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A critical survey of the literature on broadband data caps

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ABSTRACT

Proponents and opponents of data caps make conflicting claims about the effect of data caps on prices, network capacity and speeds, subscription, congestion, and consumer surplus. In this paper, we survey the academic literature on data caps and analyze the relationship between the characteristics of each paper's model or data and the paper's results. We find that model or data assumptions about service differentiation, purpose of the data cap, and amount of competition strongly influence each paper's results. Consequently, conclusions about the effect of data caps are often limited to certain types of service providers (fixed or mobile) and/or to certain types of data caps (heavy-users or profit-maximizing). We find that most proponents' claims about data caps in fixed broadband service are incorrect, and that most proponents' claims about data caps in mobile broadband service are likely to be correct if and only if data caps increase competition. We also discuss how data caps may be evaluated under the FCC's 2015 Open Internet Order. We find that heavy-users caps on mobile broadband service are likely to satisfy the Order's rules, that profit-maximizing caps on mobile broadband service may or may not satisfy the rules, and that caps on fixed broadband service are unlikely to satisfy the rules.

1. Introduction

Starting in 2010, most mobile broadband Internet access service providers in the United States instituted monthly data caps in most of their service plans. In addition, many fixed broadband Internet access service providers (often referred to as Internet Service Providers) have instituted monthly data caps in many of their service plans. The United States Government Accountability Office (GAO) found in 2014 that the four largest mobile broadband providers and seven of the thirteen largest fixed broadband providers used monthly data caps (GAO Report, 2014). Subscribers whose usage exceeds a data cap are typically either subjected to overage charges or reduced speeds. Recently, many mobile broadband providers re-introduced plans that they brand as “unlimited”. However, those “unlimited” plans usually throttle users whose monthly usage exceeds a threshold.[1]

The use of monthly data caps by broadband Internet access service providers has been an issue of public policy debate ever since their introduction. The Federal Communications Commission's Open Internet Advisory Committee (FCC OIAC) reported in 2013 on policy issues that arise from data caps (FCC OIAC Report, 2013). The Committee's report discussed often conflicting perceptions of various stakeholders over fairness between light and heavy users; correlation between monthly usage and peak period usage; the role of data caps in managing congestion, managing network growth, and as a price discrimination tool; and competition issues.

Proponents and opponents of data caps make claims that appear to conflict with each other about almost every aspect of data caps, as summarized in Table 1:

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[1] Since the frequency, duration, and effect of this throttling remains largely unknown to the public, it remains unclear whether such “unlimited” plans bear a closer resemblance to plans with data caps than to unlimited plans without throttling.

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Table 1
Claims about the effects of data caps.

	Proponents	Opponents
Purpose	Manage congestion, increase fairness, recover cost associated with heavy users.	Increase profit, protect incumbent pay-television services.
Prices	Lower service prices, at least for entry level plans.	No change in service prices.
Capacity and speeds	Greater network capacity, higher download and upload speeds.	No change, or lower, network capacity.
Subscriptions	Increased broadband subscription.	No change or decrease in broadband subscription.
Usage, congestion, and fairness	Reduced congestion, increased fairness.	No reduction in congestion, unfairly discourages discontinuing pay-television service.
Consumer surplus	Increased consumer surplus, or at least increased social welfare.	Decreased consumer surplus.

- Purposes: Proponents of data caps, including the broadband providers, usually claim that their purpose is to manage congestion, to increase fairness, and to recover the cost associated with heavy users. Opponents of data caps often express skepticism that data caps effectively manage congestion, doubt that broadband providers are using data caps to recover the cost associated with heavy users, and claim that broadband providers are using data caps to increase profit and to protect incumbent pay-television services.
- Prices: Proponents of data caps often claim that the use of data caps results in lower service prices, at least for entry level plans. Opponents often claim that the use of data caps monetizes scarcity and does not result in lower service prices.
- Capacity and speeds: Proponents of data caps often claim that the use of data caps results in greater network capacity than would exist without the use of data caps, and that the increased capacity and lower usage by heavy users results in higher download and upload speeds. Opponents often claim that the use of data caps either does not impact network capacity or incentivizes broadband providers to lower network capacity to further monetize scarcity.
- Subscription: Proponents of data caps often claim that data caps increase broadband Internet subscription. Opponents generally disagree.
- Congestion: Proponents of data caps often assert that data caps affect a small proportion of users, that data caps are high enough so that they don't affect typical consumer use, and that regulating monthly usage reduces congestion. Opponents worry that over time data caps will affect a large proportion of users, that data caps are low enough to discourage subscribers of cable television services from discontinuing that service in favor of over-the-top video, and that monthly data caps do not reduce congestion.

After making various claims about the effect of data caps on service prices, speeds, capacity, subscriptions, usage, and congestion, proponents and opponents ultimately disagree about whether data caps are in the public interest. Proponents often believe that data caps increase consumer surplus, or if not then at least increase social welfare. Opponents invariably believe data caps decrease consumer surplus.

After the better part of a decade of conflicting claims, the academic literature should be able to lend some light on most of the apparent discrepancies. The goal of this paper is to provide a critical survey of both the claims and the academic literature on the use of data caps in broadband Internet access service. Our survey includes:

- Papers that draw from the general economics literature to predict the impact of data caps: Bauer and Wildman 2012, Economides and Hermalin 2015, Howell and Layton 2016, Lyons 2013, Odlyzko et al. 2012, and Rogerson 2016.
- Papers that have presented empirical results from the use of data caps by various fixed and mobile broadband providers: Blackburn et al. 2013, Chetty et al. 2012, Felten 2011, Fukuda et al. 2015, Gyarmati et al. 2012, Hussain et al. 2012, Joe-Wong et al. 2015, Lambrecht et al. 2007, Malone et al. 2014, Minne 2013, and Poularakis et al. 2014.
- Papers that have proposed analytical models of data caps to analyze the effect of data caps
  - on various characteristics of broadband service plans: Bauer and Wildman 2012, Dai and Jordan 2015, Dai et al. 2014, Economides and Hermalin 2015, Nevo et al. 2016, Poularakis et al. 2014, and Wang et al. 2016.
  - on subscription: Bauer and Wildman 2012, Dai and Jordan 2015, and Dai et al. 2014
  - on congestion: Bauer and Wildman 2012, Dai and Jordan 2015, Dai et al. 2014, Nevo et al. 2016, Odlyzko et al. 2012, and Wang et al. 2016.
  - on welfare: Bauer and Wildman 2012, Dai and Jordan 2015, Dai et al. 2014, Economides and Hermalin 2015, Ford 2012, and Nevo et al. 2016

The papers surveyed are listed in Table 2. For each paper, the table lists the type of model or data and a summary of relevant results. The table also shows the source of support for purposes of transparency, if acknowledged in the paper or provided upon request by the author; we note that the results sometimes support the interests of a financial sponsor. The results are discussed in Sections 3–7.

The paper proceeds as follows. In Section 2, we summarize conflicting claims regarding the purposes of data caps and conflicting claims regarding competition. We also survey the relationship between monthly data usage and network congestion, and tentatively conclude that that there is likely a substantial overlap between users with heavy monthly usage and users with heavy usage during peak