

July 14, 2015

The Georgetown Center for Business and Public Policy is pleased to announce a new policy paper by Senior Policy Scholar Robert Shapiro and co-author Kevin A. Hassett. The paper explores the challenges inherent in evaluating the likely effects of regulation on investment, proposes a systematic approach to such policy evaluation, and includes an empirical example of this approach that analyzes the impact of Title II regulation on Internet investment.

True to the spirit of the Center's work *generating ideas, convening leaders, and shaping policy*, this paper is a timely and important contribution to inform the policy debate.

John W. Mayo

Professor of Economics, Business and Public Policy
Executive Director, Georgetown Center for Business and Public Policy

GEORGETOWN
UNIVERSITY

McDonough
SCHOOL of BUSINESS
CENTER FOR BUSINESS
& PUBLIC POLICY

**Regulation and Investment:
A Note on Policy Evaluation under Uncertainty,
With an Application to FCC Title II Regulation of the Internet**

By

**Kevin A. Hassett
American Enterprise Institute**

**Robert J. Shapiro
Georgetown Center for Business and Public Policy and NDN**

July 2015

Contents

Abstract	2
I. Introduction	3
II. Regulation and Investment	5
II-A. The impact of regulation on investment in economic theory	5
II-B. The search for the relevant analogy	6
II-C. Regulation, uncertainty, and investment	8
III. Applying This Approach to Title II Regulation of the Internet	10
III-A. Background on Title II	10
III-B. The impact of Title II on investment in theory	14
III-C. Empirical evidence and analogies	16
IV. Conclusion	21
References	22
About the Authors	28

Abstract

The impact of regulation on investments in fixed capital has been a central focus of economic inquiry for decades. As a general rule, economic theory can suggest either a positive or a negative role for regulation, depending on the circumstances. Recent years have seen a surge in empirical studies that seek to estimate the overall impact of regulation on investment and overall economic activity. In addition, more traditional studies analyzing specific micro-level policies have continued to contribute to our understanding. In this paper, we explore the unique challenges facing policy evaluations of the effects of regulation on investment and provide guidance on overcoming the adverse circumstances. In addition, we discuss the impact of two types of uncertainty – uncertainty regarding the actions of regulators, and uncertainty regarding the likely impact of regulations – and draw implications for the modeling of the actions of both. We close with a specific application to the current debate over net neutrality regulation of Internet service providers.

**Regulation and Investment:
A Note on Policy Evaluation under Uncertainty,
With an Application to FCC Title II Regulation of the Internet¹**

Kevin A. Hassett and Robert J. Shapiro

I. Introduction

Since the founding of the United States, regulations affecting economic agents have grown inexorably, decade by decade. Introductory economics teaches that regulations can improve social welfare in cases of simple monopoly. The monopolist reduces output, raises prices, and expands profits by moving the economy away from the Pareto-efficient competitive equilibrium. In such a setting, the role of the regulator is quite simple. If the regulator can know the price and quantity that emerge under competitive equilibrium, it can simply dictate prices and/or quantities. Alternatively, the regulator could subsidize capital investment until the output of the firm increases to the competitive level. In both cases, the impact of the regulator is unambiguously positive with respect to investment, as well as efficiency.

In more common cases, the theoretical literature, which we review below, envisions circumstances under which regulation reduces investment, and circumstances under which it increases investment. Indeed, the broad range of possible theoretical outcomes is impressive, but the range also presents a challenge for policymakers. This characteristic distinguishes regulatory analysis from many other areas of economic inquiry. If one were to consider the impact of an increase in the U.S. corporate tax rate on investment in the United States, the policymaker can explore a space with voluminous findings concerning the likely impact of this increase, from studies of the impact of state-to-state corporate variation within the United States to studies using cross-country data. Hassett and Hubbard (2002) reviewed this literature and concluded that the responsiveness of investment to tax parameters is known fairly precisely. The literature since then has confirmed and enriched this finding (see, for example, Desai and Goolsbee (2004)).

On the other hand, regulations exist in virtually infinite variety. For example, according to a recent document published by the U.S. Chamber of Commerce, federal agencies added 38,000 rules to the U.S. Code of Federal Regulations from 2001 to 2011. In 2011, the Code contained 169,301 pages as compared to 71,244 pages in 1975, and the page count of new regulations has grown in recent years by about 3,500 pages per year.²

¹ We want to gratefully acknowledge the support for our research provided by NDN. All of the analysis and views expressed here are solely those of the authors.

² U.S. Chamber of Commerce (2012).

Why are regulations so varied? First, regulators face a wide array of different policy challenges, from air pollution to market power. Second, regulators sometimes address problems caused by previous regulation. To the extent that certain regulations have been identifiably harmful in the past, regulators may seek to propose new rules that address those shortcomings or, in the worst case, deviate from past practice so much that opponents who oppose the action on theoretical grounds have little empirical evidence to cite. This wide variety of conditions and circumstances makes the problem of policy analysis in this space much more challenging than the inquiry into parametric changes in tax rates or other policies that have been varied continuously for many years.

In this paper, we explore the logical consequences of this observation for policymakers and analysts. We begin in section II with a discussion of the observation that policymakers must draw inferences concerning the likely impact of regulations from analogies. We flesh out a guide to both the theoretical and empirical literature, and draw on a vibrant academic literature that allows one to place relevant analogies in proper conceptual context. In this context, we derive three steps for a logically sound policy analogy: (1) identify the micro issue, such as rate-of-return regulation or regulatory adjustment costs; (2) compile examples of the micro issue as potential analogies; and (3) assess the plausibility of the direction and scale of the effect suggested by the micro analogy. Next, we discuss the uncertainty introduced by the uncertain legal fate of many new regulations, assuming they are challenged, and the uncertain impacts even if they are not challenged. We explore the impact of such uncertainty on behavior and discuss how the analysis of uncertainty can be used to augment and reinforce conclusions drawn from analogies.

In section III, we consider the recent Federal Communications Commission (FCC) decision to subject Internet service providers (ISPs) to new regulation under Title II of the Telecommunications Act of 1934 (Title II regulation). The FCC's plans raise important issues about how Title II regulation of ISPs is likely to affect their future capital investments. This matter is very important for the future of the U.S. economy, because strong capital investment by ISPs is essential for the Internet's continuing utility, efficiency, and expansion. Cisco has reported, for example, that U.S. IP traffic quadrupled from 2009 to 2014 and will continue to grow at high rates over the next five years.³ This rapid growth in IP traffic is supported by high levels of capital investment by ISPs, totaling more than \$1 trillion over the past 15 years.⁴ We conclude by applying the methods developed in earlier sections to the evaluation of this specific policy and demonstrate that the policy will likely have significant adverse effects on future investment in the Internet.

³ Brogan (2015).

⁴ U.S. Telecom (2014).

II. Regulation and Investment

In this section, we develop a guide to assist policymakers and analysts in evaluating the likely impact of a proposed policy. We argue that analysis should proceed in three distinct steps. First, while regulation has an uncertain theoretical effect on investment, the theoretical literature can provide a useful taxonomy of different types of policies. Before proceeding to an empirical evaluation of a policy, a researcher should attempt to place a given proposal within that taxonomy, in order to evaluate the *a priori* expectation of the likely direction of the impact of the regulation on investment. Section II-A develops this taxonomy. Second, even with reasonable insight regarding the likely direction of the effects of a given policy, the researcher can only evaluate the scale of those effects by identifying relevant analogies. With reference to our taxonomy, section II-B provides a guide for evaluating which analogies are most valuable, and examines how drawing on a broader macro-econometric literature can help identify the plausible scale of a given regulatory effect. We then draw on Organisation for Economic Co-operation and Development (OECD) data and describe a specific macro-econometric example that may be particularly useful for applied regulatory analysis when regulatory policies are highly distinctive. Third, in section II-C, we turn to a discussion of how a policy analyst should factor uncertainty into the policy evaluation process.

IIA. The impact of regulation on investment in economic theory

A theoretical study by Alesina, Ardagna, Nicoletti, and Schiantarelli in 2003 (Alesina *et al*) begins with a sketch of an economic model that can incorporate the major relevant effects of regulation on investment that appear throughout the literature. This discussion will serve as a useful organizing mechanism as we pursue a taxonomy for regulation. The first effect cited, drawing on the work of Blanchard and Giavazzi (2001), emphasizes the impact that regulation can have on the possible markup by a firm over its marginal cost. Regulations that might accomplish this include explicit price regulations; but regulatory restrictions on entry by new firms, which make it easier for incumbent firms to maintain high markups, are especially prevalent in the data. A second class of regulations influences the costs that existing firms face in expanding their capacity. For example, if regulatory approval is required for such expansions or for the introduction of a new product made possible by new investment, the cost of such investing is unambiguously higher. The third type of regulation, in the form first posited by Averch and Johnson (1962), imposes a ceiling on the rate of return. If the ceiling is above the cost of capital and guaranteed by the regulator, firms may increase their investments to take advantage of scale effects on their profits. The final form of regulation policy is a change in public or private ownership in an area. For example, if the U.S. Post Office were privatized, it might be expected to affect investment.

Alesina *et al* shows, as also follows from the broader literature, that regulation that increases entry in an industry and thus drives down its markups can be expected to increase investment in that industry as it drives the economy toward an equilibrium that

is closer to the Pareto optimum. Regulations that increase the adjustment costs via red tape or other channels can be expected to reduce investment, including operational and organizational changes to accommodate the regulation and compliance costs. For the third type, Averch and Johnson-style regulation of rates of return, the results are highly intuitive. Under rate-of-return regulation, the total profit available to the firm increases as its total investment increases, because the firm can pass along the cost of new investments to consumers while earning its set return. This encourages firms to increase their total profits by expanding to too great a scale. In such a world, the regulation could increase investment and encourage excessive capital spending. It should be noted, however, that the literature in this area is nuanced and results can become quite complex for multiproduct regulated firms that produce both competitive and noncompetitive products (e.g., see Braeutigam and Panzar (1993)). Finally, changing the extent to which a regulated firm is a public enterprise has ambiguous effects on investment. If one accepts the view that a public enterprise is less responsive to market forces, and thus less likely to have efficient scale, it is equally plausible that the enterprise will over invest or under invest. Under a “Leviathan” view of government, privatization may reduce the scale of the firm and thus the extent of its investments.

This analysis suggests a simple taxonomy, assuming the firm does not maintain a simple monopoly. A regulation may be expected to increase investment if it either encourages entry, if it makes a government-financed inefficient scale more likely, or if it introduces Averch and Johnson effects. A regulation that increases the regulatory hurdles to activity, the cost of capital or capital adjustment costs can be expected to reduce investment. Policy analysis should begin by establishing the expected sign or direction of the regulatory effect, before proceeding to analogy in order to shed additional light on the likely scale of the effect.

II-B. The search for the relevant analogy

Before beginning to assess the relevant analogy for a proposed policy, the policy researcher should sort the policy, if possible, into the relevant taxonomic box. If rate-of-return regulation is being considered, past experiments with rate-of-return regulation should be drawn upon, and so on.⁵ An increase in regulatory adjustment costs in the energy sector may be more relevant for evaluating an increase in regulatory adjustment costs in the telecommunications sector than would be an analysis of rate-of-return regulation in that sector.

Once a relevant micro analogy has been identified, the policy analyst faces the challenge of assessing the likelihood that the scale of an effect suggested by the micro analogy is plausible. If theory suggests that the effect is negative, and the micro analogies suggest that the effect would be to reduce investment by 20 percent, what other information can an analyst bring to bear to assess whether the 20 percent reduction is plausible in the current case? Moreover, different analogies may imply different scale

⁵ See Mayo (2014) on the value of such an approach.

effects. Unlike simple parametric policy changes, a researcher could attempt to weight the competing relevance of different analogies, because simply averaging the estimates from different studies has little or no theoretical basis, assuming that the underlying data are not generated by a single, ergodic process. In this circumstance, the international macro-econometrics literature is a potentially valuable and underutilized resource, especially the recent literature linking regulatory practice to economic growth and investment. This literature relies upon the path-breaking work by Nicoletti *et al* (1999), Conway *et al* (2006), Wöfl *et al* (2009), and Koske *et al* (2015), which have developed economy-wide and sector-wide indicators of the relative stringency of a nation's regulatory policies. These indicators have become "an essential element of the OECD's work as they enhance the knowledge of regulatory practices in OECD countries and the potential for investigating the link with economic performance."⁶

The OECD index of regulatory stringency is based on a questionnaire of approximately 1,400 questions regarding regulation. Individual governments have answered these questions, their coded answers were given quantitative scores, and those scores have been normalized to fall between zero and six, with zero signifying the most market friendly regulatory stance and six the least friendly stance. While the numerical values of such a complicated procedure might appear to have questionable empirical relevance to the macroeconomic differences among countries, the empirical literature finds that they do. For example, Alesina *et al* found that variation in these measures of regulatory stringency explain much of the variations across countries and across time, and that the negative relationship between regulation under the OECD measure and investment, in particular, is highly significant statistically and economically.

A few examples drawn from Alesina *et al* illustrate this point. The UK transport and communication sectors were significantly deregulated starting in 1984, and the UK measure of regulation declined sharply from about 3.75 in 1975-1983 to about 0.78 in 1994-1998. The Alesina *et al* empirical model linking investment and regulation would predict that the investment rate (the ratio of investment to capital, including new flows) in these sectors would increase from 4.96 to 8.23, 3.27 percentage points or 65 percent. The actual increase was from 4.96 to 7.99. Alesina *et al* also report that the economy-wide investment rate in the United States was 8.97 percent between 1994 and 1998, compared to an average of 6.1 in Germany, France, and Italy. In the same period, the U.S. regulation measure was 0.80, compared to a regulation measure averaging 3.8 for Germany, France, and Italy. The Alesina *et al* model would predict that the investment level in those three countries would have approached the U.S. level if they had adopted the U.S. level of regulation at that time.⁷

All told, the Alesina *et al* results suggest that a unit decrease in the OECD regulatory measure would increase the investment rate from 6 percent to about 7.1 percent, or by about 18.3 percent. These results are fairly robust to both specification

⁶ Koske *et al* (2015), at p.6.

⁷ Alesina *et al* (2003), at p. 16.

change and disaggregation to the sectoral level, and a large literature has emerged in this space.

It is our view that since the analysis of regulatory policy necessarily will require that an analyst draw from a large set of empirical analogies, these macro-econometric estimates can help researchers infer the likely direction and scale of a change in regulation. In an ideal setting, one could estimate how a given change in policy would change the index and then infer the likely impact on investment by drawing on the empirical literature. Alternatively, one could assemble micro analogies to the policy under consideration and then collect evidence on the plausibility of the scale of these effects by performing a thought experiment based on the OECD index. For example, Koske *et al* (2015) report that Slovenia had very stringent regulation of its communication sector (an index value of about 3), while Portugal has an index value of about 2. Given the macro-econometric results reported by Alesina *et al*, one might infer that deregulatory policies under which Slovenia adopted Portugal's communications regulations would increase investment and do so by about 18 percent. A given proposal in Slovenia could be evaluated for plausibility with an eye on this scale.

If a proposed regulatory change in the United States moves regulation toward the level of other identified countries, and the scale of the directional move can be inferred, the link provided by the macro-econometric literature can give policy analysts a valuable insight into the likely impact of the policy. In section III, we will examine a specific example that will highlight the value of this approach. However, first we turn to the issue of uncertainty and discuss how a policy analyst might factor in that element.

II-C. Regulation, uncertainty, and investment

Before turning to specific regulation, we must recognize the impact of uncertainty on investment in many regulatory situations and, therefore, the role that uncertainty should play in policy analysis of a specific regulation. Much of the discussion of the economic effects of regulation focuses on estimates of its likely expected impact; but questions about the scope and impact of the regulator's actions may increase the uncertainty that investors face, providing an additional way in which regulation can affect investment.

As a theoretical matter, uncertainty itself is not necessarily a negative for investment. Some models predict positive effects, such as Hartman (1972) and Abel (1983), and others predict negative effects such as Pindyck (1988). One crucial distinction drawn from this literature concerns the long-term cost of putting the capital in place. If the capital investment is associated with large sunk costs that are not easily reversible – that is, equipment or facilities that cannot be resold in a secondary market – then uncertainty can have large negative effects.

In this context, policymakers and policy analysts considering the impact of a regulation should consider first whether the impact of the regulation is well known and whether the regulator's actions can be reversed or changed, as through a lawsuit. If the

impact cannot be well known and the regulator's actions can be changed, there is a significant prospect, again depending on adjustment costs, that the regulation will have negative effects on investment through uncertainty.

The latest literature suggests that a new regulation can have an especially destructive, negative effect if it involves a threshold event that creates large incentives for investors to wait until an uncertainty is resolved. Such a threshold event could occur, for example, when a regulator's actions are not consistent with his or her past actions, and likely to be challenged in court. Between the initial regulatory decision and the final resolution, firms may radically reduce their affected investments.

The importance of such threshold events has been documented in a number of settings, and a thorough review is available in Hassett and Sullivan (2015). Nishide and Nomi (2009) explore a model in which a regulatory policy change probabilistically occurs around a national election. They find, as did Bernanke (1983), that such circumstances induce firms to act as if they know that the worst outcome will occur. For example, if one political party is hostile to business while the other is business-friendly, as the election approaches optimal investors will choose to delay investments, setting their investment at levels that would be appropriate if the unfriendly political party were certain to win.

A growing literature has found that threshold events such as elections can have very large effects on capital spending and aggregate activity. Julio and Yook (2013) investigate foreign direct investment in fixed capital, which they find is highly responsive to the timing of elections. They also found that portfolio investments are not election-sensitive, because portfolio flows are easily reversible. This work also, therefore, supports the link between uncertainty's adverse effects and the reversibility of capital. Further, Julio and Yook (2012) found similar election-sensitivity in domestic investment flows as well, with investment dropping about 5 percent during election years as investors wait for election uncertainty to be resolved. These models suggest that the forces that drive investment behave abnormally when a threshold event puts the investment on hold.

Hassett and Sullivan (2015) argue that the impact of threshold events is highly intuitive and likely to be greater when interest rates are low and expected to remain low. They argue that,

This result is in some sense obvious if the hypothetical election is tomorrow, as delay brings with it the benefit of avoiding the potential for regret in the bad state, and the opportunity cost is zero if there is no revenue from operations between then and now to lose. If the election is a month away, then a firm contemplating a new investment would trade-off the value of the possible increase in profits between now and the election

against the potential for regret on the day of the election. As elections become temporally farther in the future, and as interest rates increase, the more important the sales between now and the election become.⁸

While the quantification of the negative effect of potential threshold events is beyond the scope of this paper, the literature suggests that regulators should be cautious about creating such threshold events with controversial rulings that will turn on an uncertain court ruling, and should expect significant negative consequences when their rulings do create such events. For an analyst evaluating the likely impact of a regulation on investment, the presence of a threshold event should increase the analyst's expectation that the regulation would harm investment, at least until the threshold passes and possibly beyond that, depending on uncertainties associated with the regulations and the regulatory process. The rules may be ambiguous about which practices are allowed; their standards and definitions may be unclear, as may be aspects of their implementation, adjudication, and enforcement; and the process may be subject to disputes and change.

III. Applying This Approach to Title II Regulation of the Internet

In this section, we provide a specific example of this approach to evaluating the investment effects of a proposed regulation. We begin by providing background on the specific example. We will then turn to a discussion of the likely theoretical effects of the regulation. Next, we will assess two specific analogies drawn from the literature and relate them to the Alesina *et al* model. Finally, we will discuss the plausibility and relevance of the thought experiment suggested by the results of the Alesina *et al* model.

III-A. Background on Title II

In this section, we examine some of the economic implications of the FCC's decision to retreat from its longstanding view that Internet companies are information providers under the Telecommunications Act of 1966 (1996 Telecom Act), and embrace instead a new view that Internet service and possibly content companies are telecommunications providers subject to regulation under Title II of the Communications Act of 1934.

The history of how the FCC regulates Internet companies has been surprisingly uniform. The principle of applying minimalist regulation to the Internet was established by Congress in the 1996 Telecom Act when Congress codified the distinction between information and telecommunications services. The law excluded information services from common carrier regulation and classified cable and Internet as information services. This distinction, as then FCC Chairman William Kennard stated, sought to

⁸ If the interest rate is low, then the period in which investment is frozen can extend far away from the threshold, as the time value of money is low.

create “an oasis of regulation in the broadband world”⁹ and thereby allow market forces to create incentives for any company to use a range of technologies to deploy broadband Internet. It worked. Cable companies shifted to digital platforms, and when their pricing regulation ended in 1999, their investments in the cable-delivery of Internet service rose sharply. Similarly, national telephone companies rolled out Digital Subscriber Line (DSL) Internet service. In addition, the Budget Reconciliation Act of 1993 preempted state and local rate and entry regulation of mobile telephone companies, which later would become a major vehicle for the Internet. The Clinton administration also blocked moves by European countries to subject the Internet to the I.T.U. and its attendant common carrier regulation. In Chairman Kennard’s 1998 report to Congress, he reiterated these principles, declaring that Internet access is an integrated “information service without a telecommunications service component.”¹⁰

The Bush administration maintained this deregulatory approach to the Internet. The FCC reconfirmed this view of the Internet as information services with regard to cable modem service in 2002, wireline broadband in 2005, and wireless broadband in 2007. In 2003, the FCC also ended the common-carrier unbundling of the regional Bell operating companies’ (RBOCs) fiber networks. This was followed by sharp increases in the RBOCs’ investments in fiber optics, an integral part of fast Internet connections. In 2005, the Supreme Court upheld an FCC ruling that Internet access by cable companies is an information service,¹¹ stating that an information service that contains what could otherwise be a telecommunications element does not, on that basis, become a telecommunications service subject to regulation as a common carrier. Broadband access was understood to be a functionally-integrated information service that provides “a capability for generating, acquiring, storing, transforming, processing, retrieving, utilizing or making available information via telecommunications,”¹² distinct from a telecommunications service that provides for “the transmission . . . of information of the user’s choosing, without change in the form or content of the information as sent and received.”¹³ Under this view, Internet access services integrate data processing and transmission components – providing, for example, email service, security screening spam protection, parental controls, and customized browsers and homepages – and do not forfeit the status of information services if subscribers do not use their email service, spam protection, or customized home pages. The FCC, in effect, adopted a view of broadband service as inextricably involving information processing and interactions with stored data.

Two issues have prompted the FCC to reconsider whether to apply common carrier regulation to Internet companies – a desire for universal access to broadband service, and “net neutrality” or the terms under which Internet companies can offer differential pricing for different levels of service. The 1996 Act classified Internet

⁹ Ehrlich *et al* (2009).

¹⁰ FCC (1998).

¹¹ National Cable & Telecommunications Association *et al. v. Brand X Internet Services et al.*

¹² Bret Swanson, American Enterprise Institute. Interview, May 20, 2015.

¹³ *Ibid.*

service as an information service, and acknowledged the critical role that broadband access would soon play in the economic operations of businesses and the social and political activities of individuals by noting concerns about a “digital divide.” Section 706(a) of the Act directs the Commission to “encourage the deployment on a reasonable and timely basis of advanced telecommunications capability to all Americans . . . by using price cap regulation, regulatory forbearance, measures that promote competition in the local telecommunications markets, or other regulatory methods that remove barriers to infrastructure investment.” The authority to cap prices or rates of return has never been invoked in this setting, in part because the Commission has acknowledged that Section 706(a) does not confer new legal authority.

Section 706 also directs the FCC to conduct regular inquiries into “whether advanced telecommunications capability is being deployed to all Americans in a reasonable and timely fashion.” If the Commission determines that such deployment is not happening, it is directed to “take immediate action to accelerate deployment of such capability by removing barriers to infrastructure investment and by promoting competition in the telecommunications market.” The FCC has never undertaken such action, because the deployment of broadband as regulated as an information service has proceeded at a historically rapid rate. The White House National Economic Council and Office of Science and Technology Policy reported in 2013 that the share of American households with broadband service had increased 17-fold from four percent in 2000 to 68 percent in 2010, that broadband access with a baseline speed of at least 10 megabits per second (Mbps) is available to 94 percent of U.S. households, and that the United States (and Canada) currently enjoy the world’s fastest, average mobile connection delivery speed of 2.6 Mbps.¹⁴

Nevertheless, the FCC’s Sixth Broadband Progress Report in July 2010 concluded that broadband deployment was not “reasonable and timely” because universal access had not been achieved,¹⁵ despite an FCC analysis four months earlier demonstrating the costs of establishing universal broadband access using terrestrial networks would exceed any measure of the benefits.¹⁶ The March 2010 National Broadband Plan found that some 7 million American households had no terrestrial broadband access, or 5.4 percent of a total 129 million U.S. households. The Commission estimated that universal terrestrial access would cost another \$23.5 billion or \$3,357 per household – but access for the 250,000 most remote households would cost \$13.4 billion or \$53,600 per household.¹⁷ All of those remote households could get secure access through satellite systems, but the FCC has never classified those systems as broadband.

The data show that the diffusion of broadband access and service have occurred more rapidly than the diffusion of computers or dial-up Internet service, and with virtually no regulatory intervention. As with computers, technological advances have

¹⁴ National Economic Council and Office of Science and Technology (2013).

¹⁵ FCC (2010-A).

¹⁶ Ford and Spiwak (2012).

¹⁷ *Ibid.*

largely driven the broad adoption of broadband: as broadband speed and capacity has increased, programmers have developed tens of thousands of new broadband applications, including audio and video, and thereby have greatly enhanced the Internet's utility for businesses and households. Technological advances and competition also have promoted the rapid uptake of broadband by gradually bringing down the average, quality-adjusted price of the service, albeit at a substantially slower rate than with computers.¹⁸

As an economic matter, the rapid diffusion of broadband access and service may owe a great deal to the way it has been regulated. In the case of telephone service, numerous studies have found that common carrier regulation inhibited competition, discouraging and dramatically slowing innovations in telephone service.¹⁹ By analogy, applying the very same regulation to the Internet would be expected to produce a similar outcome, hampering future advances in the speed and capacity of broadband and the applications that depend on broadband.

The network management practices which first gave rise to concerns about net neutrality appear to have been essential for the efficient operations of broadband networks for all users. The “neutral” use of very high speed and large capacity technologies for all Internet transmissions rather than only for highly bandwidth-intensive applications would be inefficient and unnecessarily costly—as the “neutral” use of lower speed and capacity technologies for all connections rather than just bandwidth non-intensive applications would disable high-volume applications such as remote medicine and peer-sharing program. If those sending large volumes of data pay the same as those sending much smaller volumes, most people's costs must increase, and the vast majority of broadband consumers will subsidize the small minority of high bandwidth content users (and providers). The FCC has long acknowledged these dynamics, holding in its 2005 “Internet Policy Statement” that consumers are entitled to access any lawful content, run lawful applications and services, and connect to any device, all as they choose, in an environment of competitive markets in all aspects – and all subject to “reasonable network management.”²⁰ Similarly, the Commission's “Open Internet Order” in December 2010 bars Internet service providers from discriminating against any legal content, subject to reasonable network management requirements.²¹

The subsequent appeal of this Order to the courts and the judicial finding that the Commission has no legal authority to impose common carrier regulation on information services firms led to the current calls to reclassify ISPs and other Internet companies as common carriers and thereby subject them to the regulation in Title II.

¹⁸ Greenstein and McDevitt (2010).

¹⁹ Stewart (2010); Bourreau and Dogan (2001).

²⁰ FCC (2005).

²¹ FCC (2010).

III-B. The impact of Title II on investment in theory

It is clear that regulation of the Internet under Title II falls into the second category in our taxonomy of the theoretical effects of regulation on investment. Applying Title II to the Internet does not *per se* dictate specific rates of return, and it does not stimulate entry; but it does likely increase costs and regulatory hurdles for providers.²² Introducing substantial, new regulation of the businesses that provide much of the Internet's infrastructure and content could not only raise the cost and price of most Internet communications. It also could reduce the efficiency of most network arrangements that depend on Internet platforms, devalue the investments made in those platforms or based on them, and force many organizations to reorient their enterprises in ways that would minimize the costs of the regulation rather than - maximizing efficient operations. In addition, new regulatory hurdles to offering new services and innovations, such as the general conduct standard, introduce delay and uncertainty into the innovation cycles for Internet-related products and services.

Some of those additional costs would be direct ones. For example, the FCC has stated its concerns that 5.4 percent of U.S. households have access to broadband only through satellite services and not through ground-based networks, and suggested that common carrier regulation could accelerate universal terrestrial access and uptake, as it did for telephone service. The universal service program for telephony, however, has entailed fees in interstate and wireless services of eight percent to 11 percent and sometimes higher.²³ For broadband, comparable percentage costs could produce damaging feedback effects: the costs of financing universal terrestrial access and uptake would increase the cost of broadband service for everyone else, which in turn would drive a share of households and businesses to cut back, eliminate or not adopt their broadband service. In practice, such a Title II "universal service" program for broadband could drive away more households than it brings in through subsidies: the reductions among the 95 percent of households with terrestrial broadband could outweigh gains among the five percent who do not have access to terrestrial broadband.

A period of new regulation, especially one with the dimensions of Title II common carrier regulation, could lead to substantial price increases and consumer costs on top of any universal service fees. One reason is that Title II will divert the resources and strategic attention of Internet companies from their basic business challenges to how best to accommodate the new regulatory regime. This diversion of resources and brainpower will affect not only the large ISP providers such as AT&T, Verizon,

²² Advocates of Title II regulation of the Internet argue that it will stimulate entry by "edge providers," but we are not aware of any evidence supporting this argument. To the extent that the regulation raises prices and/or reduces innovation, it will discourage entry by new providers. Moreover, Brett Frischmann points out that the distinction on which this argument rests, between an edge provider ("an individual or entity that provides content, application or service over the Internet," and an edge user who "uses a broadband Internet access service," is false: "All end users provide content as they engage in communications with other users, individually or collectively." (Frischmann, 2014).

²³ Ellig (2006).

T-Mobile, and Sprint, and content delivery services such as Level 3, Akamai, and Limelight. Title II regulation and its attendant costs also could affect online video services such as YouTube, Netflix, and Hulu that provide or lease transmission capacity, web search advertising services such as Yahoo and Google that transmit customers' ads to end users, and cloud computing services, e-readers, and machine-to-machine service providers with transmission capabilities. The effects could be relatively more costly for small ISPs and content service companies with far fewer resources than the larger firms, and which advocates of Title II regulation hope would gain from such regulation.

In addition, the negative impact of regulation on cost-reducing innovation also would likely increase future costs. Some advocates of regulation cite Joseph Schumpeter,²⁴ who believed that very large companies in very concentrated industries – for example, the AT&T monopoly prior to 1982 – dominate innovation, because they can afford to undertake large and highly risky investments. Schumpeter also suggested, however, that this process is double-edged, since innovations by large, concentrated enterprises provide incentives for competitive innovations. In any event, Nobel laureate Kenneth Arrow and others showed that monopolists and oligopolists have little incentive to innovate.²⁵

Innovation always entails substantial risk of failure and often involves substantial sunk costs. Therefore, we should expect that the incentives to assume those risks and bear those costs are greatest when the additional costs of regulation are absent – and, we should add, when the potential risks of appropriation are minimized through strong intellectual property protections. If the objective of regulation, as the authors of one study put it, is to “ensure a self-sustained pro-competitive market structure ... that benefits consumers, in terms of lower prices, better quality and extended variety of product choice,”²⁶ it must be said that deregulation serves that purpose more directly and efficiently, unless the industry is truly and naturally dominated by a sustained monopoly or oligopoly.

More narrowly, the costs to comply with economic regulations may divert resources from investments, including R&D – although compliance burdens also may spur innovations to sidestep the regulation, as they have in finance, and innovations to comply with the regulations, as they have in auto emissions.²⁷ The response can depend on whether businesses can comply in the way they choose, and on how stringent the regulation is.

Taken as a whole, then, the theoretical link between this specific form of regulation and the taxonomy of theoretical effects would suggest that the impact of Title II on investment will be negative. Whether the negative effect could be expected to be large or small, however, depends on empirical analogies, to which we now turn.

²⁴ Schumpeter (1934).

²⁵ Arrow (1962); Dasgupta and Stiglitz (1980); Bulow (1982).

²⁶ Borreau and Dogan (2001).

²⁷ Stewart (2010).

III-C. Empirical evidence and analogies

In this section, we will review the literature on the economic effects of telecommunications regulation, beginning at a very general level and proceeding to the most relevant analogies for the contemplated Title II regulation of the Internet. We will then turn to the international evidence in order to shed additional light on the likely scale of the impact of Title II regulation on investment. As the regulatory change considered here involves an increase in regulation, we begin with studies that evaluated the impact of the opposite. Numerous scholars have examined the results of various forms of deregulation in telecommunications. Regulation in this industry can have unusually large economic effects, because as is often noted, telecommunications in this period is characterized by unusually high and rapid rates of innovation.²⁸ The earliest studies found that deregulation in telecommunications was associated with increases in the industry's total factor productivity, often seen as a proxy for innovation.²⁹

Later studies examined particular forms of innovation and found, for example, that as the FCC phased out some of its regulation of telephony carriers, new service offerings increased by 60 percent to 99 percent; and that if the regulatory system had never been applied to telecom, consumers would have 62 percent more services.³⁰ A subsequent study by the same author found that innovation increased when regulatory delays were reduced (for example, the time required to get approval for a new service).³¹ Similarly, Ai and Sappington (2002) found that innovation increased when telecom regulators shifted to more flexible, incentive-based approaches – shifting for example, from rate-of-return regulation to earning-sharing approaches. To be sure, another study found that incentive-based regulation slowed innovation,³² and a review of four studies on the effect of shifting to more flexible regulation on the quality of telecom services found ambiguous results.³³ Similarly, an analysis of the impact of more flexible, incentive-based regulation of local exchange carriers found no subsequent increase in efficiency.³⁴ Notably, and we return to this below, the OECD, which has written that “economic regulation is intended to improve the efficiency of markets in delivering goods and services,”³⁵ found that telecom deregulation in the United States and Japan in the late 1980s and early 1990s was followed by faster growth in new telecom patents, compared to Germany, France, and the United Kingdom, which had not deregulated.³⁶

²⁸ For example, Mathios and Rogers (1989); Kelly and Ying (2014); and Borreau and Dogan (2001).

²⁹ Schmalensee and Rohlfs (1992); and Tardiff and Taylor (1993).

³⁰ Prieger (2002). The regulation had required carriers controlling local networks to submit “comparably sufficient interconnection (CEI) plans” to the FCC whenever they offer a new service.

³¹ Prieger (2007).

³² Kahn *et al* (1999).

³³ Sappington (2003).

³⁴ Uri (2003).

³⁵ OECD (2010).

³⁶ OECD (1995).

Economists also have examined the impact of regulation on innovation in wireless telecom. Ehrlich, Eisenach, and Leighton (2009) reviewed the record of telecom regulation and showed that the entry of MCI and Sprint in the long-distance business in the 1970s accelerated the deployment of fiber cable, which in turn helped enable the Internet. They also examine claims that the FCC should regulate the wireless space along the lines of net neutrality advocates, on the basis that wireless carriers have the market power and incentives to discriminate against some devices, applications and tent. They reject these claims by demonstrating that the U.S. markets for wireless service, devices, handsets and applications all display extensive product choice and competition with no evidence of non-competitive pricing.³⁷ Smaller carriers and producers can compete effectively by offering, for example, a cooler device, faster network, or more extensive coverage. More generally, they show that competition among wireless networks has accelerated both innovation and investment in wireless networks, much as the platform competition between fiber and cable did for the wireline industry. On this basis, they argue that regulation in the wireless area would slow the industry's investments in innovation and capacity. For example, wireless carriers often share in efforts to develop new handsets and devices such as the iPhone in exchange for temporary exclusive rights to market them.

At a general level, then, the literature suggests that the impact of telecommunications regulation on investment can be quite large. Two recent studies have provided a detailed perspective on the possible scale of the negative impact of Title II regulation on investment. Singer (2015) begins with a bottom-up analysis, exploring anecdotally the potential harm of specific aspects of Title II regulation. For example, he discusses the impact of banning "paid priority agreements" under which a content provider pays a fee for its packets to receive higher priority. Singer argues that some real-time applications such as virtual reality and telemedicine may only be feasible with paid prioritization, and therefore would be inhibited by these rules. As an illustrative example, he estimates that the telemedicine effect alone could cost the economy \$100 million per year by 2019.

Singer further argues that an analysis of the investment experience under a prior episode of Title II should inform our expectations for the FCC's current plan. He focuses on the period when telecommunications companies but not cable companies were subject to Title II regulation (1996-2008), and finds that cable capital expenditures grew 7.5 percent per year, compared to annual increases in telecommunications companies' capital expenditures of only 3.2 percent.³⁸ This estimate implies, he suggests, that Title II reduced telecommunications companies' investments by about 5.5 percent per year, compared to what it could have been counterfactually. However, he cautions that this calculation is sensitive to assumptions about the appropriate year to begin the analysis, as the beginning of period in question included the dot.com boom. A second and more directly relevant study was performed by Hassett and Shapiro, the authors of this paper, in 2014. We performed an illustrative exercise that

³⁷ *Ibid.*

³⁸ Singer (2015).

attempted to statistically filter investment into two component parts, Title II investments and non-Title II investments. Under a set of detailed assumptions, we found that Title II regulation of ISPs could reduce their future wireline investments by between 17.8 percent and 31.7 percent per year, and their future total wireline and wireless investments by between 12.8 percent and 20.8 percent per year.³⁹ We derived these estimates from a fairly restrictive set of identifying assumptions, which the FCC has questioned.⁴⁰ For example, the FCC said that we had assumed that no wireless services are Title II services, citing wireless voice service subject to Title II but with forbearance.⁴¹ This criticism is irrelevant to our argument because our analysis focused on broadband service, not voice. Title II does not apply to mobile broadband service. The Commission also criticized our analysis for not factoring in the potential effect that FCC forbearance from Title II regulation would have on investment decisions made by ISPs.⁴² This criticism is also irrelevant: Such forbearance would suspend the burden of Title II in whatever aspect the FCC subsequently determines, while our study sought to roughly estimate the impact on investment assuming Title II regulation is actually imposed. It is a truism that regulation can be modeled to have no effect on investment if one assumes that the regulation will never be enforced and the fact that it will not be enforced is known with certainty by all relevant players. Such a “Red Herring” defense of new regulation has a long history, but it is intellectually indefensible. A policy analyst should analyze the impact of new regulations under the assumption that they will be enforced. Finally, the FCC noted that our analysis assumed that Title II regulatory burdens would trump demand in determining wireline capital investments.⁴³ However, our assumption here was as legitimate as the FCC’s alternative assumption, which certainly would have produced smaller adverse effects on investment. If the regulator desires the option to regulate in the future, then a cost-benefit analysis of the regulation can offer insight even to the impact of a regulatory option. One need only add an assumption about the probability that the regulation will be enforced to acquire an estimate of an expected impact.

To be sure, however, our analysis and Singer’s evidence are relevant only to the extent that the analogies are appropriate and applicable. In the previous section, we argued that corroborative evidence for such micro studies of scale could be gleaned from an analysis of the OECD regulation data. Those data suggest that a single point reduction in the index could increase the ratio of investment to capital stock by approximately 18 percent. How plausible would such a movement be? The latest OECD data do not cover the United States in 2013, so the best analogy has to rely on slightly older data. According to the OECD database, the U.S. had very light regulation in the telecommunications sector in 2008, with an overall index value of 0.60 (The most recent year for which data are available at that level of disaggregation is 2008). The OECD online database contains information for that year covering many

³⁹ Hassett and Shapiro (2014).

⁴⁰ FCC (2015).

⁴¹ *Ibid.*, at para 420.

⁴² *Ibid.*

⁴³ *Ibid.*

countries, as well as information for earlier years when, based on the success of the U.S. approach, many European nations moved their regulatory approaches toward that of the United States.⁴⁴ The average 2008 index value for continental European countries in the OECD was 1.1. A decade earlier, in 1998, the U.S. regulatory variable was slightly higher at 0.66, while the average for OECD continental European countries was a striking 3.95. Taking the average of those two points produces an index value of 0.63 for the U.S. regulatory approach and 2.53 for the OECD continental European approach, a difference of about two full index points. As each index point, applying the macro elasticity, can explain an 18 percent difference in investment, these data suggest that telecom investment over that time period should be approximately 36 percent higher in the United States than in continental Europe.

One way to put the range of estimates in perspective is to say that if Title II regulation of the Internet in the United States subjects the sector to the same level of regulation that was present in European communications between 1998 and 2008, then the range of effects of the more micro studies is in fact a bit understated. This scale, while large, is consistent with other evidence. For example Yoo (2014) reports that capital spending in the United States from 2007 to 2012 was approximately double that found in Europe, an even larger gap than would be predicted from the empirical evidence contained in the OECD index.

Yoo further reports that “the mapping studies conducted by the US and EU for 2011 and 2012 reveal that the US led the EU in many broadband metrics.” For example, 82 percent of U.S. households had access to “Next Generation Access” (NGA) networks (25Mbps), compared to 54 percent of EU households; U.S. fiber-to-the-premises coverage rates were nearly double those in the EU (23 percent compared to 12 percent); U.S. broadband was less expensive than European broadband at all speed tiers below 12 Mbps; and the higher U.S. price for higher-speed tiers “was justified in no small part by the fact that US Internet users on average consumed 50% more bandwidth than their European counterparts.” Finally, Yoo reports, as noted above, that “the U.S. broadband industry has invested more than two times more capital per household than the European broadband industry every year from 2007 to 2012,” including investments by the U.S. industry in 2012 of \$562 per household compared to investment by EU providers of \$244 per household. This suggests that it is reasonable to expect large negative effects on investment from Title II regulation, if Title II regulations move the United States closer to the European regulatory model that prevailed in continental Europe in the first decade of the 21st century. In this context, Campbell (2015) provides some corroborative evidence, arguing that,

The data indicate that the significantly lower levels of capital investment, competition and broadband coverage in the EU are attributable to its Title II regulatory approach. Last year, the EU government itself acknowledged that investments in high speed broadband are taking place more quickly in the U.S. and concluded that EU regulatory policy was to blame.

⁴⁴ OECD (2015).

He goes on to detail the specific ways in which the regulatory approaches of the EU and the U.S. differed over the past decade or so. In particular, the EU historical approach to broadband wholesale and interconnection regulation, and mobile interconnection regulation have, he argues, played an important role in depressing investment.

The final piece of this analysis involves factoring in how uncertainty about the future of these proposed regulatory policies affect our confidence in the estimated scale of their effect on investment. There is no doubt that substantial uncertainty attends the FCC decision to apply Title II regulation to ISPs.⁴⁵ The decision reversed a long-standing position of the FCC and therefore is ripe for legal dispute. Moreover, the FCC and supporters of the new regulation have insisted that substantial forbearance will apply, and therefore no one knows precisely which aspects of Title II will be applied, in what way they will be applied, and to which types of services and companies they will be applied. Many of the capital investments of the ISPs are irreversible – that is, if the actual application of Title II regulation reduced the return on certain capital investments sufficiently to render them uneconomic, the ISP could not retrieve some of that investment by reselling the capital. Finally, because the reach of this decision will certainly be the subject of litigation, it introduces a threshold event, which for investment, as discussed above, is the worst possible circumstance. Given the evidence presented above, if this threshold effect is similar to that experienced during an election year, then investment between now and the resolution of the uncertainty could be approximately 5 percent per year lower. Such a negative impact heightens the confidence one should have in the sign and the scale of the negative effect of this specific expansion of regulation on investment.

All of these factors suggest that the uncertainty costs associated with the FCC's decision will be substantial. We should expect that ISPs will reduce some of their planned capital investments, at least until the FCC establishes how, to what extent and toward whom the new regulations will be applied, and the legal challenges to those decisions have been resolved. Beyond the threshold event of judicial review, which could take several years to resolve, the process of establishing how, to what extent, and toward whom the rules will apply is also likely to lengthy. Adjudication of complaints under the just and reasonable standard and enforcement of the general conduct rule will be an ongoing process, especially as new complaints are filed and the legality of new services is questioned. These issues also will likely trigger further judicial challenges as parties use the process to seek rule changes and refinements. They may seek to roll back or expand forbearance, a key structural component of the regulations. During this process, the leadership of the Executive Branch and the FCC also will change, and the new leadership may use this process to advance new agendas. Finally, the FCC has left

⁴⁵ Gigi Sohn has argued that net neutrality rules, which the FCC has cited to justify Title II regulation of ISPs, would increase certainty (Sohn 2013). Whether or not this view is correct, the protracted process of defining, implementing and defending Title II regulation of ISPs introduces substantial uncertainty about its final character.

unanswered how it will exercise its new jurisdiction over interconnection, which it has claimed by applying novel interpretations of what constitutes the public switched network. In so doing, the Commission has extended its authority across the Internet, from end users to content and applications. Sorting this out could take years or even decades, not unlike the more than 70 years it has taken to give effect to Title II. These multiple sources of uncertainty extend beyond the enduring and compounding negative effects of the regulation, such as the increased costs, prohibited practices, and delayed innovation.

The literature suggests that these negative uncertainty effects on investment could be quite large. At a minimum, these uncertainty effects reinforce our general conclusion that Title II regulation will have substantial adverse effects on Internet investment.

IV. Conclusion

In this paper, we discussed the special challenges faced by policy analysts attempting to evaluate the likely impact of regulation on investment. We suggested a systematic approach toward policy evaluation wherein a researcher first relies upon our theoretical taxonomy to sort a particular regulation into the correct box. This allows one to have clarity regarding the likely sign of the effect of the regulation. To investigate the scale, we argue that micro analogies can be informative but should be checked for plausibility against the predictions of the macro literature we cite. Finally, one should classify the type of investment likely to be affected by the policy, and establish both whether the policy would increase that uncertainty, which is harmful, and would introduce a threshold effect, which could have devastatingly negative effects on investment until the threshold issue is resolved.

The final section provided an empirical example of our approach to analyzing the impact of Title II regulation on Internet investment. First, we showed that Title II regulation should be expected to increase costs, and therefore is the type of policy that should be expected to reduce investment. Second, we reviewed field-specific evidence that suggested that the scale of the negative effect could be quite large, from about 5.5 percent to as much as 20.8 percent. Next, we documented that the ratio of investment to the capital stock would be expected to decline to roughly that extent if Title II regulation in the United States would be comparable to the regulatory framework of the OECD continental European countries in the first decade of the 21st century. Next, we cited an analysis by a legal scholar that suggests that this analogy is reasonable. Finally, we found that the negative effects on investment may well be significantly understated by these factors because the new regulation's threshold effect will maximize the negative effects of uncertainty.

References

- Abel, Andrew B. (1983). "Optimal investment under uncertainty." *American Economic Review* 73 (1): 228-233.
- Ai, C. and D.E. Sappington (2002). "The Impact of State Incentive Regulation on the U.S. Telecommunications Industry." *Journal of Regulatory Economics* 22(2): 133-160.
- Alesina, Alberto, Silvia Ardagna, Guiseppe Nicoletti and Fabio Schiantareli (2003). "Regulation and Investment." National Bureau of Economic Research, Working Paper No. 9560. March 2003.
- Arrow, Kenneth J. (1962). "Economic Welfare and the Allocation of Resources for Innovation" in *The Rate and Direction of Inventive Activity: Economic and Social Factors*. Nelson, R.R., ed. Princeton University Press.
- Averch, Harvey and Leland L. Johnson (1962). "Behavior of the Firm under Regulatory Constraint," *The American Economic Review*. Vol. 52, No. 5 (Dec., 1962), pp. 1052-1069. Available at: http://pascal.iseg.utl.pt/~carlosfr/ses/averch_johnson.pdf
- Bernanke, Ben S. 1983. "Irreversibility, Uncertainty, and Cyclical Investment, *Quarterly Journal of Economics*, 98: 85-106.
- Blanchard, Olivier and Francesco Giavazzi (2001). "Macroeconomic Effects of Regulation and Deregulation in Goods and Labor Markets," *The Quarterly Journal of Economics*, MIT Press, vol. 118(3), pages 879-907, August. Available at: <http://www.nber.org/papers/w8120.pdf>
- Blind, Kurt (2011). "The Internet as Enabler for New Forms of Innovation: New Challenges for Research," Prepared for 1st Berlin Symposium on Internet and Society. Alexander von Humboldt Institut fur Internet und Gesellschaft. October 2011.
- Bourreau, Marc and Pinar Dogan (2001). "Regulation and Innovation in the Telecommunications Industry." *Telecommunications Policy*. Volume 25, No. 3, January 2001, pp. 167-184. http://warrington.ufl.edu/centers/purc/purcdocs/papers/0211_bourreau_regulation_and_innovation.pdf
- Braeutigam, Ronald E. and John C. Panzar (1993). "Effects of the Change from Rate-of-Return to Price-Cap Regulation." *American Economic Review* 83 (2): 191–198.
- Brogan, Patrick (2015). "U.S. Solidifies and Expands Leadership in Internet Usage." June 9, 2015. <http://www.ustelecom.org/blog/us-solidifies-and-expands-leadership-internet-usage>

Brynjolfsson, E. and L. M. Hitt (2000). "Beyond Computation: Information technology, Organizational Transformation and Business Performance." *Journal of Economic Perspectives*. Vol. 14, No. 4, pp. 23-48.

Bulow, Jeremy (1982). "Durable Good Monopolists." *Journal of Political Economy*, April 1982, 90(2), pp. 314-332.

Campbell, Fred B. Jr. (2015). "Impact of "Title II" Regulation on Communications Investment: A Comparison Between the United States and the European Union." Internet Innovation Alliance.

http://internetinnovation.org/images/misc_content/Impact_of_Title_II.PDF

Conway, Paul, Donato De Rosa, Guiseppe Nicoletti and Faye Steiner (2006). "Regulation, Competition and Productivity Convergence." OECD Economics Department Working paper No. 509. September 2006.

Crew, Michael A., ed. (1999). *Regulation Under Increasing Competition*. Springer Sciercer + Business Media, New York, NY.

Dasgupta, Partha and Joseph Stiglitz (1980). "Industrial Structure and the Nature of Innovative Activity." *Economic Journal*, June 1980, 90 (358), pp. 266-293.

Desai, Mihir and Austan Goolsbee (2004). "Investment, Overhang, and Tax Policy," *Brookings Papers on Economic Activity* 2, Pg. 285-338.

Durnev, Art. 2010. "The real effects of political uncertainty: Elections and investment sensitivity to stock prices." *Paris December 2010 Finance Meeting EUROFIDAI-AFFI*. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1695382

Ehrlich, Everett, Jeffrey Eisenach and Wayne Leighton (2009). "The Impact of Regulation on Innovation and Choice in Wireless Communications." *Review of Network Economics*, September 1, 2009 at

http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1478528

Ellig, Jerry (2006). "Costs and Consequences of Federal Telecommunications Regulations." *Federal Communications Law Journal*. Vol., 58, No. 1, pp. 38-102. January 2006.

Federal Communications Commission (1998). *Universal Service Report to Congress*, Federal-State Joint Board on Universal Service, 13 FCC Rcd 11501, Sec 46.

_____ (2005). Internet Policy Statement.

https://apps.fcc.gov/edocs_public/attachmatch/FCC-05-151A1.pdf

_____ (2010). "Open Internet." December 23, 2010. <http://www.fcc.gov/openinternet>

_____ (2010-A). "Sixth Broadband Progress Report." July 2010. <http://www.fcc.gov/reports/sixth-broadband-progress-report>

_____ (2015). "In the Matter of Protecting and Promoting the Open Internet." GN Docket No. 14-28. Report and Order on remand, Declaratory Ruling and Order. March 12, 2015.

Ford, George and Lawrence Spiwak (2012). "Justifying the Ends: Section 706 and the Regulation of Broadband." *Perspectives*. Phoenix Center for Advanced Legal and Economic Public Policy Studies. August 13, 2012.

Brett Frischmann (2014) "Does the FCC really not get it about the Internet?" Posted by David Post, *The Volokh Conspiracy*, October 31, 2014. <http://www.washingtonpost.com/news/volokh-conspiracy/wp/2014/10/31/does-the-fcc-really-not-get-it-about-the-internet/>

Garbacz, Christopher and Herbert Thompson (1997). "Assessing the Impact of FCC Lifeline and Link-Up Programs on Telephone Penetration." *Journal of Regulatory Economics*, Vol. 1, 67-77.

Grabowski, Henry, John Vernon and Lacy Glenn Thomas, "Estimating the Effects of Regulation on Innovation: An International Comparative Analysis of the Pharmaceutical Industry," *Journal of Law and Economics*, Vol. 21, No 1 (April 1978), pp. 133-0163.

Greenstein, Shane and Ryan McDevitt (2010). "Evidence of a Modest Price Decline in U.S. Broadband Service." National Bureau of Economic Research. NBER Working Paper No. 16166 (July 2010).

Hartman, Richard (1972). "The effects of price and cost uncertainty on investment." *Journal of Economic Theory* 5 (2): 258-266.

Hassett, Kevin and R.G. Hubbard (2002). "Tax Policy and Business Investment," *Handbook of Public Economics* Vol. III, Auerbach and Feldstein eds., Elsevier Science B.V.

Hassett, Kevin A. and Robert Shapiro (2014). "The Impact of Title II Regulation of Internet Providers On Their Capital Investments." Sonecon. November 2014. http://www.sonecon.com/docs/studies/Impact_of_Title_II_Reg_on_Investment-Hassett-Shapiro-Nov-14-2014.pdf

Hassett, Kevin A. and Joe Sullivan (2015). "Policy Uncertainty and the Economy." American Enterprise Institute. Forthcoming (2015).

Julio, Brandon and Youngsuk Yook (2013). "Policy Uncertainty, Irreversibility, and Cross-Border Flows of Capital."
http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2024612

_____ (2012). "Political uncertainty and corporate investment cycles." *The Journal of Finance* 67 (1): 45-83.

Kahn, A.E., T.J. Tardiff and D.L. Weisman (1999). "The Telecommunications Act at Three Years: An Economic Evaluation of its Implementation by the Federal Communications Commission." *Information Economics and Policy*. 11(4): 319-365.

Kelly, Mary, and John Ying (2014). "Testing the Effectiveness of Regulation and Competition on Cable Television Rates." *Eastern Economic Journal*. Vol. 40, Issue 3, pp. 387-404, June 2014.

Koske, Isabell, Isabelle Wanner, Rosamaria Bitetti and Omas Barbiero (2015), "The 2013 update of the OECD's database on product market regulation: Policy insights for OECD and non-OECD countries", *OECD Economics Department Working Papers*, No. 1200, OECD Publishing. <http://dx.doi.org/10.1787/5js3f5d3n2vl-en>

Leeuwen, van G. and S. Farooqui (2008). "ICT, innovation and productivity" in *Information Society: ICT impact assessment*. Eurostat.

Mathios, Alan and Robert P. Rogers (1989). "The Impact of Alternative Forms of State Regulation of AT&T on Direct-Dial, Long-Distance Telephone Rates." *The RAND Journal of Economics*. Vol. 20, No. 3 (Autumn, 1989), pp. 437-453.

Mayo, John W. (2014). "Beyond Ideology: A Results-Based Approach." *Democracy Journal*. Issue 34. Fall 2014.

National Economic Council and Office of Technology and Science (2013). "Four Years and Broadband Growth."
www.whitehouse.gov/sites/default/files/broadband_report_final.pdf

National Cable & Telecommunications Association et al. v. Brand X Internet Services et al., 545 U.S. 967 (2005).

Nicoletti, Giuseppe, Stefano Scarpetta, and Olivier Blanchard (1999) “Summary indicators of product market regulation with an extension to employment protection legislation”, *OECD Economics Department Working Papers*, No. 226. <http://www.oecd-ilibrary.org/content/workingpaper/215182844604>

Nishide, Katsumasa and Ernesto Kazuhiro Nomi (2009). "Regime uncertainty and optimal investment timing." *Journal of Economic Dynamics and Control* 33 (10): 1796-1807.

Organisation for Economic Co-Operation and Development (OECD), “Regulatory Reform and Innovation.” <http://www.oecd.org/science/inno/2102514.pdf>

_____ (1995). *Communications Outlook*, 1995.

_____ (2015). “Regulation in energy, transport and communications 2013.” <http://stats.oecd.org/Index.aspx?datasetcode=ETCR>

Pindyck, Robert S. (1988). “Irreversible Investment, Capacity Choice, and the Value of the Firm.” *American Economic Review* 78 (5): 969–85.

Polder, M. and G. van Leeuwen, P. Mohanan and W. Raymond (2009). “Productivity effects of innovation modes.” MPRA Paper No. 18893

Prieger, J.E. (2002). “Regulation, Innovation and the Introduction of New Telecommunications Services,” *Review of Economics and Statistics* 84(4): 704-715.

_____ (2007). “Regulatory Delay and the Timing of Product Innovation.” *International Journal of Industrial Organization* 25(2): 219-236.

Sappington, David E. (2003). “The Effects of Incentive Regulation on Retail Telephone Service Quality in the United States,” *Review of Network Economics*, Vol 2, Issue 4 – December 2003.

Schmalensee, R.E. and J.Rohlfs (1992). “Productivity Gains Resulting from Interstate Price Caps for AT&T.” National Economic Research Associates. Center for Economic Studies, U.S. Census Bureau.

Schumpeter, J.A. (1934). *The Theory of Economic Development*. Oxford University Press, New York.

Singer, Hal (2015). “Three Ways the FCC’s Open Internet Order Will Harm Innovation.” Policy Memo. Progressive Policy Institute. May 2015.

Sohn, Gigi. “Should Congress Overturn the Net Neutrality Rules?” *The Wall Street Journal*, May 12, 2013.

Spiezia, Vincenzo. (2011). “Are ICT Users More Innovative? An Analysis of ICT-

Enabled Innovation in OECD Firms.” *OECD Journal: Economic Studies*. Vol. 2011/1. http://dx.doi.org/10.1787/eco_studies-2011-5kg2d2hkn6vg

Stewart, Luke A. “The Impact of Regulation on Innovation in the United States: A Cross-Industry Literature Review,” Information Technology & Innovation Foundation (June 2010).

Tardiff, T. and W. Taylor (1993). “Telephone Company Performance under Alternative Forms of Regulation in the U.S.” National Economic Research Associates.

U.S. Chamber of Commerce (2012). “Background on Regulatory Cost Issues.” September 7, 2012.

U.S. Telecom (2014). “Internet Usage Data Reaffirm U.S. Leadership,” Research Brief, and U.S. Telecom Broadband Industry Statistics. October 22, 2014.

Uri, Noel (2003). “Measuring the impact of incentive regulation on technical efficiency in telecommunication in the United States,” (June 9 2003), Industry Analysis Division, Media Bureau, Federal Communications Commission.

Wölfl, Anita, Isabelle Wanner, Tomasz Kozluk, and Guiseppe Nicoletti. (2009). “Ten Years of Product Market Reform in OECD Countries – Insights from a Revised PMR Indicator,” *OECD Economics Department Working Papers*, No. 695.

Yoo, Christopher S. (2014). “U.S. vs. European Broadband Deployment: What Do the Data Say?” Research paper No. 14-35. Institute for Law and Economics, University of Pennsylvania. June 3, 2014.

About the Authors

Kevin A. Hassett is Director of Economic Policy Studies and Resident Scholar at the American Enterprise Institute (AEI). Before joining AEI, Dr. Hassett was a senior economist at the Board of Governors of the Federal Reserve System and an associate professor at the Graduate School of Business of Columbia University. He was the chief economic advisor to John McCain during the 2000 primaries. He also served as a policy consultant to the U.S. Department of the Treasury during both the former Bush and Clinton administrations. He holds a B.A. from Swarthmore College and a Ph.D. from the University of Pennsylvania. Dr. Hassett is a member of the Joint Committee on Taxation's Dynamic Scoring Advisory Panel. He is also the author, coauthor or editor of six books on economics and economic policy. He has published articles in many scholarly professional journals as well as popular media, and his economic commentaries are regularly aired on radio and television.

Robert J. Shapiro is a Senior Policy Fellow of Georgetown University's Center for Business and Public Policy and chairman of the Globalization Initiative at NDN. He is also the chairman of Sonecon, LLC, a private firm that advises U.S. and foreign businesses, governments and non-profit organizations on economic matters. Dr. Shapiro has advised, among others, U.S. President Bill Clinton, British Prime Minister Tony Blair, Treasury Secretaries Timothy Geithner and Robert Rubin, and UK Foreign Minister David Miliband; private firms including Amgen, AT&T, Elliot Management, Exxon-Mobil, Gilead Sciences, Google, Liberty Mutual, Nordstjernan of Sweden, and Fujitsu of Japan; and non-profit organizations including the International Monetary Fund, the Center for American Progress, PhRMA, and the U.S. Chamber of Commerce. Dr. Shapiro also is co-chair of the American Task Force Argentina, advisor to Cote Capital and Reye Partners, and chief strategist for BrandTransact. From 1997 to 2001, Dr. Shapiro was Under Secretary of Commerce for Economic Affairs. Prior to that, he was co-founder and Vice President of the Progressive Policy Institute and, before that, Legislative Director and Economic Counsel for Senator Daniel P. Moynihan. He also served as principal economic advisor in Bill Clinton's 1991-1992 presidential campaign and as a senior economic advisor to the campaigns of Al Gore, Jr., John Kerry, and Barack Obama. He also has been a Fellow of Harvard University, the Brookings Institution, and the National Bureau of Economic Research. Dr. Shapiro holds a Ph.D. and M.A. from Harvard University, an A.B. from the University of Chicago and a M.Sc. from the London School of Economics.