

Infrastructure Investment After Title II

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USTelecom recently released an update to its U.S. broadband industry capital spending series. In this update, USTelecom reported that sector investment rose \$1.5 billion (or 2%) between 2016 and 2017—a reversal of a two-year decline following the *2015 Open Internet Order*.¹ It was welcome news to many, including Federal Communications Commission (“FCC”) Chairman Ajit Pai, who observed the USTelecom “report confirms that the FCC’s policies to promote broadband deployment are working. After internet service providers reduced new investments in 2015 and 2016 under the prior Administration’s regulatory approach, broadband investment increased in 2017 by \$1.5 billion over the previous year.”² Certainly, the current FCC in the past two years has done much to unravel the regulatory excesses of the prior administration,³ including, but by no means limited to, reversing the reclassification of broadband Internet access as a Title II telecommunications service⁴—a decision receiving much of the blame for declining investment in the sector.⁵

Reversing the slowdown in capital spending in telecommunications is indeed progress, but questions remain about how much damage has been done by the attempts to increase regulatory control in telecommunications.⁶ Much attention was given to the investment changes around the finalization of the reclassification decision in 2015, though such changes did not motivate directly the Commission’s analysis of investment effects in the *2018 Restoring Internet Freedom Order* (“*RIF Order*”), since the naïve comparisons of

yearly changes involved no counterfactual (or, what would investment have been *but for* the regulatory intervention).⁷ As USTelecom advises, “the relevant question with respect to the impact of Title II on investment is what investment would have been over the long term under different regulatory scenarios, holding other factors constant.”⁸

I find that while the decline in capital spending rose in 2015 and 2016 stopped in 2017, investment in the telecommunications sector is materially compressed, being about \$10-to-\$13 billion (or 12-to-15%) below expectations. As measured here, about \$24-to-\$30 billion in investment has been lost to the Title II drama since 2015.

In this PERSPECTIVE, I look at changes in capital spending beginning in 2015 (as measured by USTelecom) with the aid of a counterfactual constructed with guidance from the analysis of investment effects from the *RIF Order*.⁹ I find that while the decline in capital spending rose in 2015 and 2016 stopped in 2017, investment in the telecommunications sector is materially compressed, being about \$10-to-\$13 billion (or 12-to-15%) below expectations. As measured here, about \$24-to-\$30 billion in investment has

been lost to the Title II drama since 2015. At a time when infrastructure investment in broadband networks is needed, regulators must take great care in their policy choices to avoid attenuating investment incentives.

Building a Counterfactual from the RIF Order

While Chairman Pai is pleased that the USTelecom data indicate that the slowdown in infrastructure investment appears to have eased in 2017, the Commission's RIF Order details the limitations of simplistic comparisons of capital spending over time, finding that year-to-year changes in capital spending "can only be regarded as suggestive, since they fail to control for other factors that may affect investment."¹⁰ Instead, as the Commission correctly concluded, "methodologies designed to estimate impacts relative to a counterfactual tend to provide more convincing evidence of causal impacts of Title II classification."¹¹

The analysis of investment effects in the RIF Order offers some guidance on ways to construct a simple counterfactual for use with the USTelecom data. First, in reviewing the raw investment numbers determined to be "suggestive," the Commission noted "the stark trend reversal that has developed in recent years" and that "[i]n 2015, capital investment appears to have declined for the first time since the end of the recession in 2009. And investment levels fell again in 2016—down more than 3 percent from 2014 levels."¹² Second, the Commission found these declines to be "particularly curious" since the economy "has been growing."¹³

In this discussion the Commission is describing, albeit informally, the construction of a counterfactual. First, the Commission is clearly applying a trend analysis, not unlike that appearing in earlier work by Michael Horney of the Free State Foundation.¹⁴ Second, the Agency assumes that telecommunications investment is positively correlated with the overall economy, which is sensible. An expectation of investment,

based on the Commission discussion in the RIF Order, looks something like this expression,

$$y_t = \beta_0 + \beta_1 t + \beta_2 GDP_t + \varepsilon_t, \quad (1)$$

where y_t is capital spending in year t , t is trend variable, GDP_t is Gross Domestic Product in year t , and ε_t is a random influence on investment (that may be serially correlated and heteroscedastic). While there are other influences on investment incentives, I assume such influences are not systematic over this period and thus captured in ε_t .

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To be consistent with the earlier work by Horney, Equation (1) is estimated over the period 2003 through 2014. Then, using the coefficients from the estimated equation, forecast values are obtained for years 2015 through 2017. The USTelecom data are in current dollars, so I have adjusted the raw data for inflation using the GDP Deflator (to 2017 dollars).¹⁵ A 90% confidence interval around the forecast values is constructed using Newey-West errors to account for serial correlation.¹⁶ A simple linear trend, as in

Horney’s work, is also estimated for comparison purposes. The data are sparse (12 observations), with all that implies.

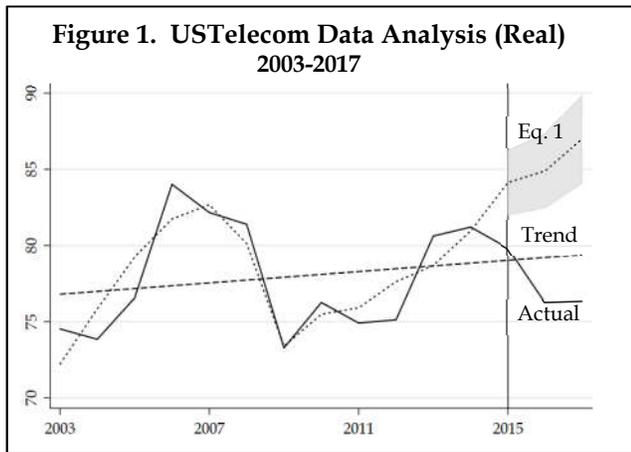


Figure 1 illustrates the results.¹⁷ The solid line is the actual level of (real) investment; the straight dashed line is fitted linear trend and its forecast (consistent with Horney’s earlier work); and the dotted line is the fit and forecast from Equation (1). The shaded area is the 90% confidence interval around the forecast from Equation (1).

From the figure, it is apparent that the model with GDP fits the data much better than does the linear trend, which fits poorly and misses the 2014 investment level by a large amount.¹⁸ The linear trend is a poor approximation of the data. In contrast, the prediction based on Equation (1) almost exactly matches the 2014 investment level and is remarkably close to the actual investment levels prior to 2015.¹⁹ It is a simple model but fits the data well, at least over this somewhat short span of time.

The difference between conditioning on GDP and not doing so is substantial, a difference that supports the *RIF Order’s* dissatisfaction with the counterfactual analysis offered by Horney. Moreover, conditioning the forecasted counterfactual on GDP produces much larger investment effects than does the linear trend. As detailed in Table 1, the linear trend predicts actual 2016 investment to be \$3 billion below

trend, whereas when conditioned on GDP the difference is \$8.7 billion.²⁰ And in 2017, capital spending was \$10.7 billion below the conditioned forecast, but only \$3.1 billion below the linear trend. Actual investment is well outside the forecast’s confidence interval during the treatment period.

Table 1. Investment v. Counterfactuals

Year	Actual	Eq. 1 Prediction	Act. - Pred.	Linear Prediction
2014	81.2	81.0	0.2	78.9
2015	79.8	84.1	-4.3	79.0
2016	76.2	84.9	-8.7	79.2
2017	76.3	87.0	-10.7	79.4

Attributing the declining investment to reclassification—though perhaps other regulatory excesses played a part as well—the Title II decision reduced investment in 2015 through 2017 by a total of \$24 billion, or \$8 billion annually on average. While the decline in capital spending may have turned for the better in 2017, capital spending remains well-below expectations based on recent trends and capital spending’s correspondence to GDP.

While the analysis is simple and based on few data points, Figure 1 suggests the simple model cannot be dismissed outright, as least as a predictor of recent investment behavior. That does not preclude, of course, better estimates from alternate and more sophisticated forecasting methods (though any expanded analysis is limited by the small sample).²¹ At a minimum, this analysis demonstrates the role of the counterfactual and the fundamental flaw in ignoring a “but for” analysis when evaluating investment trends.

The Full USTelecom Data

The analysis above considers the USTelecom data from 2003 through 2017, but the data series actually begins in 1996. Horney excluded years prior to 2003 to avoid the Dot-com Bubble, which began in 1996, peaked in 2000, and crashed

spectacularly in 2001.²² Bubbles are difficult to model, but I try here and meet with some success by recognizing the investment bubble coincided with a stock market bubble.²³ Equation (1) is extended as follows,

$$y_t = \beta_0 + \beta_1 t + \beta_2 GDP_t + \beta_3 X_t + \beta_4 DX_t + \beta_5 D + \varepsilon_t \quad (2)$$

where X_t is the value of the Fidelity Select Telecommunications Portfolio (symbol FSTCX) and D is a dummy variable for years before 2003.²⁴ The interaction term DX_t permits a differential effect of the stock index on y_t during the Dot-Com Bubble, since we have already observed that the investment series is well explained by the trend and GDP after 2002, but GDP does correlate with the investment bubble.

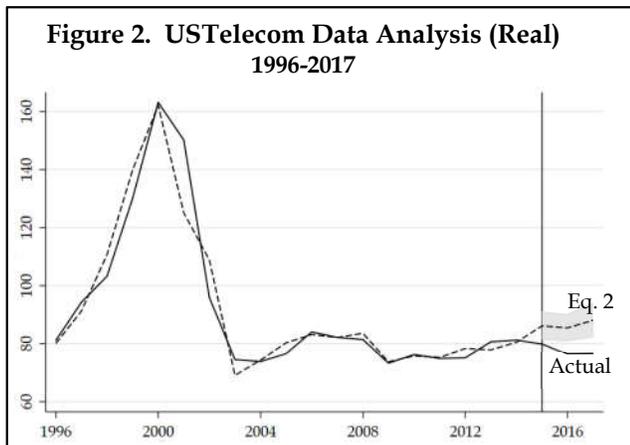
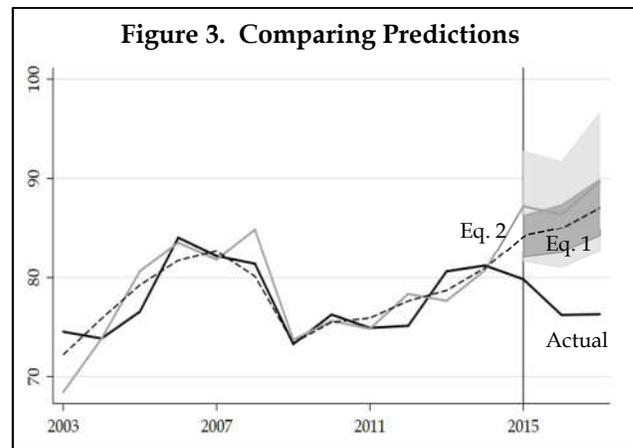


Figure 2 illustrates the fitted values and forecasts and reveals the model fits the data well (with an R^2 of 0.91).²⁵ Again, after 2014, actual investment was well below the counterfactual and is outside the 90% confidence interval of the prediction.

Table 2. Investment v. Counterfactual 1996-2017

Year	Actual	Eq. 2 Prediction	Act. - Pred.
2014	81.2	80.7	0.5
2015	79.8	87.2	-7.3
2016	76.2	86.4	-10.1
2017	76.3	89.7	-13.4

Table 2 summarizes the fit for year 2015 and the forecasted values for years 2015 through 2017. The model closely matches the 2014 level of investment, but the spread between the counterfactual and actual spending rises sharply thereafter. By 2016, capital spending was \$10.1 billion below the counterfactual, rising to \$13.4 billion by 2017 (a 15% decline). Total investment lost since 2015 is \$30 billion. Equation (2) indicates a slightly larger decline in capital spending than does Equation (1); a difference of about \$2.7 billion in 2017. For both models, the investment effect of reclassification is large.



In light of the scale differences between Figures 1 and 2, Figure 3 illustrates the predictions from the two models over the shared 2003-2017 period. Equation (1) is the dashed line and Equation (2) is the greyscale line. The more lightly-shaded area is the confidence interval for the Equation (2) predictions. The two predictions are very similar, as we have already seen, though the confidence interval is much wider for Equation (2) as a result of including the Dot-com Bubble in the data. Nonetheless, actual investment is well below the lower bound of the 90% confidence interval for both predictions.

Investment is a Cost not a Benefit

It is important to keep in mind that in the calculation of social welfare, capital spending is *subtracted* from benefits, not added to them. Capital spending is a cost, not a benefit. The

fascination with capital spending is not in the spending, per se, but that we equilibrate more investment with the expansion of and improvement in services available. If the same level of benefits could be obtained at a lower level of capital spending, then society would be better off. Also, under some definitions, capital spending is a barrier to entry, and thus not something to be welcomed in and of itself.²⁶ Also, the shift to price-cap regulation from rate-of-return regulation was due to the latter's tendency to lead to over investment.²⁷

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As wireless increasingly displaces fixed services, it is likely that the amount of investment required to satisfy the demand for high-speed communications will decline. I suspect, for instance, that 5G wireless technology will permit the expansion of broadband service at much lower expense. If so, then a reduction in overall capital spending in the sector is to be expected and welcomed, not disparaged or avoided. Over short periods of time with stable technologies and input prices, looking at changes in capital spending in response to regulatory treatments may be useful. At some point, however, perhaps even in the very near future, a more economically-sensible view of capital spending must take hold in the telecommunications debate.

Some temperance in expectations of capital spending is also warranted. Analysis of recent capital spending trends suggests many of the larger providers of broadband services—including AT&T, Comcast and Charter—are not spending as much as expected in 2018, and Verizon has indicated it will materially reduce capital spending for 2018 and 2019.²⁸ Still, it is the availability and quality of service that determines benefits, not the cost of producing services, whether those costs are incurred for capital equipment or labor.

While recent data from USTelecom suggest the declines in capital spending in the telecommunications sector have ceased for now, capital spending appears to be well-below expectations based on two counterfactual models. The analysis offered [herein ...] demonstrates that investment in the sector is below expectations by \$24-to-\$30 billion over the 2015 through 2017 period. Investments lost from the Title II drama are more substantial than a simple year-to-year comparison suggest. The small increase in capital spending in 2017 is welcome but fails to mark a full recovery.

Conclusion

While recent data from USTelecom suggest the declines in capital spending in the telecommunications sector have ceased for now, capital spending appears to be well-below expectations based on two counterfactual models. The analysis offered in this PERSPECTIVE, which is based on the informal counterfactual analysis discussed in the *RIF Order*, demonstrates

that investment in the sector is below expectations by \$24-to-\$30 billion over the 2015 through 2017 period. Investments lost from the Title II drama are more substantial than a simple year-to-year comparison suggest. The small increase in capital spending in 2017 is welcome but fails to mark a full recovery.

With the Title II debate still unsettled, broadband companies will continue to hedge capital spending for fear of another regulatory revival.

At a time when policymakers are seeking increased investment in broadband networks, disputes over the regulatory classification of Internet access, which may materially diminish investment incentives, appear to be counterproductive. A more temperate approach to Net Neutrality, perhaps delaying action until some material breach is observed, may be a better regulatory approach.

NOTES:

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¹ P. Brogan, U.S. *Broadband Investment Rebounded in 2017*, USTELECOM RESEARCH BRIEF (October 18, 2018) (available at: <https://www.ustelecom.org/sites/default/files/documents/USTelecom%20Research%20Brief%20Capex%202017.pdf>); *Protecting and Promoting the Open Internet*, REPORT AND ORDER ON REMAND, DECLARATORY RULING, AND ORDER, FCC 15- 24, 30 FCC Rcd 5601 (rel. Mar. 12, 2015) (hereinafter “2015 Open Internet Order”); *aff’d*, *United States Telecom Association v. FCC*, 825 F.3d 674 (D.C. Cir. 2016), *pet. for rehearing en banc denied*, 855 F.3d 381 (2017).

² *Chairman Pai Statement on Broadband Investment Increasing in 2017, Reversing Two-Year Decline*, Federal Communications Commission (October 18, 2018) (available at: <https://docs.fcc.gov/public/attachments/DOC-354639A1.pdf>).

³ G.S. Ford and L.J. Spiwak, *The Unpredictable FCC: Politicizing Communications Policy and its Threat to Broadband Investment*, PHOENIX CENTER POLICY PERSPECTIVE NO. 14-05 (October 14, 2014) (available at: <http://www.phoenix-center.org/perspectives/Perspective14-05Final.pdf>); G.S. Ford, “Regulatory Revival” and Employment in Telecommunications, PHOENIX CENTER POLICY PERSPECTIVE No. 17-05 (June 12, 2017) (available at <https://ssrn.com/abstract=2989333>).

⁴ *Restoring Internet Freedom*, DECLARATORY RULING, REPORT AND ORDER, AND ORDER, FCC 17-166, 33 FCC Rcd. 311 (rel. January 4, 2018) (hereinafter “RIF Order”).

⁵ See, e.g., G.S. Ford, *Reclassification and the Availability of “Broadband” Service: A Counterfactual Check on Recent Claims*, PHOENIX CENTER POLICY PERSPECTIVE No. 18-02 (April 19, 2018) (available at: <http://phoenix-center.org/perspectives/Perspective18-02Final.pdf>); G.S. Ford, *Reclassification and Investment: A Statistical Look at the 2016 Data*, PHOENIX CENTER POLICY PERSPECTIVE No. 17-08 (July 13, 2017) (available at: <https://ssrn.com/abstract=3138865>); G.S. Ford, “Regulatory Revival”, *supra* n. 3; G.S. Ford, *Net Neutrality, Reclassification and Investment: A Further Analysis*, PHOENIX CENTER POLICY PERSPECTIVE No. 17-04 (May 16, 2017) (available at <https://ssrn.com/abstract=2982413>); G.S. Ford, *Net Neutrality, Reclassification and Investment: A Counterfactual Analysis*, PHOENIX CENTER POLICY PERSPECTIVE No. 17-02 (April 25, 2017) (available at <https://ssrn.com/abstract=2982436>); G.S. Ford, *A Review of the Internet Association’s Empirical Study on Network Neutrality and Investment*, PHOENIX CENTER POLICY PERSPECTIVE No. 17-09 (July 24, 2017) (available at: <https://ssrn.com/abstract=3138864>); G.S. Ford, *A Further Review of the Internet Association’s Empirical Study on Network Neutrality and Investment*, PHOENIX CENTER POLICY PERSPECTIVE No. 17-10 (August 14, 2017) (available at <https://ssrn.com/abstract=3138862>); G.S. Ford, *Below the Belt: A Review of Free Press and the Internet Association’s Investment Claims*, PHOENIX CENTER POLICY PERSPECTIVE No. 17-06 (June 20, 2017) (available at <https://ssrn.com/abstract=2989968>); G.S. Ford, *Reclassification and Investment: An Analysis of Free Press’ “It’s Working” Report*, PHOENIX CENTER POLICY PERSPECTIVE No. 17-04 (May 22, 2017) (available at <https://ssrn.com/abstract=2982440>); see also H. Singer, *Does The Tumble In Broadband Investment Spell Doom For The FCC’s Open Internet Order?* FORBES (August 25, 2015) (available at: <https://www.forbes.com/sites/halsinger/2015/08/25/does-the-tumble-in-broadband-investmentspell-doom-for-the-fccs-open-internet-order/#48c4b03e1ef5>); Free Press Fact Sheet, *The Truth About ISP Industry Investment After the FCC Net Neutrality Vote* (September 10, 2015) (available at: <https://www.freepress.net/resource/107129/truthabout-isp-industry-investment-after-fcc-net-neutrality-vote>); H. Singer, *Three Ways the FCC’s Open Internet Order Will Harm Innovation*, PPI POLICY MEMO (May 2015) (available at: <http://www.progressivepolicy.org/issues/economy/three-ways-the-fccs-open-internet-order-will-harm-innovation>); M.J. Horney, *Broadband Investment Slowed by \$5.6 Billion Since Open Internet Order*, FREE STATE FOUNDATION BLOG (May 5, 2017) (available at: <http://freestatefoundation.blogspot.com/2017/05/broadband-investment-slowed-by-56.html>).

⁶ My own analysis, using a broad-based measure of investment in telecommunications, found that the Obama Administration’s regulatory revival in telecommunications reduced investment by about 20% annually, on average, since 2010. G.S. Ford, *Regulation and Investment in the U.S. Telecommunications Industry*, 50 APPLIED ECONOMICS 1-12 (2018).

⁷ *RIF Order*, *supra* n. 4.

⁸ Brogan, *supra* n. 1 at pp. 1-2.

⁹ Horney, *supra* n. 5.

¹⁰ *RIF Order*, *supra* n. 4 at ¶ 92.

NOTES CONTINUED:

¹¹ *Id.* at ¶ 93.

¹² *Id.* at ¶ 90.

¹³ *Id.*

¹⁴ Horney, *supra* n. 5.

¹⁵ Data on nominal GDP and the GDP Deflator are obtained from the Federal Reserve Bank (<https://fred.stlouisfed.org>).

¹⁶ J.D. Hamilton, *TIME SERIES ANALYSIS* (1994) at pp. 279–285.

¹⁷ The coefficients (t-stats) are: $\beta_1 = -65.57$ (-3.69); $\beta_2 = -2.29$ (-6.86); $\beta_3 = 0.0104$ (8.09).

¹⁸ The R^2 of the linear trend is 0.03 and of Equation (1) is 0.77.

¹⁹ Forecasting year 2014 investment using data from 2003 through 2013, the linear trend misses by 4% whereas Equation (1) misses by only 0.45%, nearly a ten-fold improvement.

²⁰ Horney, *supra* n. 5, found a larger difference, but he used preliminary (or estimated) data for 2016 rather than official USTelecom data.

²¹ *See, e.g.*, Ford (2018), *supra* n. 6.

²² A. Sufi and A. Mian, *Why the Housing Bubble Tanked the Economy and the Tech Bubble Didn't*, FIVETHIRTYEIGHT (May 12, 2014) (available at: <https://fivethirtyeight.com/features/why-the-housing-bubble-tanked-the-economy-and-the-tech-bubble-didnt>).

²³ *See, e.g.*, G. Guthrie, *Regulating Infrastructure: The Impact on Risk and Investment*, 44 *JOURNAL OF ECONOMIC LITERATURE* 925–972 (2006).

²⁴ Historical data obtained from Yahoo! Finance (<http://finance.yahoo.com>). I use the average monthly value for the year.

²⁵ The coefficients (t-stats) are: $\beta_1 = -70.87$ (-1.98); $\beta_2 = -2.39$ (-4.99); $\beta_3 = 0.011$ (3.93); $\beta_4 = -0.006$ (-0.04); $\beta_5 = 1.27$ (4.20); $\beta_6 = -103.9$ (-1.91).

²⁶ *See, e.g.*, T.W. Hazlett and G.S. Ford, *The Fallacy of Regulatory Symmetry: An Economic Analysis of the 'Level Playing Field' in Cable TV Franchising Statutes*, 3 *BUSINESS AND POLITICS* 21–46 (2001) (available at: <https://ssrn.com/abstract=1674533>).

²⁷ H. Averch and L.L. Johnson, *Behavior of the Firm Under Regulatory Constraint*, 52 *AMERICAN ECONOMIC REVIEW* 1052–1069 (1962); S. H. Wellisz, *Regulation of Natural Gas Pipeline Companies: An Economic Analysis*, 71 *JOURNAL OF POLITICAL ECONOMY* 30–43 (1963); P.L., Joskow, *Regulation and Deregulation after 25 Years: Lessons Learned for Research in Industrial Organization*, 26 *REVIEW OF INDUSTRIAL ORGANIZATION* 169–193 (2005).

²⁸ S. Leopold, F.G. Louthan IV, V. Chiu, and M. Munoz, *Communications Equipment: Not Seeing the Investments We Expected; Lower Capex Outlook*, RAYMOND JAMES U.S. RESEARCH (October 24, 2018); S. Leopold, F.G. Louthan IV, V. Chiu, and M. Munoz, *Comcast 3Q18 Readthrough: Lower Capex and Guide, Long-Term Spending Priorities Remain Intact*, RAYMOND JAMES U.S. RESEARCH (October 23, 2018); S. Leopold, F.G. Louthan IV, V. Chiu, and M. Munoz, *Communications Equipment: VZ 3Q18 Capex Read Through; Full Year Capex Outlook Down on Lower Wireless*, RAYMOND JAMES U.S. RESEARCH (October 23, 2018); S. Leopold, F.G. Louthan IV, V. Chiu, and M. Munoz, *Communications Equipment: Charter 3Q18 Capex Readthrough - Lower Capex, Outlook Largely Unchanged*, RAYMOND JAMES U.S. RESEARCH (October 26, 2018).