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Net Neutrality and internet fragmentation: The role of online advertising☆

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ABSTRACT

We investigate the relation between Net Neutrality regulation and Internet fragmentation. We model a two-sided market, where Content Providers (CPs) and consumers interact through Internet Service Providers (ISPs), and CPs sell consumers' attention to advertisers. Under Net Neutrality, a zero-price rule is enforced. By contrast, in the Unregulated Regime, ISPs make access to their subscribers for CPs conditional on payment of a termination fee. Multiple impressions of an ad on the same consumer are partially wasteful. Thus, equilibrium ad rates decrease when audiences overlap. We show that ISPs may strategically set termination fees to induce fragmentation. This takes place when advertising revenues are potentially large but strongly diminished by competition among CPs, and when consumers are not highly sensitive to content availability. We therefore identify an important link between termination fees, the online advertising market and Internet fragmentation. We extend the model to account for multi-homing consumers, vertically integrated ISPs, third-party advertising platforms and heterogeneous CPs.

1. Introduction

Traditionally, the Internet has been characterized by the Net Neutrality principle. This principle has various practical implications. In particular, it implies a zero-price and a non-discrimination rule (Schuett, 2010). The former establishes that Internet Service Providers (hereafter, ISPs) should not collect fees from Content Providers (hereafter, CPs) for delivering (or "terminating") data to final users, while the latter establishes that ISPs should treat all traffic equally.[1] Presently, there is a very important policy debate on whether Net Neutrality should be codified in formal regulation. Opponents assert that allowing ISPs to have greater pricing flexibility will ensure a more efficient use of bandwidth and strengthen investment in network infrastructure. Proponents argue instead that Net Neutrality regulation is necessary to preserve plurality on the Internet, alongside content innovation (Krämer et al., 2013).

The above issues have received considerable attention in previous literature (reviewed in Section 2 below). There is, however, another aspect of the Net Neutrality debate that has been much less scrutinized thus far. Namely, the implications of a zero-price rule for Internet fragmentation. Several scholars, regulators and Internet operators have expressed concerns that termination fees could lead to a fragmented network, with

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[1] Currently, the general practice is that CPs pay a fee to the ISP that connects them to the Internet, but they do not pay ISPs to terminate their traffic to end users. However, in 2013 French ISP Orange reportedly asked Google to pay for delivering its traffic (see http://www.forbes.com/sites/ewanspence/2013/01/20/why-oranges-dominance-in-africa-forced-google-to-pay-for-traffic-over-their-mobile-network) and in February 2014 Netflix agreed to pay Comcast for peering, resulting in improved service to Comcast's subscribers (see http://online.wsj.com/news/articles/SB10001424052702304834704579401071892041790).

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some consumers being unable to access content available to others, thereby creating "multiple Internets" (Lee and Wu, 2009).[2] Despite this, economic research has largely neglected the problem.

Our objective is to shed some light on this important, yet unexplored, issue. We do so by means of a simple model, considering two CPs and two ISPs. An ISP is a platform connecting CPs to consumers and a CP is a platform selling consumers' attention to advertisers. Consumers pay the ISP for a connection to the Internet and browse content free of charge. We consider two regulatory regimes. Under Net Neutrality, a zero-price rule is enforced: ISPs have to terminate all traffic free of charge. In the Unregulated Regime, on the other hand, CPs can reach subscribers of an ISP only on condition that they pay a termination fee.

It is well recognized that the Internet is a two-sided market bringing together consumers and advertisers. Yet, to the best of our knowledge, previous literature on Net Neutrality has never explicitly studied the advertising side. The main novelty of our approach is that we model competition in such market. We account for the stylized fact that the marginal value of an ad decreases with the number of times a consumer is exposed to it (see, e.g., Calvano and Jullien, 2012; Anderson et al., 2014; Athey et al., 2013; Ambrus and Reisinger, 2006). Given that consumers commonly consult several online contents in a short time frame, an advertiser's willingness to pay for ad impressions diminishes when audiences overlap.[3]

We show that this mechanism is at the heart of the forces driving network fragmentation. Indeed, a rational response by CPs would be to avoid competition by serving different audiences. However, under Net Neutrality, neither ISPs nor CPs are able to shape the configuration of the network. As a result, content is available to all consumers (a situation referred to as "Universal Connection"). Things are different in the Unregulated Regime, as termination fees create a link between ISPs and advertising. Because they can recover CP profits via termination fees, ISPs behave as editors, caring about the profitability of the content they carry. Hence, they have an incentive to induce fragmentation when (i) advertising revenues are potentially large but strongly diminished by competition among CPs, and (ii) contents are not highly valuable and complementary for consumers. Fragmentation, we show, can be achieved by raising termination fees to a level high enough for a CP to be willing to pay only as long as it has no competition for consumers' attention. Nonetheless, Universal Connection still emerges when competition has limited impact on advertising profits (so that little gain can be expected by creating exclusive audiences) and when content is highly valuable to consumers (so that offering additional content boosts demand for an ISP's services).

In summary, our results suggest that Net Neutrality helps preserve universal availability of online content. If the Unregulated Regime is adopted instead, the extent to which repeated ad impressions lose value is crucial in shaping the network configuration. We therefore contribute to the current debate by uncovering an important relation between Net Neutrality, Internet fragmentation and competition on the online advertising market. We believe this should not be ignored when drafting regulations on these critical issues.

For ease of exposition and in order to simplify the analytics, our baseline model imposes a restriction on how termination fees are set. Namely, we assume that each ISP charges all CPs the same fee (we refer to this as "uniform fees"). We then relax this assumption in an extension, allowing for discriminatory termination fees. We show that discriminatory fees strenghten our basic arguments. We propose further extensions in the final part of the paper: we consider heterogeneous CPs, alternative arrangements for the sale of ad impressions (i.e., outsourcing to advertising platforms either run by third parties or by ISPs), multi-homing consumers, vertical integration of Content and Internet Service Providers. Finally, we discuss alternative timings of our model.

The remainder of this paper is organized as follows. Section 2 presents a brief literature review. In Section 3 we describe the baseline model, solved in Section 4. Section 5 contains the extensions. Section 6 concludes. Unless otherwise stated, Proofs of Propositions and Lemmas are in Appendix. Furthermore, a Supplementary Appendix (available on the authors' website) contains formal derivations of additional results that we only discuss in the main text.

2. Literature

There is a wide debate on Net Neutrality that has only recently been analyzed from an economic perspective.[4] The main focus of previous literature has been on service tiering and investment. Hermalin and Katz (2007) study the desirability of traffic discrimination, finding an ambiguous welfare comparison between the Unregulated Regime and Net Neutrality. Choi and Kim (2010) consider service tiering and investment incentives for a monopolist ISP and for CPs in different regulatory regimes. The effect of the regulatory regime on investment and social welfare is again ambiguous. Bourreau et al. (2015) study a similar issue in a model with two competing ISPs. Under discrimination, ISPs have larger investment incentives, there are more active Content Providers and there is less congestion. Hence, the discriminatory regime is welfare superior to Net Neutrality. Economides and Hermalin (2012) show that the socially optimal configuration maximizes contents delivered to consumers. Differently from Bourreau et al. (2015), the discriminatory regime can either increase or decrease the variety of distributed content. Contrary to Choi and Kim (2010), abandoning Net Neutrality increases the incentives to invest in infrastructure. However, the net effect on welfare is once again ambiguous.

Unlike the authors of the above papers, we consider Net Neutrality as a zero-price rule: it requires that ISPs charge CPs no fees in order to terminate traffic to final users. This definition is also used in Economides and Tag (2012), who concentrate on pricing issues linked to the two-sidedness of the market that arise due to a departure from Net Neutrality. Musacchio et al. (2009) analyze a similar issue in a model where ISPs and CPs can also invest in network quality.

As mentioned in the Introduction section, previous papers on Net Neutrality treat profitability of Content Providers as exogenous. In our model it results instead from platform competition on the advertising market. A novelty of our work is therefore that it is at the intersection between the literature on Net Neutrality and that on online advertising markets. Ambrus et al. (2013) and Anderson et al. (2014) build models of media platform competition where both consumers and advertisers multi-home. A common finding is that platforms have monopoly power over single-homing consumers, but can only charge

[2] The FCC recently adopted the "Open Internet Rules", stating that ISPs "shall not block lawful content, applications, services, or non-harmful devices, subject to reasonable network management" (FCC, 2015). Furthermore, the European Commission stated that ISPs should not "block or throttle traffic in their networks or give priority to some particular content or services in exchange of payment" (http://europa.eu/rapid/press-release_MEMO-15-5275_en.htm). In April 2014, Neelie Kroes, European Commissioner for the Digital Agenda, stated: "the Internet is unified, global, open. […] Fail to act, fail to reform — and we could see the net fragment" (neurope.eu, 2014, "Kroes: Defending open internet and net neutrality" http://www.neurope.eu/article/kroes-defending-open-internet-and-net-neutrality). Content Providers such as Netflix have repeatedly called for regulation preventing ISPs from charging for termination. As a matter of fact, several countries such as the Netherlands and Chile, have enshrined Net Neutrality principles into legislation, banning termination fees.

[3] Todd Haskell, vice-president of advertising for the New York Times, stated that "rates for online-video ads have not been increasing though publishers have more demand than supply". He also stated that publishers may seek differentiation from competitors as a way to "avoid the downward commoditized price positioning" of ad slots (WSJ.com, 2013, "If Media's Future Is Online, Where Are the Profits?", retrieved June 2013).

[4] See Lee and Wu (2009) for a discussion on the economic issues concerning Net Neutrality. See Schuett (2010) and Krämer et al. (2013) for a review of the literature.