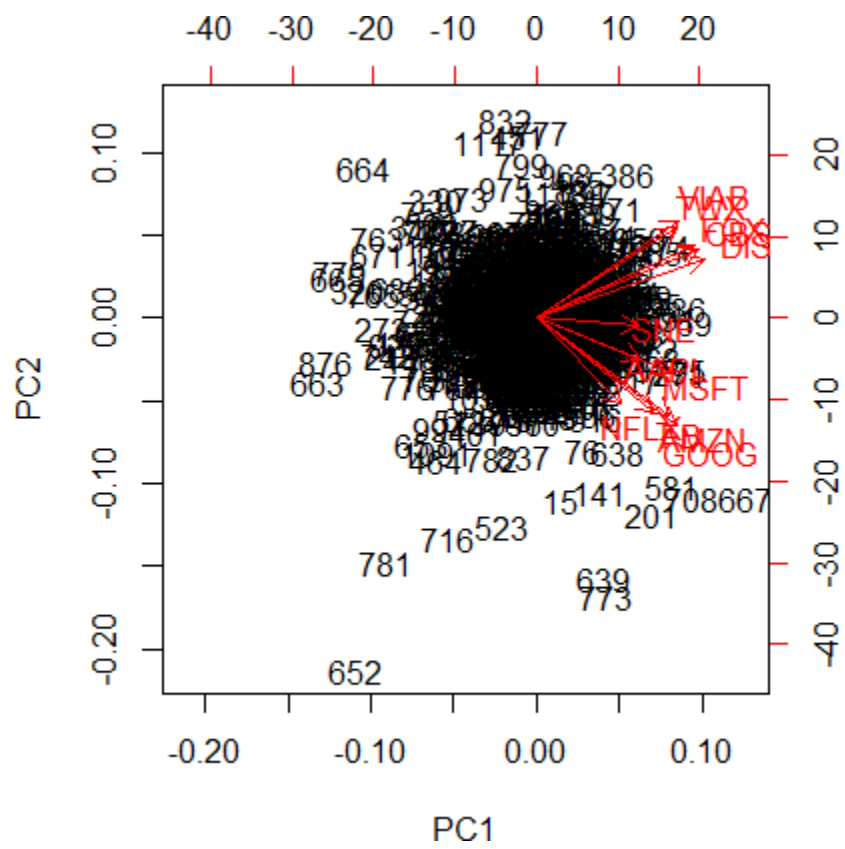


Figure 6: PCA Biplot: Traditional and New Media

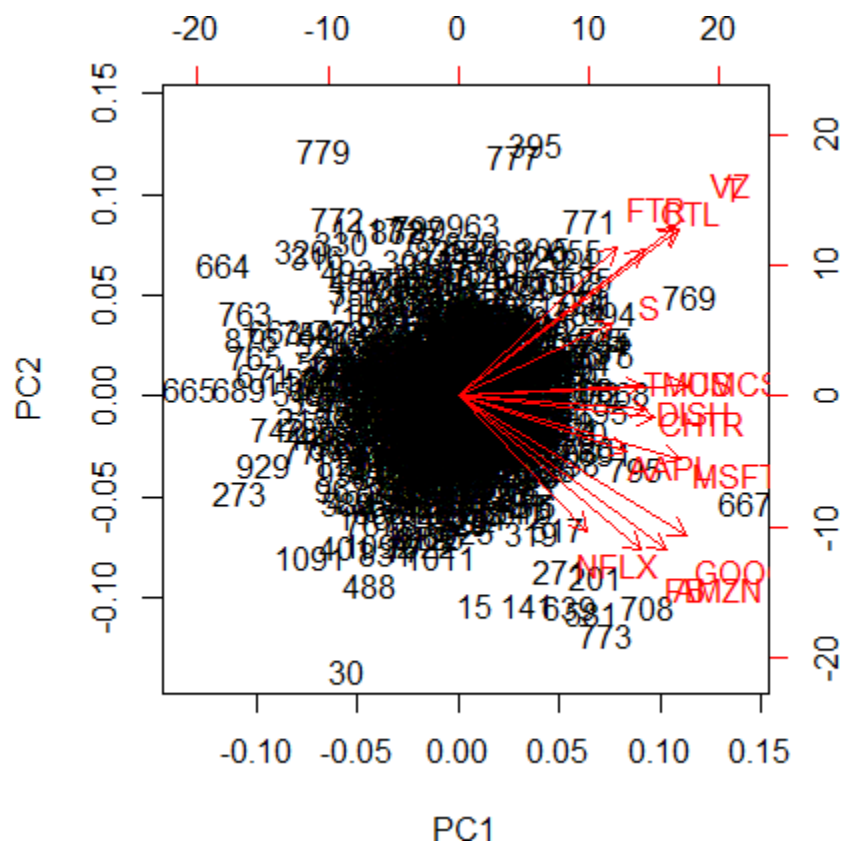


Figure 7: PCA Biplot: ISP' s and New Media

13 Appendix C - OLS Regressions

| | | | | |
|---|----------|------------|---------|-------------|
| New Media | | | | |
| Coefficients: | | | | |
| | Estimate | Std. Error | t value | Pr(> t) |
| (Intercept) | 0.06065 | 0.03626 | 1.673 | 0.09465 . |
| mkt | 1.09114 | 0.04547 | 23.996 | < 2e-16 *** |
| vzfcc | 0.70109 | 1.21589 | 0.577 | 0.56432 |
| obama | 0.77394 | 1.21493 | 0.637 | 0.52424 |
| trump | -3.38199 | 1.21655 | -2.780 | 0.00553 ** |
| dca | 0.54530 | 1.21492 | 0.449 | 0.65364 |
| --- | | | | |
| Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1 | | | | |
| Residual standard error: 1.214 on 1125 degrees of freedom | | | | |
| Multiple R-squared: 0.3407, Adjusted R-squared: 0.3378 | | | | |
| F-statistic: 116.3 on 5 and 1125 DF, p-value: < 2.2e-16 | | | | |
| ISP's | | | | |
| Coefficients: | | | | |
| | Estimate | Std. Error | t value | Pr(> t) |
| (Intercept) | 0.02493 | 0.02464 | 1.012 | 0.31181 |
| mkt | 0.75893 | 0.03088 | 24.578 | < 2e-16 *** |
| vzfcc | 0.43728 | 0.82562 | 0.530 | 0.59647 |
| obama | -2.49530 | 0.82497 | -3.025 | 0.00255 ** |
| trump | 1.05567 | 0.82607 | 1.278 | 0.20153 |
| dca | 0.11885 | 0.82496 | 0.144 | 0.88547 |
| --- | | | | |
| Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1 | | | | |
| Residual standard error: 0.8246 on 1123 degrees of freedom | | | | |
| Multiple R-squared: 0.356, Adjusted R-squared: 0.3531 | | | | |
| F-statistic: 124.2 on 5 and 1123 DF, p-value: < 2.2e-16 | | | | |
| Traditional Media | | | | |
| Coefficients: | | | | |
| | Estimate | Std. Error | t value | Pr(> t) |
| (Intercept) | 0.01365 | 0.02328 | 0.586 | 0.5579 |
| mkt | 0.94775 | 0.02920 | 32.459 | <2e-16 *** |
| vzfcc | -0.25165 | 0.78075 | -0.322 | 0.7473 |
| obama | -0.42333 | 0.78014 | -0.543 | 0.5875 |
| trump | -1.64556 | 0.78118 | -2.107 | 0.0354 * |
| dca | 0.82419 | 0.78013 | 1.056 | 0.2910 |
| --- | | | | |
| Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1 | | | | |
| Residual standard error: 0.7798 on 1125 degrees of freedom | | | | |
| Multiple R-squared: 0.484, Adjusted R-squared: 0.4817 | | | | |
| F-statistic: 211.1 on 5 and 1125 DF, p-value: < 2.2e-16 | | | | |

Figure 8: OLS Regression Results for Three Portfolios

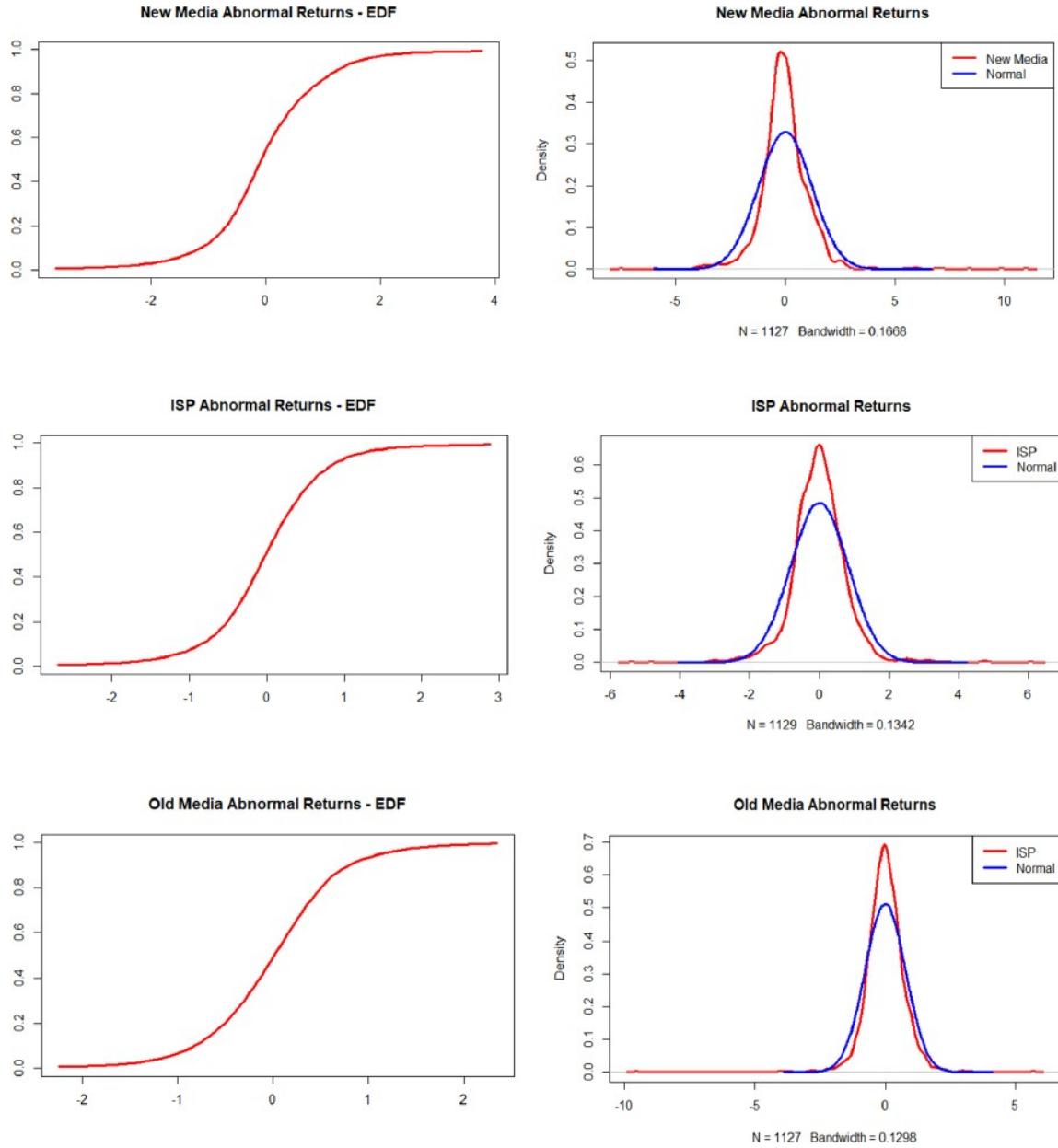


Figure 9: Abnormal Returns EDF and Density for Three Portfolios

13.1 Appendix D - Sensitivity Analysis

While we have segmented the sample of firms into 3 groups, we recognize that the group classification is not cut and dry. For instance, the ISP group contains Comcast, and Comcast owns NBC, a traditional media company. We perform a principal component analysis on the returns for the companies in our study to determine whether there is support for our three groupings. A set of four bi-plots of the first two eigenvectors of the returns are shown in the Appendix B. The first bi-plot Figure 4 contains all of the firms. Looking at all the firms together in Figure 4 there is no clear grouping or separation of the firms. There is a continuum from New Media to ISPs, with significant overlap. We also consider bi-plots for each pair of groupings. Figure 5 shows the bi-plot for ISP's and traditional media firms. We find a continuum from traditional media to ISPs, again with some overlap. Figure 6 is the bi-plot for Traditional and New media companies. There is a sharper distinction between the two groups, with little or no overlap. Finally, Figure 9 contains the ISP's and the New media companies. While the distinction between the two groups is not as clear as in Figure 6, the New media companies are in the bottom left quadrant, separate from the ISP's.

In order to determine the relevance of overlap among groupings, we combine the firms into indexes, and re-estimate the models with bootstrap standard errors. Table 11 contains regression results from two alternative regressions. The first group is ISP's without Comcast. The second is Traditional Media with Comcast.³⁹

| Hypothesis | Event | ISP w/o CMCST | | Old Media/w CMCST | |
|------------|-------|---------------|---------------|-------------------|---------------|
| | | β | $\alpha=0.05$ | Coefficient | $\alpha=0.05$ |
| 1 | vzfcc | 0.4931 | 1.5646 | -0.3022 | 1.4198 |
| 2 | obama | -2.6484 | -1.2027 | -0.2391 | 1.0922 |
| 3 | dca | 0.0567 | -1.2027 | 0.7990 | 1.0922 |
| 4 | trump | 1.0850 | 1.2388 | -1.6474 | -1.0680 |
| A | obama | -2.6484 | -0.5005 | -0.2391 | 0.4611 |
| | trump | 1.0850 | 0.4964 | -1.6474 | -0.4471 |
| B | vzfcc | 0.4931 | 0.3285 | -0.3022 | 0.3198 |
| | obama | -2.6484 | -0.2255 | -0.2391 | 0.1888 |
| | dca | 0.0567 | -0.2255 | 0.7990 | 0.1888 |
| C | vzfcc | 0.4931 | 0.1461 | -0.3022 | 0.1462 |
| | obama | -2.6484 | -0.0516 | -0.2391 | 0.0348 |
| | dca | 0.0567 | -0.0516 | 0.7990 | 0.0348 |
| | trump | 1.0850 | 0.0240 | -1.6474 | -0.0383 |

* $p < 0.05$

Table 11: Alternative Category Definitions

³⁹New media coefficient estimates do not appear in the Table because the sensitivity analysis only involves reclassification of firms within the other two groups of firms.

Moving Comcast from the ISP category into the Old Media category made the coefficient on the Obama letter slightly less negative for the ISP's and much less negative for Old Media, though the coefficient remains significant in both equations.

The coefficient for US Telecom Ass'n vs. FCC in the ISP regression was almost halved, but the sign is still positive, and the coefficient remains insignificant. The coefficient in the Old Media regression was largely unchanged when Comcast was included.

We find the initial results, rather than the results from the alternative groupings, more compelling because approximately 66 percent of Comcast's operating income comes from its cable communications division. Twenty five percent of its income comes from cable networks, broadcast television, and filmed entertainment. The remaining nine percent comes from theme parks.⁴⁰ We believe that the greater percentage of Comcast's operating income that comes from its cable communications division supports our original grouping of Comcast as an ISP.

⁴⁰Comcast 10-K For Year Ending December 31, 2016, p.40.