The Economics of the Internet

Welcome

I hope you enjoy our eleventh Vodafone Policy Paper. Our aim in these papers is to provide a platform for leading experts to write on issues in public policy that are important to us at Vodafone. These are the people that we listen to, even if we do not always agree with them. These are their views, not ours. We think that they have important things to say that should be of interest to anybody concerned with good public policy.

Vittorio Colao, Chief Executive, Vodafone Group

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Introduction

This latest collection of papers in the Vodafone Public Policy series arises from our interest in the 'net neutrality' debate and, in particular, the FCC's Notice of Proposed Rulemaking which was published in October 2009 and is expected to result in the adoption of rules later this year. Vodafone has an obvious interest in the US market through our involvement in Verizon Wireless, but our interest in this topic goes wider than that. The internet is not easily contained within national boundaries, and nor are the implications of policies which might seek to govern it in future. The questions which are being debated in the United States ought to be of interest to everyone.

Some aspects of the net neutrality debate are not new. The FCC adopted four net neutrality principles in its Internet Policy Statement Published in 2005. These represent what I would call the traditional 'user rights' approach to net neutrality, affirming the rights of users to determine for themselves how they access and use the internet. Competition was generally sufficient to ensure that this happened and that 'walled gardens', where they existed, have been dismantled. There have been few clear examples of firms breaching the principles since 2005 and European legislators adopted similar principles during their review of European telecoms policy in 2009.

The October 2009 proposals from the FCC have taken the net neutrality debate in an entirely new direction. Instead of focussing on the relationship between operators and their end users, the FCC's latest proposals focus instead on the relationships between operators on the one hand and the content, service and applications providers on the other. This is an important shift in emphasis: instead of being about 'user rights' this debate is about the economics of the internet. Instead of being about the end user experience it is about the business models and, in particular, the pricing rules, employed by the firms in the internet. It is about the way in which profits and revenues might be distributed amongst the various parties in the value chain.

Much of our traditional communications regulation has, of course, also been concerned with how firms deal with each other rather than how they deal with end users (recall the long history of interconnection or intercarrier rate regulation). But the FCC's proposal that net neutrality rules include a prohibition on the ability of network operators to charge upstream content, services or applications providers represent a striking new contribution to the debate.

We think that any proper assessment of economic regulation, such as that proposed by the FCC, must start with an understanding of how the internet value chain functions and the nature of the economic relationships between firms. We quickly found that although the economic and social importance of the internet has created a large number of studies looking at the value the internet creates for users, surprisingly little is known about how value is created for and divided amongst the firms inside the value chain itself.

One reason for this appears to be that telecoms regulators have, understandably, focussed on those parts of the internet for which they have responsibility: network access and some parts of the core infrastructure. They have needed to know much less about the upstream providers of internet services. Another reason is that the value chain is enormously complex and that the level of financial and other disclosures by many of the large participants make it difficult to decompose. Many of these players operate across multiple parts of the value chain - and do so on a global basis.

We asked A.T. Kearney to attempt the task and we present their findings in this paper. Some of their findings confirm what we already knew, some were new to us. The internet is a massive source of wealth creation, generating almost $2000 billion of global revenues in 2008. Around 60% of this arises from business to business activities – electronic ordering, supply chain management, back office functions etc - rather than the higher profile consumer services with which we are all familiar. Most of the revenues generated in the business to business internet flow to the providers of e-commerce services in the upstream part of the internet – the revenues earned by the infrastructure providers and network operators account for only 5% of the total.

On the other hand, the revenues earned by the network operators providing internet access to consumers are

30% of the total revenues for this segment – the same as that earned by the upstream providers of online services for consumers. Online service revenues are, however, growing twice as fast as network revenues.

A.T. Kearney also find that, far from being 'free' to consumers, only about 30% of the revenues in the consumer internet are derived from advertising. The vast majority of these (59%) flow to search providers. More than 50% of the costs of the consumer internet are met by consumers themselves, chiefly through their purchases of the network access and the devices needed to access the internet.

Competition also varies markedly along the value chain. The markets for search, digital books, VoIP, operating systems and smart phones are all concentrated (at a global level) and all yield relatively high returns on investment. These are the markets typically characterised by strong network effects and/or strong global brands. Some services markets like e-retail and e-travel also yield high returns despite being very fragmented at the global level. They are more likely to be concentrated at a national level. And 'vice' activities – gambling, gaming and adult services – all seem to deliver relatively high returns despite significant differences in competition in each market.

Finally, A.T. Kearney also draw attention to the disconnection between the revenues generated from different internet services and the demands (and hence the costs) which the consumers and providers of those services impose on the infrastructure of the internet. Video services account for more than 70% of all the traffic on the consumer internet, yet contribute to less than 10% of the revenues. A disconnect of this size between the prices paid and the costs caused is bound to lead to tensions along the value chain. The current net neutrality debate is one way in which these tensions will play out.

There is more to be done to improve our understanding of the internet, but the A.T. Kearney paper is intended to provide a start. 'Net neutrality' must mean 'internet neutrality' and not just 'network neutrality'.

In the second paper we wanted to examine the central economic argument in the FCC's October 2009 proposals, namely that various forms of discrimination, at least as practiced or potentially practised by network operators, should be prohibited by a new regulation.

Many net neutrality advocates have suggested that discrimination knows no place on the internet. The FCC's proposals do not go quite this far. They would allow certain forms of discrimination in relations between network operators and their end users (for example, different prices for different broadband packages). But the FCC does propose to prohibit discrimination when network operators deal with upstream content, service or applications providers. And in doing so they equate 'non discrimination' not simply with charging the same price to everyone but with charging a price of zero in all cases.

We wanted to understand the economic arguments which might inform this position, so we asked Professor Janusz Ordover and his colleagues, Doug Fontaine and Professor Greg Shaffer to focus on price discrimination. We wondered why, if price discrimination is so pervasive elsewhere in the economy, it might be so problematic in the internet. We also wondered whether the two-sided nature of many internet markets made a difference, and whether it made sense to prohibit price discrimination by network operators when so many other players in the internet seemed to have built successful business models with price discrimination at their core.

Professor Ordover and his colleagues provide a very useful overview of the current economic thinking on price discrimination. They note that whilst the welfare effects of different forms of price discrimination can be complex, most forms of price discrimination are generally accepted as being welfare enhancing in many different market settings. This is particularly likely to be the case if the markets are competitive and if large fixed costs or continuous investments are involved. The welfare effects are also likely to be amplified if markets are two-sided. They also note that regulators do not generally impose per se prohibitions on price discrimination, with the result that price discrimination is pervasive in most market economies today, irrespective of the intensity of competition.

They then turn their attention to the same internet value chain which was the subject of the A.T. Kearney study. The internet is often characterised by competitive, two sided markets and often allows for easy discovery and capture of consumer preferences (a prerequisite if firms are to engage in some forms of price discrimination). It is therefore unsurprising to find, as Ordover and his colleagues do, that price discrimination is equally if not more pervasive in the internet, to the benefit of firms and users alike.

Ordover then asks whether, if much of the internet of today is built on price discrimination, there are any grounds for regulators to seek to prohibit discrimination in some or all parts of the internet of the future. He and his colleagues examine the various arguments advanced by net neutrality advocates who favour such a prohibition – most notably the 'damaged goods' argument that allowing discrimination would serve to harm those who are unable to buy premium tier services. Professor Ordover concludes that there is no sound economic basis for imposing the pricing prohibitions being contemplated by the FCC. He further concludes that whilst such a rule might serve the interests of particular firms, they would likely harm users of the internet and reduce welfare overall.

The A.T. Kearney paper showed that more than half of the costs of the internet are already borne directly by internet users in the form of payments for devices and for network access. It is difficult to see why a rule which

would prohibit anyone else making a contribution to these costs is in the interests of those users. And this is particularly the case when, as A.T. Kearney show, such a small number of online services are responsible for such a large proportion of those costs.

This is a fascinating policy debate which will no doubt continue in the United States and around the world for months and years to come. The FCC's latest proposals have attempted to take the debate in a radical new direction – away from 'user rights' and towards regulation of the economic relationships between different firms in the internet value chain. We hope these papers help others, as they did us, in understanding exactly what is at stake.

Internet Value Chain Economics

A. T. Kearney

Introduction

When considering the technological innovations of the past fifty years, probably the Internet is the one that has had the greatest impact on everyday life in developed economies. Nearly six out of ten Americans now shop online and more than four out of ten bank online.[1] 20 hours of video are uploaded to YouTube every minute,[2] while 5% of all time online is spent on the social networking site, Facebook.[3] The Internet has also changed the way in which businesses operate – today, 64% of C-level executives conduct six or more searches per day to locate business information.[4] The Internet has been a source of great good – as evidenced by the role played by Internet-based mapping and communications in the relief effort following the recent Haiti earthquake.[5] The Internet also has shown a negative side – more than 97% of all emails are spam,[6] while more than 70% of Americans fear online identity theft and 57% of them feel that their personal privacy has been greatly diminished by the Internet.[7]

Behind the statistics and headlines, however, there remains a low level of understanding of how the Internet economy works. Who are the different players involved in the Internet, beyond the flagship names? How is the industry structured and how concentrated is it? How do players make money and how do revenues flow across the value chain? Is the industry attractive in terms of growth and returns?

As the Internet continues to grow and develop, playing an increasingly important role in the lives and activities people and organizations, a sound understanding of the Internet economy will be important for all stakeholders. This includes the companies playing a role in the Internet economy, private and business consumers, and the regulators and policy-makers who are increasingly being asked to oversee or intervene in multiple aspects of the Internet.

To help improve the understanding of the Internet landscape, Vodafone commissioned A.T. Kearney to conduct a review of the Internet's value chain and economics. This paper has been produced independently and does not necessarily represent the views of Vodafone. Neither Vodafone nor A.T. Kearney is responsible for the use that might be made of this paper.

This paper has a global scope but most examples and illustrations focus on North American and European markets. The paper begins with a brief overview of the Internet's growth and usage trends. Next, we lay out the Internet value chain and describe each part of the value chain in terms of key players and revenue models. We provide an assessment of the industry's market size, growth trends, profitability and competitive structure.

It is not the purpose of this paper to provide recommendations, but rather to provide a consistent framework and fact base to inform public debate. With such a broad remit we may inevitably disappoint readers who would like more detail on individual markets or issues; for that reason we have provided documentation of our sources and assumptions to assist further research.

Summary of Findings

The number of Internet users has grown rapidly to 1.7 billion people in 2009, or a quarter of the world's population. Consumers use the Internet for an increasing range of everyday activities, from shopping and banking to sharing photos and watching TV. As a result they spend a growing proportion of their media consumption time and wallet on the Internet. A complex value chain has developed to deliver these services, comprising global and local players with assets as diverse as content rights, communications and IT infrastructure, proprietary software and global brands. Businesses also use the Internet extensively to market and distribute their services as well as to procure and manage supply chains.

Total Internet value chain revenues are estimated at US$1,930 BN in 2008, growing on average at 10% p.a. More than 60% derives from business-to-business activities as many organisations have embraced the Internet to market and sell their services and to manage relationships with suppliers and partners. On the consumer side, the largest categories of spend are for retail Internet access and end-user devices/hardware. Between them, these enablers for households to access the Internet account for 44% of total consumer value chain revenues. Consumer online services, the most visible part of the Internet economy, represent a US$ 242 BN market, of which a substantial part relates to e-

Commerce. Search engines capture over a third of remaining online service revenues and indeed 59% of online advertising revenues. Revenues for consumer online services are growing more than twice as fast as those for Internet access provision and over five times faster than sales of hardware and software. Bandwidth growth has been even stronger, but online service revenues are for the most part disconnected from bandwidth consumption – in 2008 file-sharing and video-on-demand accounted for nearly three-quarters of bandwidth but only 8% of revenues.

Our analysis shows that the most concentrated markets in the value chain are the online services of VoIP, gaming and search plus certain categories of hardware/software, namely games consoles, smart phones and operating systems. The online advertising network market is also highly concentrated. In all of these categories the top three players account for over 60% of revenues, driven by strong network and/or scale effects.

We also analysed the profitability of the largest players in all categories. While many factors influence a company's profitability in a given year, we did find the most concentrated categories to be among those with the highest returns on capital employed (ROCE) in the value chain, at least 20% in all cases. Content rights and connectivity, on the other hand, are less concentrated markets when measured at a global level, although local differences apply. Both these markets also have lower ROCE (10-15%) and the market capitalisations of their largest players have been stagnant for years.

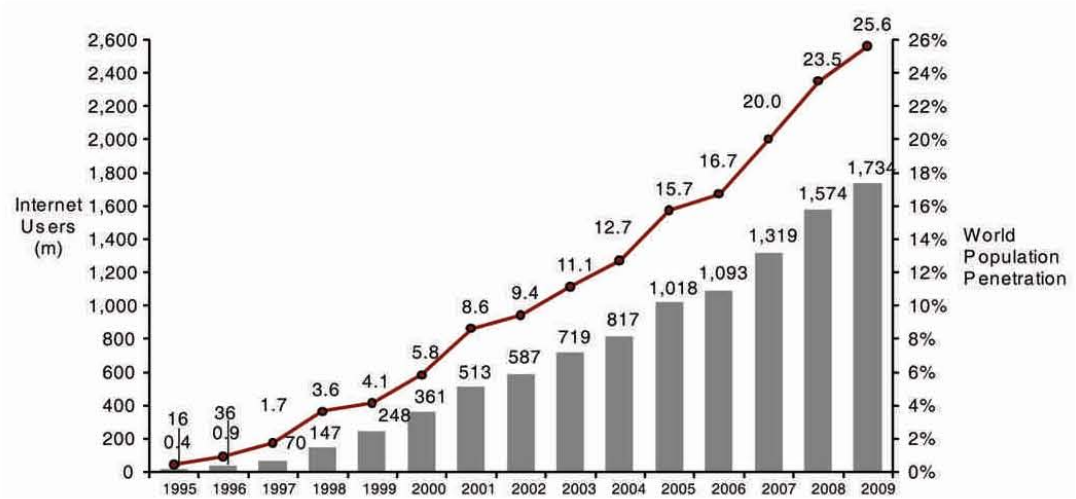
The Internet has a short history characterised by rapid bursts of technological and economic development, often stimulated by the emergence of new entrants on a global scale. Whether it will continue to be so dynamic or is now of such a size and relative maturity that it begins to resemble other parts of the global economy, is beyond the scope of this paper. Certainly one could expect such differences in economic performance across the Internet value chain to influence corporate strategic activity and regulatory decision-making in the years ahead.

Growth of Internet Usage

The number of Internet users globally has grown dramatically in the last 15 years (see Figure 1). In 1995, there were only 16 million Internet users, equating to 0.4% of the world's population. By 2009, this had risen to 1.7 billion users, corresponding to more than a quarter of the world's population. In most West European and North American markets, Internet usage penetration now surpasses 75% of the population.

In recent years the strongest growth has come from emerging markets. In China, the penetration rate has jumped from 2% in 2000 to 27% by the end of 2009. With 360 million people online, China has more Internet users than the whole of Western Europe, and 60% more than the US. Brazil already has more Internet users than any European country, while the Middle East has gone from 3 million to 57 million users between 2000 and 2009.

Figure 1 : Growth of Internet Penetration and Users
Source : Nielsen, ITU



Most users access the Internet via fixed line broadband connections at home or at work. The take-up of broadband, delivered via multiple technology options but primarily via DSL connections over the original copper telephone networks, has transformed the telecommunications landscape in most countries. With plans to deploy fibre to deliver far greater bandwidth per connection, the telecommunications sector faces a major investment wave in the next decade and is currently engaged in extensive debate over the future regulatory framework and commercial model to support such investments.

More recently, mobile devices have become a key means to access the Internet, driven by the availability and increasing affordability of smartphones as well as high-speed data modems and USB 'dongles' that provide Internet access for laptop computers. Total shipments for smartphones for instance are projected to grow from 54m in 2005 to 289m in 2013.[8]

Time spent online is also growing substantially, to some extent at the expense of traditional media. A recent study conducted in Germany for instance projected that the Internet's share of media consumption time would increase from 4% in 2000 to 24% in 2015. This, however, does not come solely at the expense of other media.

Total media consumption time grew by nearly 50% between 2000 and 2009 to an average of 10.3 hours per day. There is a growing trend of consuming multiple media at the same time – for instance, browsing the Internet whilst watching TV.

With increasing share of time, the Internet is inevitably also capturing an increasing share of consumer and advertiser spend – from 5% in 2000 to 42% of total by 2015 in Germany (see Figure 2), potentially twice as much as TV and Radio combined. This trend is likely to be repeated for other European markets.

Internet usage is expanding to a broader range of services and becoming central to everyday lives. In the US, 56% of people reported having bought a product online in 2009 compared with just 27% in 2000. 42% bank online, compared to 10% in 2000. 28% use social networking sites, in contrast with only 5% in 2000.

Internet usage patterns have evolved rapidly, as illustrated by consumers' preferred websites. Of the top 15 websites in the US in 1999, measured by unique visitors, only four remained in this league table by 2009 (see Figure 3). Most of the top 11 websites have been launched fairly recently and include sites such as Google, Facebook, eBay, and Apple iTunes.

Figure 2 : Internet Share of Consumer Time and Wallet (Germany)[9]
Source : PWC, SevenOne Media, ARD/ZDF Online Study, A.T. Kearney Analysis

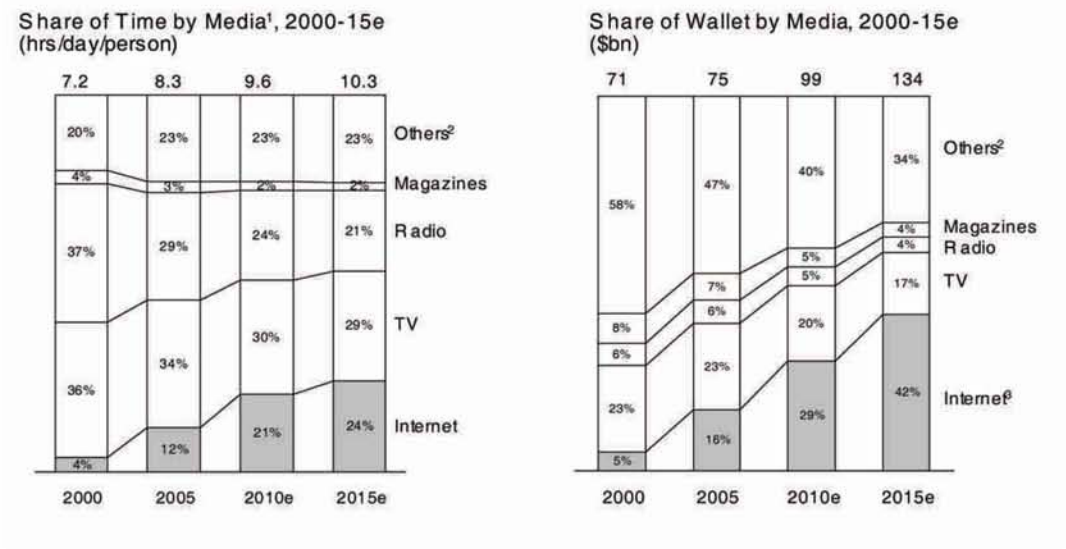


Figure 3 : Top 15 Internet Web Sites – 1999 vs. 2009[10]
Source : ComScore, A. T. Kearney Analysis

US Top 15 Sites – 1999

Web Property	UVs (m)	Genre
1. AOL Sites	46	Portal
2. Microsoft Sites	32	Portal
3. Yahoo Sites	31	Portal
4. Lycos X	29	Search
5. Go Network X	21	Portal
6. GeoCities[1] X	19	Web Hosting
7. The Excite Network	17	Portal
8. Time Warner Online	13	Media
9. Blue Mountain Arts	12	e-Cards
10. AltaVista X	11	Search
11. Amazon	10	e-Commerce
12. Xoom X	9	Web Hosting
13. Snap	9	Search
14. Real Networks	8	Media Player
15. CNET X	8	Media

X = No longer operating

US Top 15 Sites – 2009

Web Property	UVs(m)	Genre
1. Google Sites	164	Search
2. Yahoo Sites	158	Portal
3. Microsoft Sites	133	Portal
4. AOL Sites	99	Portal
5. Facebook	97	Social Network
6. Ask Network	88	Search
7. Fox Interactive Media	83	Media/Social Network
8. Amazon	70	e-Commerce
9. WikimediaFoundation	69	Reference
10. eBay	67	e-Commerce
11. Turner Network	63	Media
12. CBS Interactive	59	Media
13. Apple Inc	58	Music
14. Glam Media	56	Lifestyle
15. Answers.com	55	Reference

X = No longer exists as an independent entity

Search and Social Networking are two examples of services where market leadership has changed rapidly. In 1999, Google captured only 4% of global search revenues. Today Google has two-thirds of the market, while 1999 leader Yahoo!'s share has shrunk from 29% to 7%. In social networking, Facebook did not exist in 2003. Five years later, it held 23% of the market, while 2003 market leader Xanga is no longer among the top five players.

Overview of the Internet Value Chain

The Internet ecosystem is complex and involves multiple activities and players. We break down the Internet value chain into five main markets: Content Rights, Online Services, Enabling Technology/Services, Connectivity, and User Interface (Devices and Applications). The exhibit below shows the main strategic segments within each market and the different service categories within those segments, together with the logos of some of the larger players.

Figure 4 : Overview of the Internet Value Chain[11]
Source : A.T. Kearney Analysis

A number of industry players operate in two or more segments of the value chain. This can be powerful in terms of creating a seamless customer experience but can also be used to take full advantage of assets such as technology, brands and customer relationships in order to strengthen competitive positioning.

Description of the Key Markets in the Internet Value Chain

Content rights

Much Internet content is user-generated (e.g., an individual's page on a social networking site, a 'tweet' message on Twitter) which typically does not involve remuneration to content creators, although they may well retain copyright or some degree of privacy protection over how their content is used by others. The Content Rights market quantified in our subsequent analysis corresponds to the provisioning of content to online service providers on a commercial basis. Examples of such content include music, filmed entertainment, games, news or the content of books and magazines.

Content rights owners are typically media companies such as Warner Brothers, the BBC or Electronic Arts providing their content for a share of revenues and/or license fees. Content rights owners typically retain 50-70% of the revenues generated by the online service provider that makes the content accessible to Internet users. For instance, iTunes shares approximately 70% of revenues earned on each music purchase with the music majors.[12] In some cases, content rights owners provide their own online services, such as the BBC iPlayer service.

Online Services

Online services correspond to the range of services accessed by Internet users and are, as a result, very

diverse. For simplification, we have grouped Online Services into five main segments:[13]

- **Communications :** Includes all forms of communications between Internet users – including voice (VoIP), social networking, email and instant messaging. Leading providers of such services include Skype (part of eBay), Facebook, and Hotmail (part of Microsoft). With the exception of VoIP, these services are invariably provided free-of-charge and funded by advertising revenues.
- **General/Vertical Content Destinations :** This segment includes general content portals (e.g., Yahoo!) and more targeted services such as dating websites, general news / consumer publishing or special interest content websites on a very diverse range of topics from wine to politics. Revenues are mostly generated through advertising, though some websites charge for access to their services (e.g., dating websites, FT.com).
- **Search :** This consists primarily of web search engines such as Google or Baidu, as well as local/national directories such as Yell in the UK or Pages Jaunes in France. Revenues are primarily generated from advertising, with sophisticated models such as auctioned keyword references or pay-per-click having established themselves in recent years.
- **Entertainment :** This comprises websites focused on audio-visual entertainment, such as downloads of digital content (e.g. iTunes), music and video streaming / online radio (e.g., YouTube, last.fm), IPTV, gaming (e.g. Xbox Live), gambling (e.g. PartyPoker) or adult content. Revenues are generated almost equally from advertising and payments from end-users.
- **e-Commerce :** Many websites sell non-digital products and services. The biggest service categories include e-Retail (e.g., Amazon), e-Travel (e.g., Expedia) and online brokerage (e.g., Boursorama.com). Both bricks-and-mortar and pure-play online players are active in this segment. The e-Commerce site operator will collect payment from the customer and retain a margin, with the remainder passed to the manufacturer or service provider. Online costs are typically much lower than for traditional retailing so that prices are often, though not always, lower. This has triggered substantial growth and a displacement of volumes from traditional retail to e-Commerce for items such as books.

Revenues generated by online services therefore originate from a combination of advertising, paid-for access to content and services, and e-Commerce transaction fees.

Enabling Technology / Services

Enabling technology and services are generally invisible to the end-user, but are essential for the technical delivery of web content and the generation of revenues. Highly fragmented, these services fall into three broad segments – Support Technology, Billing and Payments and Advertising Services.

- **Support Technology** refers to a set of technical services provided to online service providers and includes website design and development, web hosting and technical service platforms (e.g., content management platforms). Akamai, for example, provides content delivery services through its network of servers that improve the speed and reliability of the connection and manage the network load efficiently on behalf of online service providers.
- **Billing and Payments** services comprise all payment platforms used to process monetary transactions made by consumers on the Internet – to pay for accessing specific services (e.g., music downloads) or to conduct online e-Commerce transactions. Beyond payment processing services provided by banks and payment processors such as First Data, there are also pure play online payment service providers such as PayPal (part of eBay) and Google Check-Out.
- **Advertising Services** providers are fundamental to revenue generation for most online service providers. This segment includes four categories of company:
  - Advertising agencies that provide a range of services to their clients, including media campaign planning, ad inventory acquisition for online advertising campaigns, and creative services to design and produce online advertising. They charge commissions based on the total volume of advertising spend and, in the case of large multi-service agencies such as OMD and WPP, online advertising is simply part of their portfolio of client services, albeit a growing part that requires specific skills;
  - Dedicated online advertising networks and exchanges such as Doubleclick (part of Google). Ad networks are a technical and payment clearing house for advertising space. They both acquire advertising space on behalf of media buyers / advertisers and sell ad inventory on behalf of Internet websites. They also provide the technical platforms that facilitate the placement of display ads on websites. In some cases, such as Advertising.com (owned by AOL), ad networks will acquire and resell ad inventory with a mark-up;

- Third party ad serving providers that host and distribute online ads. This is also often performed by the advertising agency that provides the creative services;
- Ratings and analytics service providers that provide Internet user and usage metrics.

Advertisers have the option to buy advertising space either through ad networks, through their regular advertising agency or directly from the website/content publisher.

Connectivity

Connectivity refers to Internet access services provided by telecommunications network operators, whether fixed or wireless. Telecommunications markets vary in their structure based on regulatory and competitive dynamics, particularly with regard to the "access layer", colloquially known as the "last mile". Many customers will arrange their Internet access service via their home telecommunications provider, but cable TV companies, independent resellers or service providers and wireless operators provide highly competitive offers in terms of network speed and pricing. These services are typically provided on the basis of a monthly subscription fee – which can in some instances include the fixed line subscription fee and bundled voice calls and TV subscriptions. As usage volumes grow exponentially for some heavy users, there is debate on the future revenue model, with options including volume-based pricing (benefitting occasional users) or models where the online service provider pays for the customer connectivity to ensure a particular quality of service which matches its content offering.

Also involved in providing Connectivity are core network operators which provide the so-called "highways" of Internet traffic transport. Core network operators tend to be remunerated based on the capacity they provide to the access providers. They connect the access network nodes to the "super-exchanges" of Internet traffic, which route global Internet traffic based on technical standards defined by the Internet Corporation for Assigned Names and Numbers (ICANN). Major core network providers exchange traffic with each other on the basis of "peering", whereby each covers its own costs for installing and operating equipment which interconnects with others. Many providers also procure interconnection on the basis of IP transit, since this is more cost effective at lower traffic volumes.

Both core network and interchange operators tend to be part of large, integrated telecoms operators such as Verizon or BT, but there are specialist companies such as Level 3 or XO.

User Interface

The user interface is an essential part of the Internet value chain, involving both devices (e.g., PCs, game consoles, mobile phones) and the related software (e.g., operating systems, web browsers, media players, games) used to render services to end-users. Key players include hardware manufacturers such as Dell, Nintendo, Apple or Nokia, as well as software providers such Microsoft, Real Media or McAfee.

Revenues generated from the user interface mainly derive from the end-user's acquisition of the device, which often includes pre-installed software. Subscription models are increasingly common for some applications, such as anti-virus security software. In some cases, software is provided free-of-charge (e.g., Internet browsers, media players) – as providers seek to maximize their user base and generate revenues from advertising. In wireless markets, it has been common for the connectivity provider to provide the device on a subsidised basis and recover the cost through ongoing subscription revenues. In some markets there have been trials with laptop computers provided on a similar basis.

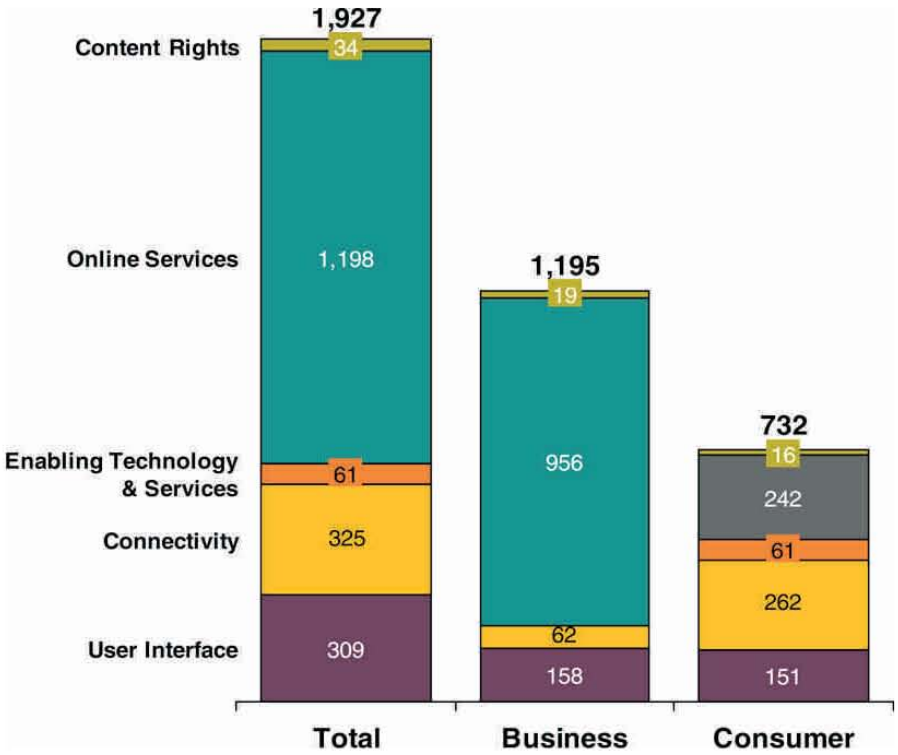
The replacement cycle for devices from PCs to wireless phones has been very short, with a virtuous cycle from the perspective of the players in this segment, as new applications drove a need for stronger device functionality (e.g. chip processing speeds) which encouraged customers to upgrade. In the economic downturn, however, many corporate customers sought to slow down replacement cycles for their computing infrastructure. The subsidised model in wireless markets has also become increasingly strained as operators question the profitability of customers acquired on this basis.

Market Size and Growth

Internet Market Size

Total revenues generated in the Internet Value Chain amounted to US$ 1,930 BN according to our estimates for the year 2008 (see Figure 5). Revenues generated from consumer services, the main focus of this paper, amounted to US$ 732 BN.

Figure 5 : Revenues Generated by the Internet Industry (2008)
Source : A.T. Kearney analysis



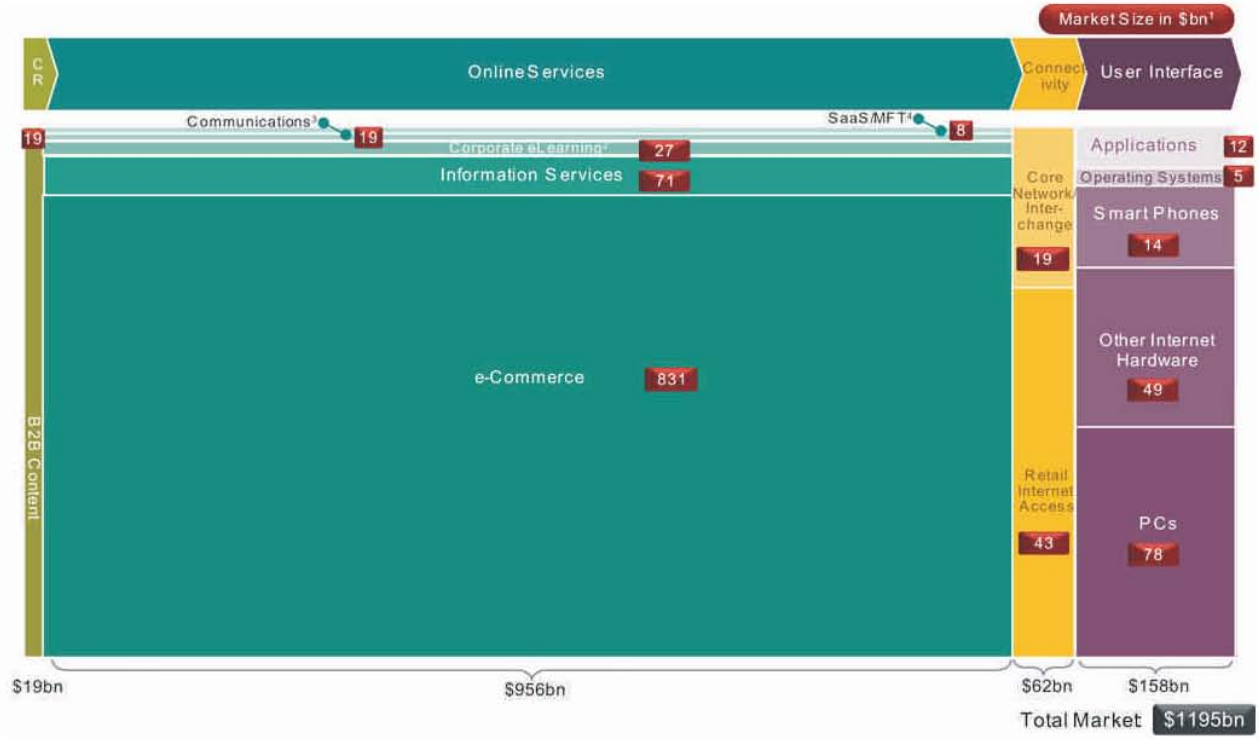
Revenues from business services were substantially higher at US$1,195 BN. 80% of these revenues derive from the Online Services market and by far the biggest category here is B2B e-Commerce, accounting for 86% of the revenues for Online Services (see Figure 6). The Internet has brought substantial efficiency gains to the way in which businesses deal commercially with one another, through electronic data interchange (EDI) services, which offer greater speed and traceability than offline transactions. This has resulted in the rapid replacement of offline transactions with web-based transactions – in 2007 around half of e-Commerce transaction volume between businesses in the US was already taking place through the Internet.[14] The analysis in Figures 5 and 6 omits the actual value of the goods and services and related fulfilment costs for B2B e-Commerce.

After e-Commerce, the next biggest service category in B2B Online Services is online information services, a US$71 BN market for the provision of professional data on subjects such as finance, healthcare and law. Providers include the likes of Thomson Reuters and Reed Elsevier. Other major Online Services categories are the provision of professional online e-Learning services and Internet communication services, the latter incorporating professional (or corporate) VoIP, email, instant messaging, video-conferencing and machine-to-machine communication.

The Content Rights, Connectivity and User Interface B2B markets largely share the same categories as in the consumer market. In the User Interface market, however, it is worth noting that user-paid software and other internet hardware categories are significantly larger for businesses than for consumers. The B2B user-

paid software market was worth US$ 12 BN in 2008, compared to just US$ 2 BN for the parallel B2C markets. This includes for example corporate security and networking applications. The internet hardware market was worth US$ 49 BN in 2008, compared to US$ 7 BN for the parallel B2C market, and incorporates the likes of enterprise storage, Ethernet and enterprise routing hardware.

Figure 6 : Revenues Generated by the Internet Industry – Business to Business (2008)[15]
Source : A.T. Kearney analysis



The remainder of this paper focuses on the B2C market.

Revenues generated by consumers (B2C) are focused on Connectivity (US$ 262 BN), User Interface (US$ 151 BN) and e-Commerce (US$ 146 BN), which covers e-Retail, e-Travel and e-Brokerage services (see Figure 7). In other words, a typical household will spend most of its "Internet budget" on the access device (such as a PC with software) and the access connection (such as a broadband subscription), as well as paying substantial sums per year as margin on their e-Commerce purchases. As before, this analysis omits the actual value of the goods and services and related fulfilment costs, so that for instance the wholesale price of a book sold by a publishing house to an e-Retailer such as Amazon is excluded and only the gross margin earned by Amazon is included.[16]

Online services represent perhaps the most visible part of the industry to the general public, but of the US$242 BN in revenues most are related to e-Commerce while Search and Entertainment generates US$76 BN – 10% of total value chain revenues. Even high profile players such as Skype, Facebook or YouTube generate less than a half a billion dollars in revenues each, despite substantial user numbers.As Figure 8 illustrates, over 75% of the revenues from online advertising and user-paid content and services are concentrated in search and the largest entertainment categories, namely gambling, gaming and adult.

Figure 7 : Revenues Generated by the Internet Industry – Consumer (2008) [17, 18]
Source : A.T. Kearney analysis

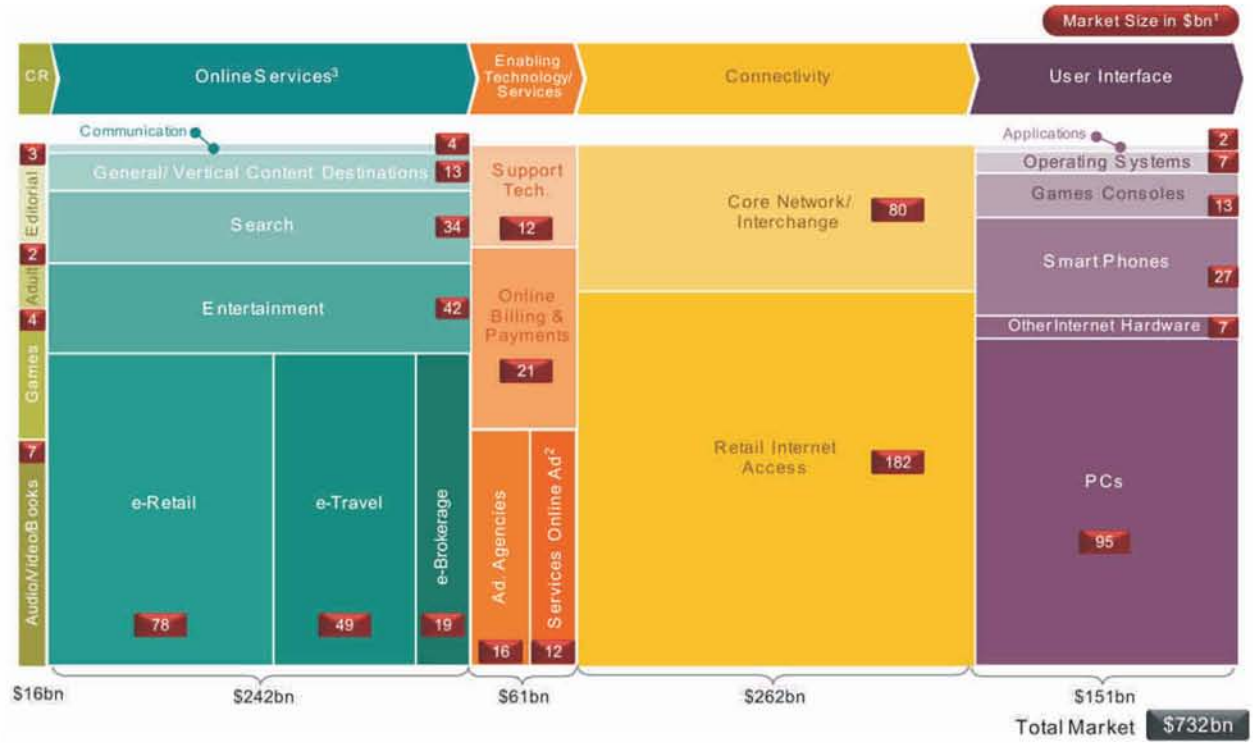
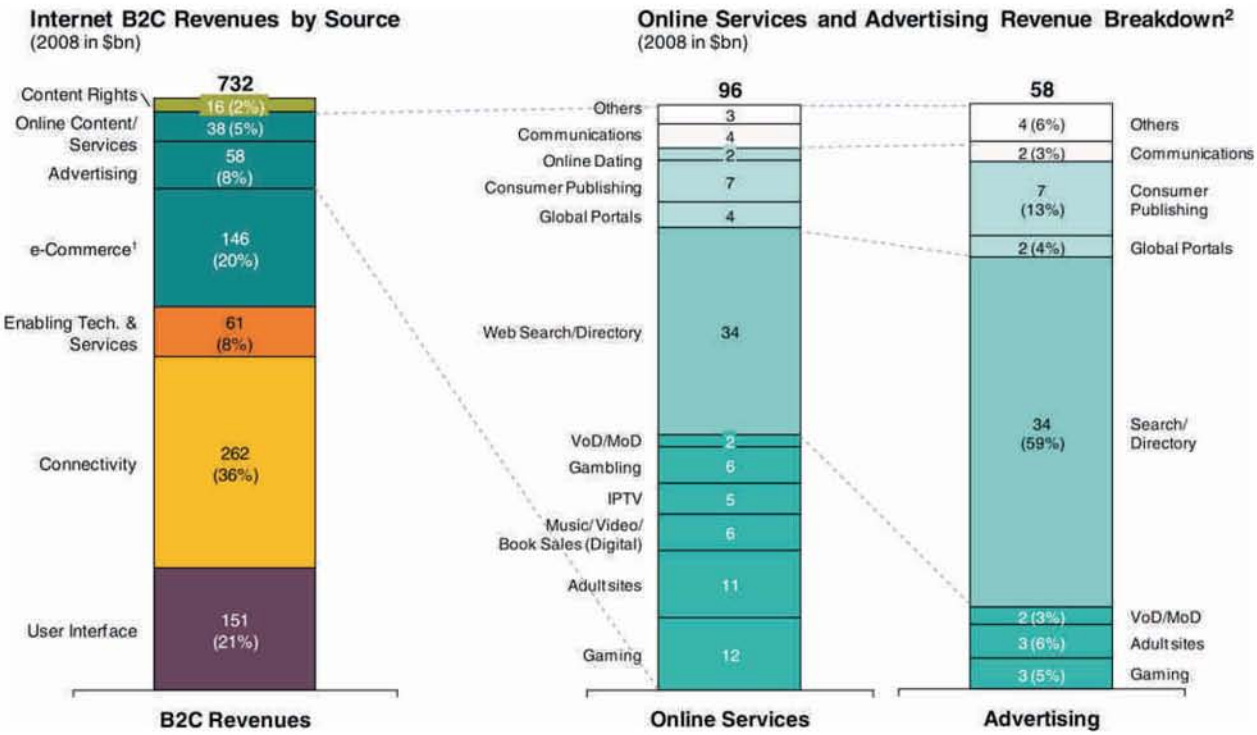


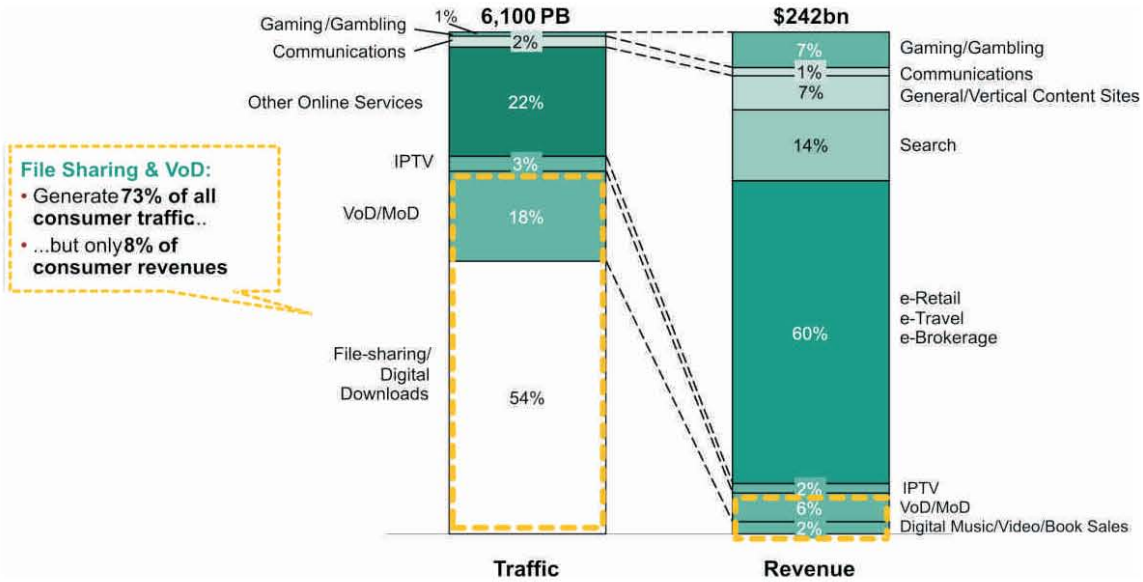
Figure 8 : Breakdown of Consumer Online Services Revenues (excl. e-Commerce; 2008)[19]
Source : A.T. Kearney analysis



Advertising (mainly Search-related) generates US$58 BN, or 60% of total online services revenues, while the remaining 40% comes from payments by Internet users. The ratio of advertising revenue to end-user payments in the online services market is similar to the ratio seen in more traditional media such as consumer publishing.

A comparison between global Internet traffic volume (as measured in petabytes[20]) and the generation of Internet revenues suggests a significant disconnect (see Figure 9). File sharing, including both legal and illegal downloads and uploads, generates 54% of total Internet traffic but only 2% of total revenues. Video- and music-on-demand services generated 18% of traffic but only 6% of revenues. This might explain the concerns raised by a number of Internet Service Providers (ISPs, operating in the Retail Internet Access segment of the market), as traffic transportation costs account for over 40% of their costs yet Internet traffic growth does not, under current pricing models, translate into incremental revenues.[21]

Figure 9 : Online Traffic vs. Online Revenues in the Consumer Internet Value Chain (2008)[22]
Source : Cisco, A.T. Kearney Analysis

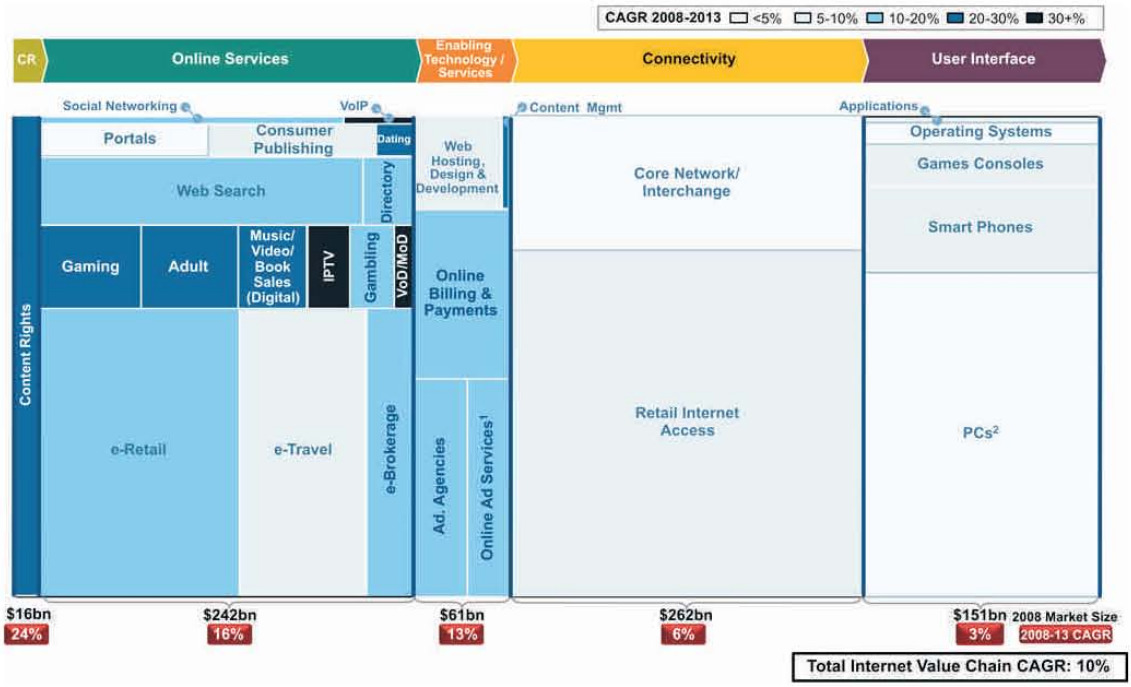


Internet Growth Perspectives

A.T. Kearney has reviewed the growth trends in each market, strategic segment and service category in the Internet value chain and collated growth forecasts from multiple sources (see section 6 for details). It is challenging to make long term forecasts, but for the next 3 years, we expect Internet revenues to grow at 10% p.a. but with substantial differences across the industry value chain.

Figure 10 represents our growth estimates, with the darker-shaded categories of the value chain being those with the strongest growth trajectory. Online Services is one of the most dynamic markets in the Internet value chain, with a growth rate of 16% p.a. – driven by migration of advertising spend to online formats and increased success in charging end-users for access to audio-visual entertainment services as opposed to illegal downloading. Growth of Connectivity services is set to be moderate at approximately 6% p.a., representing a mix of robust growth in emerging markets and in wireless access but a major slow-down of broadband Internet access penetration growth in developed countries and intense pricing pressure. As discussed earlier, the User Interface market should experience the slowest growth at 3% p.a. – following a period of strong device penetration growth (e.g., PCs and game consoles). New devices, such as e-Books, may well provide new growth impetus.

Figure 10 : Growth Perspectives of the Consumer Internet Industry (2008-2013)[23]
Source : A.T. Kearney analysis



Industry Structure and Economics

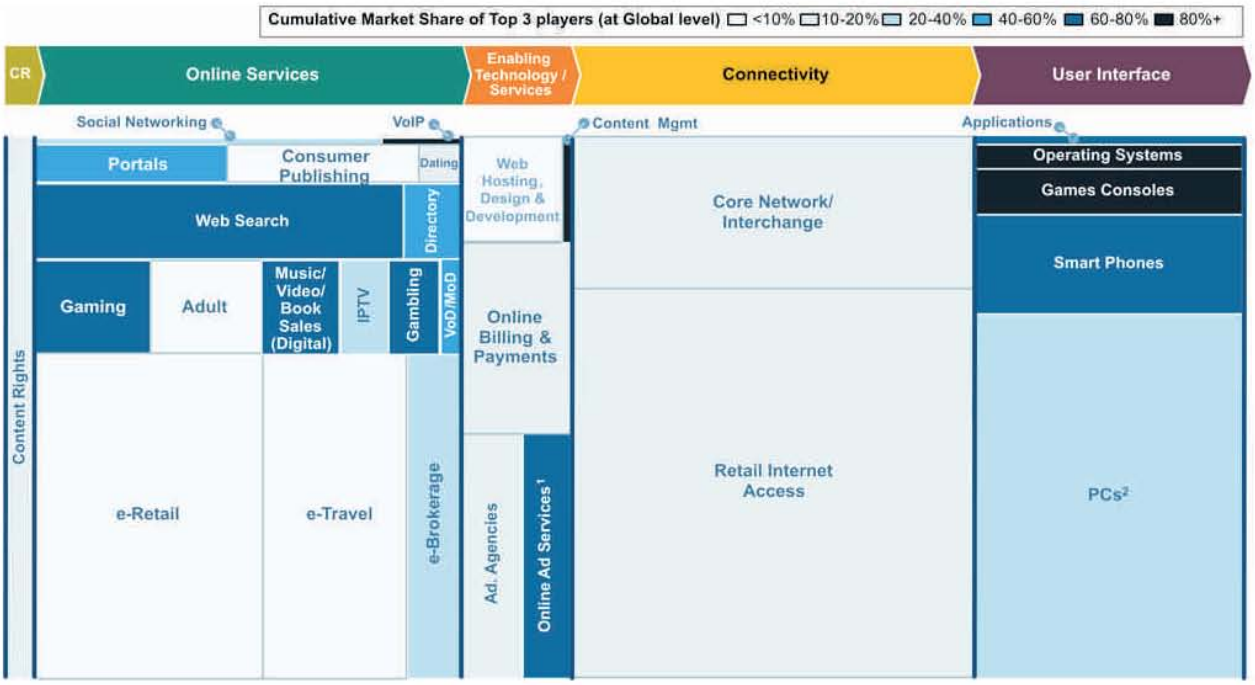
Structure and Concentration of the Internet Value Chain

The Internet value chain comprises some segments and categories that are global and others that are more local in nature. PCs and operating systems are inherently global businesses, due to the standardised nature of these products and the very high economies of scale. Businesses such as e-Commerce and Connectivity are much more local in nature – though some players might operate in multiple countries (e.g., eBay or Vodafone).

Viewed at the global level, the Internet value chain seems highly fragmented, with a few notable exceptions. For categories such as operating systems, smartphones, search, games consoles / services, music and video, the top three market players account for more than 40% of the global market and, in some cases, more than 80%. This is due to the inherently global nature of these activities and the high economies of scale and / or network effects.

Figure 11 is a graphical representation of the degree of concentration at global level of the Internet value chain categories – the darker-shaded categories have higher concentration.

Figure 11 : Market Concentration of the Consumer Internet Industry (2008)[24]
Source : A.T. Kearney analysis



e-Commerce appears particularly fragmented at a global level. This is due to the local nature of these activities and specialization of industry players by type of service. Although fragmented when considered at global level across all retail types, e-Commerce is highly concentrated in some specific areas, i.e. at a national level and at product category level. For example Amazon has a 53% share of the US online book market, which is projected to grow at a CAGR of 44% between 2008 and 2013.[25]

In Connectivity, concentration at a global level for Network Access is low as this is a fundamentally local business. Market concentration at a country level may be strong, given local economies of scale and the legacy of monopoly infrastructure providers. There are however significant differences across countries. In 2008, the five largest UK ISPs accounted for over 91% of the Consumer market (following a wave of consolidation) while the five biggest US ISPs had a combined market share of 56%.

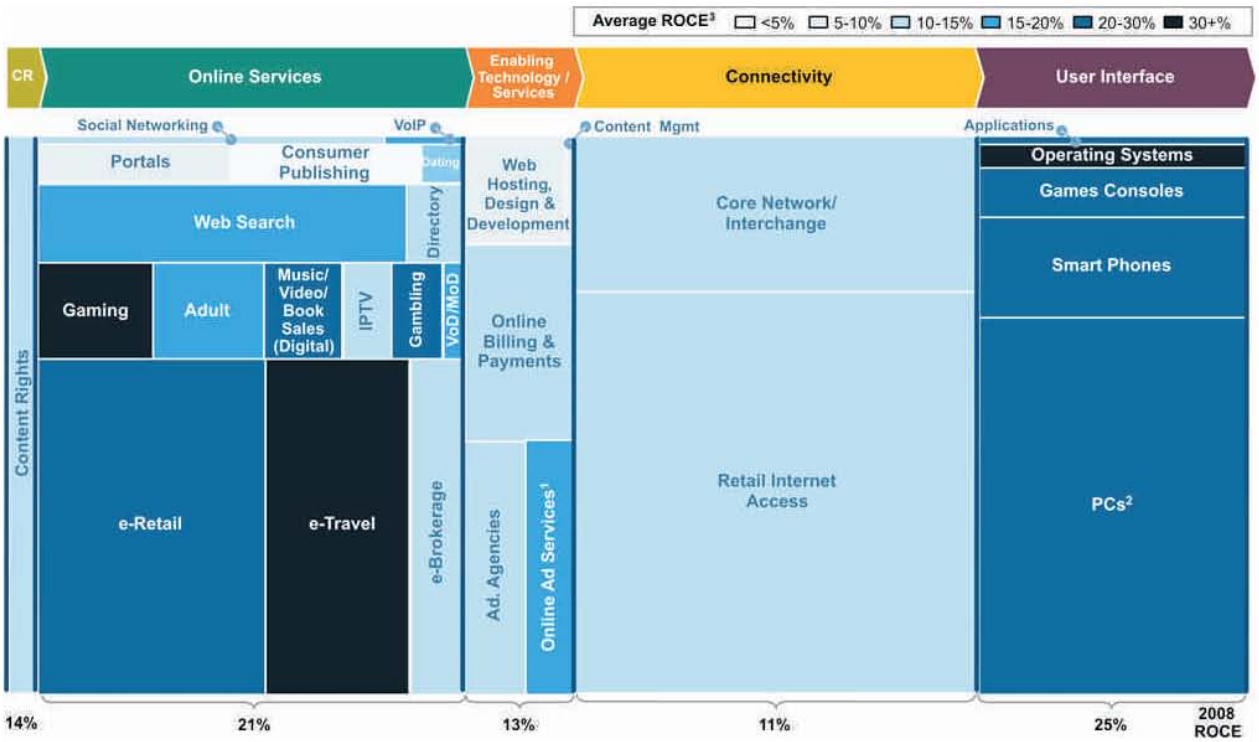
Profitability in the Internet Value Chain

A.T. Kearney further attempted to calculate the profitability of the larger players across the value chain. Figure 12 represents our estimates, with the darker-shaded categories having the highest returns (measured as Return on Capital Employed, ROCE). Higher ROCEs (20%+) can be observed in User Interface (e.g., operating systems, PCs, smartphones and games consoles) and selected Online Services (e.g., e-Commerce, search, gaming, gambling, and adult services).

Returns in Connectivity and Enabling Technology / Services appear significantly lower (10-15%). This is likely due to higher capital intensity, more fragmented competition and in some cases specific regulation of prices and/or margins, as in the case of telecoms services in many countries. Consumer publishing demonstrates returns that are likely below the cost of capital – the problems of this market in responding to the challenge of "free" content have been well documented.

Beyond the mainstream market leaders, the Internet offers multiple niche positioning options – some of which appear particularly profitable. For instance, online nutrition company Nutrisystem delivers a ROCE of nearly 80%; the company offers customized online nutrition programs and delivers ready-made meals that can be ordered online.

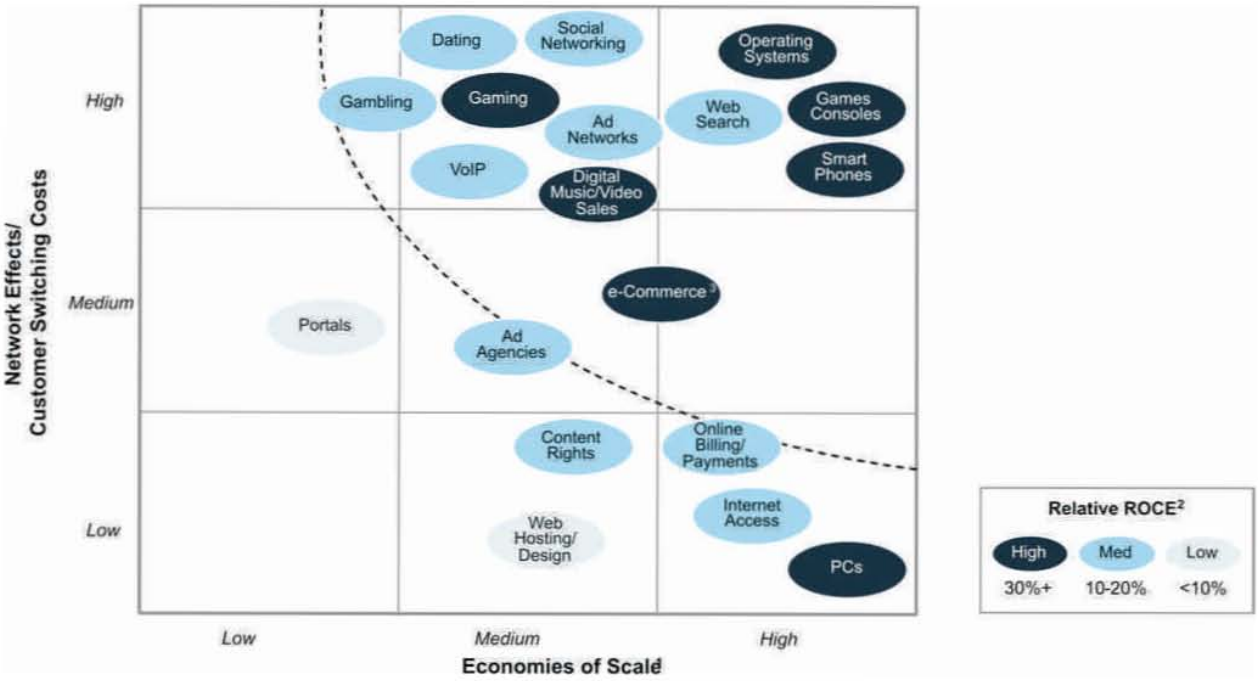
Figure 12 : Returns on Capital Employed for Market Leaders in the Consumer Internet Industry (2008)[26]
Source : A.T. Kearney analysis



Economics of the Internet

Economic theory would suggest that the highest returns should be earned in categories with high market concentration. Such concentration may be due to high economies of scale and strong network effects (including customer switching costs). Our analysis (see Figure 13) seems to confirm this for a number of categories – including operating systems, games consoles and smartphones. Categories with low / moderate network effects and economies of scale are expected to deliver modest returns – this is, for example, the case for general interest portals and web hosting/design.

Figure 13 : Network Effects and Economies of Scale for Selected Consumer Internet Strategic Categories[27]
Source : A.T. Kearney analysis



Some service categories do not deliver returns in line with what economic theory would suggest. Social networking delivers low returns despite strong network effects. This might result from the emerging and fast growing nature of these services and from challenges to date in monetizing usage. Internet access service providers also deliver low returns, despite high scale effects. Possible explanations might include the highly capital intensive nature of this industry, strong competition, regulation and limited opportunities to differentiate beyond price given legacy technology platforms. Some categories of online services may appear fragmented at a global value chain level but actually involve concentrations in national or regional markets which underpin stronger profitability. Another exception to common theory would be "vice" services – gambling, dating, adult content and gaming. Despite moderate economies of scale and network effects, returns are high (>15%) for these services – perhaps due to strong customer willingness to pay.

Future Outlook

At a highly aggregated level, the Internet value chain offers a strong growth outlook (10% p.a.) and good returns for market leaders (>10% and in some cases much higher). Yet, as this paper has shown, it is important to understand differences between service categories. Some categories deliver low returns and face decelerating growth perspectives – e.g., web hosting and Internet access provisioning. They may see attempts to consolidate or expand into other parts of the value chain: there are some cases of telecoms companies investing in devices or in content, for instance. Figure 14 shows our estimates of future growth and current returns.

In a number of smaller categories such as social networking, returns are expected to increase substantially as market leaders benefit from greater scale effects and diminishing needs for start-up investment. However, the value chain is dynamic and a number of market leaders in 2010 could in theory be out of business by 2015.

Differences in growth perspectives and returns largely explain diverging market capitalization gains over the last six years (see Figure 15). Connectivity and Content Rights have failed to create significant shareholder value – largely due to sluggish market growth prospects and relatively low returns. Online Services and User Interface have delivered the strongest market capitalization growth – due both to strong growth prospects and high returns. Although more impacted by the stock market downturn in 2008/2009, the rebound in these markets has been very strong.

Figure 14 : Forecast Growth vs. Returns of the Consumer Internet Industry by Category[28]
Source : A.T. Kearney analysis

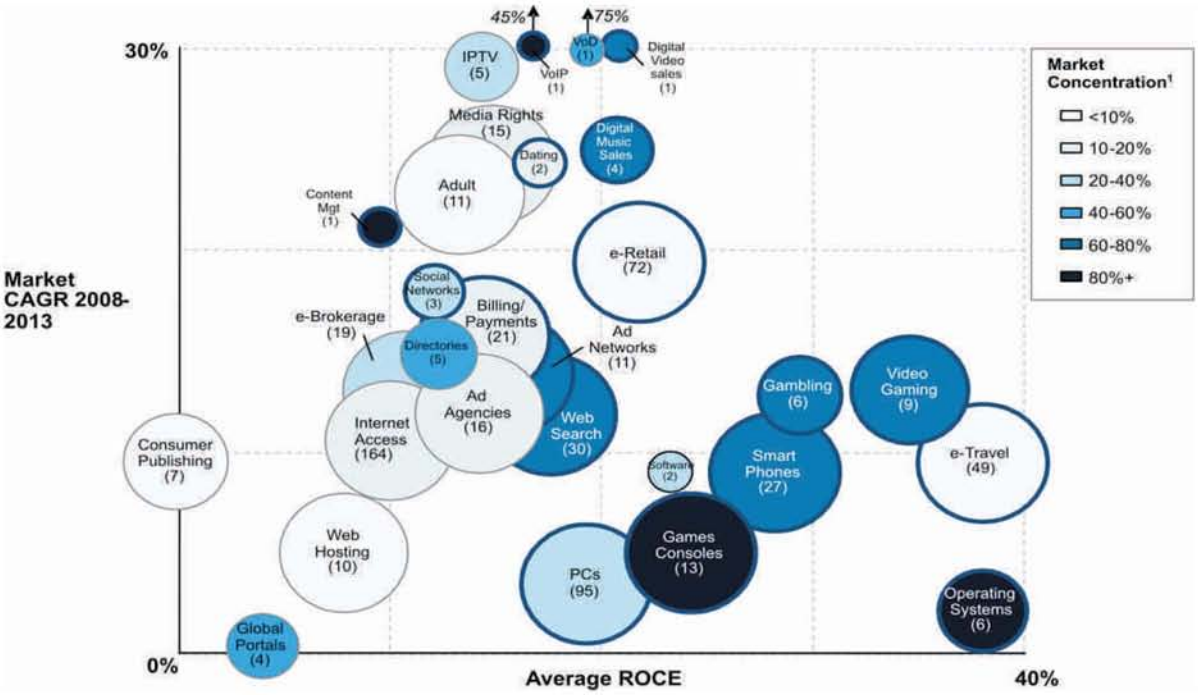
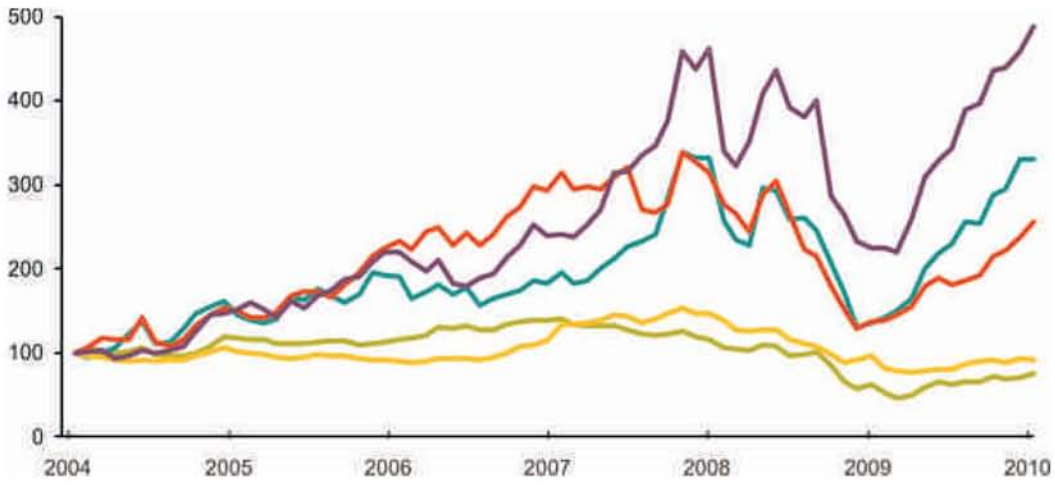


Figure 15 : Evolution of Market Capitalization by Value Chain Market (Base 100 in 2004)[29]
Source : Bloomberg, A.T. Kearney analysis



Concluding Remarks

This paper has shown some clear trends in terms of the economic performance of the various markets in the Internet value chain. Online Services and some categories of hardware and software at the User Interface show high concentration, rapid growth and high returns which are reflected in the market capitalisation of their leading players. Content Rights and Connectivity are less concentrated globally and earn returns around 10-15%, but their market capitalisations have stagnated as investors weigh high capital requirements against continued margin pressure. Strategic moves along the value chain may be expected as players react to these economic trends. Understanding these trends in such a dynamic part of the global economy is a key challenge for the companies involved, for investors and for policy-makers.

Report Methodology and Sources of Information

Overall Report Methodology

Value Chain Definition

The Internet value chain includes all activities which exist as a direct result of Internet usage. The Internet value chain includes five markets and fifteen strategic segments, as described in section 3. Suppliers to segments have only been described when they are specific to the Internet. For example, we did not isolate call center providers or insurance brokers providing services to e-Commerce players, but have included web hosting. Each segment was also further broken down into more detailed service categories – 47 consumer categories and 20 business categories. We have assessed separately revenues generated by consumers and businesses – given the specifics of business services. These include services such as B2B e-Commerce and exchange platforms, online information services (e.g., Reuters), and paid-for hosted applications such as email servers, Software as a Service and videoconferencing.

Market Sizing Analysis

All market sizes are based on gross revenues, except where otherwise stated. Revenues generated from other companies in the value chain (e.g. through commissions, fees, sales, advertising) are not distinguished from those generated from companies outside the Value Chain. In other words this is not a "value-add" analysis for the Internet economy and there are overlaps between revenue categories. For example, revenue from content rights overlap with revenues from online services.

For all Online Services categories, we have calculated revenues generated from advertising and from end-users. Advertising covers all formats – i.e., search, display, lead generation, classifieds, email direct marketing, and in-game online advertising. Advertising revenues are calculated on a net advertising value basis (source: IDC). Online Services revenues from end-users include subscriptions, pay-per-use services and digital goods purchases.

ROCE Analysis

ROCE has been used as a key financial metric to evaluate the profitability of companies involved in the Internet Value Chain. The ROCE calculation that we have used is the company's EBIT divided by its Capital Employed. Capital Employed is defined as Total Assets less Current Liabilities.

Where ROCE is calculated at segment or category level, we have taken an average for the top 3 players in the category (which report financials), weighted by their 2008 Revenues. In segments where there are no pure players, we have had to apply the overall returns of the leading players in that category or select second-tier pure players. ROCE is calculated using Bloomberg data and annual reports. Focusing on the top 3 does of course exclude the effect of failed companies which may have experienced negative returns in any given year, but we believe that it captures the long term profitability characteristics of the segment for successful players.

Market Competition / Concentration Analysis

To provide a view of the level of competition in each Category, we have evaluated the combined market share of the three largest companies, at global level.

The HHI index system is a commonly used measure of market concentration. Due to the global scope of our analysis and the nature of the industry, a full HHI indexing would, however, be impossible to conduct with high accuracy. Therefore, we have avoided using this methodology. We do however believe that the results of an HHI analysis would be in line with our current approach, in terms of providing a picture of the relative level of concentration across Internet value chain categories.

Market Definitions

The definition and market sizing methodology for all service categories are provided hereunder. We only elaborate on the market sizing methodology for cases requiring a specific explanation and not based on an established public source of information.

Content Rights

Segment	Methodology/Description
Media Rights Owners	Market size is based on the percentage of revenues made by Online Services that is paid to content rights owners, either as: - Revenues from digital product sales after commission - Content acquisition or license cost The Online Services Categories in scope are: VoD, MoD, IPTV, Video Gaming, Casual Games, Filmed Entertainment Sales, Digital Music Sales, Electronic Book Sales, Global Portals, Consumer Publishing, Adult Content For each Category on Online Services we estimated the percentage of total online revenues that would be subject to a revenue share with the corresponding Content Rights owners – based on publically available information and interviews with key industry stakeholders
User-generated Content	Revenues received by user-generated content owners are not included in the analysis – but is negligible as is user generated content is very rarely remunerated

Online Services

Segment	Category	Methodology/Description
Entertainment	VoD (Video-on-Demand)	▪ Websites providing audio-visual content on-demand through a streaming service, funded by either ads or subscription. Excludes adult content (see below)
	MoD (Music-on-Demand)	▪ Websites providing audio content on-demand through a streaming service, funded by either ads or subscription
	IPTV	▪ Television services delivered through an IP Connection
	Video Gaming	▪ Websites and applications providing the ability to play console or PC games on the Internet, usually with other gamers, through an interactive streaming service ▪ End users are generally required to purchase a console and game software (through a physical disk or download) in order to play ▪ Includes subscription revenue, in-game online advertising and sale of in-game virtual items ▪ Combined with Casual Games under 'Gaming' for parts of the analysis
	Casual Games	▪ Websites providing Internet-hosted games to end users through an interactive streaming service ▪ End users are not required to purchase a game or gaming device in order to play ▪ Combined with Video Gaming under 'Gaming' for parts of the analysis
	Gambling	▪ Includes websites providing all types of online gambling services, including betting, casino and other gambling services
	Adult content sites	▪ Websites providing adult content
	Video Sales/Rental (digital)	▪ Websites providing the ability to either purchase and download digital filmed entertainment products, or rent physical filmed entertainment products ▪ Excluded from e-Retail

Online Services (ct'd)

Segment	Category	Methodology/Description
Entertainment	Music Sales (digital)	▪ Websites providing the ability to purchase and download digital music products ▪ Excluded from e-Retail
	Book sales (digital)	▪ Websites providing the ability to purchase and download electronic books ▪ Excluded from e-Retail
General/ Vertical Content Sites	Consumer Publishing	▪ Websites operated by newspapers and magazines, usually with similar branding and content ▪ Revenues include advertising only. The market for paid content on consumer publishing sites remains negligible although many publishers are considering how to change this
	Online Dating Sites	▪ Websites offering match-making and communication services focusing on developing romantic relationships
	Global Portals	▪ Selected General Interest Portal and website operators with a global scope: Yahoo!, MSN, AOL and IAC, including their subsidiaries ▪ Market sizing includes revenues from all branded product types including webmail and instant messaging but excludes Casual Games and search revenues, which are captured elsewhere
Search	Directories	▪ Websites providing categorised, searchable lists of organisations – typically consists of "Yellow Pages" publishers' websites
	Web Search	▪ Search engines providing the ability to find information/other websites on the Internet
Communications	Social Networking	▪ Websites primarily focused on facilitating person-to-person communications through a variety of channels including one-to-one (e.g., in-site delayed and instant messaging) and one-to-many formats
	VoIP	▪ Companies providing voice communication transmission services over IP networks ▪ Only includes third-party VoIP, i.e. it includes VoIP based on bespoke applications downloaded by end-users from a website. VoIP services operated by telecom operators are excluded
Transactions (e-Commerce)	e-Brokerage	▪ Websites providing the ability to buy and sell financial products on the Internet
	e-Retail	▪ Websites selling goods/services over the Internet. Includes marketplaces and auction sites ▪ Revenues are based on total transaction value less direct cost of goods/services sold and fulfilment. The percentage to be subtracted is an estimate based on company reports for a selection of leading operators
	e-Travel	▪ Websites providing travel booking services on the Internet ▪ Revenues are based on total transaction value less direct cost of goods/services sold and fulfilment. The percentage to be subtracted is an estimate based on company reports for a selection of leading operators

Enabling Technology & Services

Segment	Category	Methodology/Description
Billing and Payments	Billing and Payments	▪ Consists of payment processing for online transactions ▪ Market sizing is based on total B2C e-Commerce transaction value plus user-paid online services multiplied by an estimated average transaction processing fee
Advertising	Online Ad Agencies	▪ Companies providing services to plan online campaigns and acquire online ad inventory for advertisers ▪ Companies that design, produce, host and serve online ads
	Online Ad Networks/ Exchanges/ Other Services	▪ Companies providing intermediary online advertising services to advertisers ▪ Includes companies that acquire ad inventory from websites to resell to advertisers, platforms for buying and selling inventory, or tools to optimise online advertising effectiveness. All market size numbers are gross revenues
	Online Ad Servers	▪ Companies offering technology that places ads on websites ▪ Includes third-party ad serving only. Excludes ad serving performed by interactive ad agencies
	Ratings/Analytics Services	▪ Companies offering data and analytics on Internet user and usage metrics
Support Technology	Content Management	▪ Companies that offer services that allow Online Services to optimise the flow of content through the Internet (primarily Content Delivery Networks)
	Web Design & Development	▪ Companies create and code Internet pages
	Web Hosting	▪ Companies that provide a service allowing individuals/organisations to store their websites on their servers and make them available on the Internet

Connectivity

Segment	Category	Methodology/Description
Core Network	Core Network	▪ Companies that own and operate the core telecommunications network, providing wholesale services to Retail Access Providers (which may be a division of the same company as the core network provider, but typically with some degree of regulatory separation)
Interchange	Interchange	▪ Operators providing the "super-exchanges" of Internet traffic between core network operators ▪ There are limited standalone / independent interchange operators, besides Level 3 Communications and XO Communications, which are both US operators. In the majority of other major markets, Interchange is provided by large network operators
Retail Internet Access	Retail Internet Access	▪ Companies providing access to the Internet – typically known as ISPs ▪ Includes both fixed and mobile Internet access; Excludes charges for voice calls, TV and fixed line rental ▪ For the Market Concentration analysis we have taken the leading players in 3 major markets (US, Japan, France) and evaluated their share of the total global market. This is notwithstanding the fact that Retail Access Providers largely operate on a local basis

User Interface

Segment	Category	Methodology/Description
Devices	Games Consoles	▪ Personal gaming devices and software with the ability to connect to the Internet ▪ Based on total worldwide sales multiplied by the percentage of gamers who play online
	Operating Systems	▪ Based on total worldwide sales multiplied by the percentage of PCs bought by consumers (as opposed to businesses), multiplied by the estimated percentage of consumer PC time spent on the Internet. We assume for simplicity equal average purchase price for consumers and businesses
	PCs	▪ Based on total worldwide PC sales, multiplied by the percentage of PCs bought by consumers (as opposed to businesses), multiplied by the estimated percentage of consumer PC time spent on the Internet. We assumed equal average purchase price for Consumers and Businesses
	Smart Phones	▪ Mobile handsets offering Internet access ▪ Based on total worldwide smart phone sales, multiplied by the percentage of smart phones bought by consumers (businesses excluded). We assume equal average price for consumers and businesses
	Other Internet Access hardware	▪ Peripherals allowing other Devices to connect to the Internet and enabling usage of Online Services (e.g. modems, routers, webcams)
Applications[30]	Applications	▪ Other applications providing tasks relating to Internet usage ▪ Includes endpoint, messaging, web and IAM software sales multiplied by the percentage of sales that are to consumers (as opposed to businesses). For this percentage we have taken the same percentage split as for Internet access hardware

Business-to-Business

The additional clarifications below only relate to those B2B Categories that we felt required additional explanation of methodology and assumptions not covered in the Overall Report Methodology, or where our approach is different to the equivalent Category for in the Consumer Internet economy

Segment	Category	Methodology/Description
Content Rights	Content Rights	▪ Market size is based on the percentage of revenues made by Online Services that is paid to content rights owners, either as: - Revenues from digital product sales after commission - Content acquisition or license cost ▪ The Online Services Categories in scope are: Corporate e-Learning, Information Services and Professional Digital Book Sales ▪ For each Category on Online Services we estimated the percentage of total online revenues that would be subject to a revenue share with the corresponding Content Rights owners
Online Services	Communications	▪ Includes revenues from business VoIP (58%), Email (17%), Instant Messaging (2%), Video Conferencing (11%) and Machine-to-Machine Communication (12%)
	Corporate e-Learning	▪ Web-based enterprise education and training programmes ▪ Includes professional digital book downloads
	e-Commerce	▪ Commercial transactions between businesses over the internet, generally through electronic data interchange (EDI) ▪ The approach and assumptions taken is as for Consumer B2B, i.e. transaction volume less cost of goods sold and fulfillment costs

Segment	Category	Methodology/Description
	Information Services	▪ Online business information services. Estimated based on percentage of sales that are online for a basket of information services genres (e.g. legal, tax, healthcare) ▪ Includes advertising revenues from digital trade magazines (accounting for less than 3% of total for this Category)
	SaaS/MFT	▪ Online revenues from businesses from Software-as-a-Service products and from professional Managed File Transfer services
Devices	Other Internet Hardware	▪ Peripherals allowing other Devices to connect to the Internet and enabling usage of Online Services (e.g. modems, routers, webcams) ▪ Business hardware includes enterprise video conferencing, Ethernet, enterprise storage and routing

Notes

1. Pew Internet & American Life Project survey, 2009
2. YouTube, May 2009
3. ComScore, April 2009
4. Google, Forbes, BtoB, June 2009
5. "Social media get quake reports out fast", Los Angeles Times, January 2010
6. Microsoft, 2009, quoted in http://news.bbc.co.uk/2/hi/technology/7988579.stm
7. ABC News / Washington Post, 2009, quoted in http://www.spendonlife.com/blog/new-poll-shows-increased-id-theft-fear
8. Credit Suisse, June 2009
9. Notes to Diagram: (1) Includes simultaneous media consumption; (2) Books, films, newspapers, offline-video games, video; 3) Internet Advertising & Access Spending
10. Notes to Diagram: (1) GeoCities now only available in Japan (2) The Unique Viewers (UV) metric enables a clearer comparison of different types of websites than the more connectively referenced page views metric;
11. Notes to Diagram: (1) Content Rights abbreviated to 'CR' in subsequent value chain diagrams; (2) Refer to the Online Services Categories list in the Methodology section for details; (3) Enabling Technology / Services abbreviated to 'ETS' in subsequent value chain diagrams; (4) Company logos may represent trade or service marks.
12. Content rights are often more complex than described here: an artist may own rights to different elements of a composition and receive royalties out of the revenues collected by the media company.
13. In subsequent analyses we also refer to the main categories of service within these segments where market characteristics are distinct.
14. US Census website
15. Notes to Diagram: (1) All Market Sizes are based on Gross Revenues. Revenues generated from other companies in the Value Chain are not distinguished from those from companies outside the Value Chain; (2) Includes professional e-Book sales; (3) Includes VoIP, Email, Instant Messaging, Video Conferencing, Machine-to-Machine communication; (4) SaaS = Software as a Service, MFT = Managed File Transfer
16. Approach based on An Economic Map of the Internet (MIT 2002)
17. Notes to Diagram: (1) All Market Sizes are based on Gross Revenues. Revenues generated from other companies in the Value Chain are not distinguished from those from companies outside the Value Chain; (2) Includes ad networks/exchanges, 3rd party servers, ratings/analytics services; (3) Online Services includes US$3bn Revenues for other website types not covered by the Categories we have defined. This is excluded from subsequent analysis (4) In dertmining the value of Retail Internet Access we have made assumptions about the directly attributable portion of monthly 'bundled' subscription fees paid to connectivity provides - in some markets regeneration makes speicfic distinctions on this point.
18. In subsequent versions of this graphic we break down certain Online Service segments into categories that have different growth, concentration or ROCE characteristics: Communications into Social Networking and VoIP; General/Vertical Content into Portals, Consumer Publishing and Dating; Search into Web Search and Directories; Entertainment into 6 categories. Refer to the prior section and the Methodology for details.
19. Notes to Diagram: (1) Includes e-Retail, e-Travel, e-Brokerage; (2) Excludes e-Commerce (e-Retail, e-Travel, e-Brokerage)
20. One petabyte is equal to 1,000,000 gigabytes
21. This has led to a number of disputes between ISPs and providers of online services, particularly media services. For example in 2009 the BBC voiced concern that BT was limiting Internet download speeds during peak times, and that this was impacting the user experience of the BBC's iPlayer video-on-demand service
22. Notes to Diagram : (1) Gamming includes Video and Casual Gaming; (2) Other Online Services includes all General / Vertical Content, Search and e-Commerce Online services; (3) VoD/MoD includes Adult Video.
23. Notes to Diagram: Size of box indicates relative market size (2008); (1) Includes ad networks/exchanges, 3rd party servers, ratings/analytics services; (2) Includes other Internet hardware; (3) Gaming includes Video Gaming and Casual Gaming.
24. Notes to Diagram: Size of box indicates relative market size (2008); (1) Includes ad networks/exchanges, 3rd party servers, ratings/analytics services ; (2) Includes other Internet hardware; (3) See Methodology for approach used for Connectivity Component of Value Chain
25. Global Entertainment and Media Outlook: 2009-2013, PWC
26. Notes to Diagram: Size of box indicates relative market size (2008);
    (1) Includes ad networks/exchanges, 3rd party servers, ratings/analytics services ;
    (2) Includes other Internet hardware;
    (3) ROCE is based on top 3 players by market share in each Category
27. (1) Low: Low capex, low operating economies of scale; Medium: Low capex, high operating economies of scale; High: High capex, high operating economies of scale;
    (2) Relative weighted average ROCE of top 3 players (where possible);
    (3) Includes e-Retail and e-Travel
28. Notes to Diagram: Size of bubble denotes relative market size 2008 (Value in brackets in US$bn); all Categories over US$10bn have same bubble size; Bubble border thickness denotes relative Barriers to Entry, through network effects or economies of scale/capital intensity; (1) Based on modified HHI index approach – see Methodology for details
29. Notes to Diagram: (1) Average for Disney, NewsCorp, Time Warner, Warner Music Group, Vivendi & Electronic Arts; (2) Average for Amazon, Google, Yahoo, eBay, Baidu, Expedia & PartyGaming; (3) Average for Akamai, CyberAgent, Google, ValueClick, Verisign & WPP; (4) Average for AT&T, Vodafone, NTT, British Telecom, Deutsche Telecom & France Telecom; (5) Average for Microsoft, Apple, Dell, Acer, Nokia & McAfee
30. Also includes Internet browsers and media players, however these have generally not been provided on a paid-for, stand-alone basis

The Economics of Price Discrimination

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Executive Summary

Price discrimination is pervasive in market economies. To the public, price discrimination can have negative connotations, but economists are in broad agreement that price discrimination is welfare enhancing in a wide range of market settings, is an important competitive tool for firms in many industries, and is at times essential to their economic viability. While economists debate around the edges whether (and under what conditions) price discrimination is beneficial to overall economic welfare in a particular market setting, as a general matter, price discrimination is not viewed as presumptively harmful to either economic welfare or to competition.

While it is true that price discrimination is not feasible under textbook conditions of perfect competition, in realistic market scenarios, where firms sell differentiated products and where there are scale and scope economies, price discrimination is widely practiced by firms with varying degrees of market power, without intervention or oversight from regulatory authorities.

Price discrimination in two-sided markets – such as the Internet – is likely to deliver benefits beyond those available through price discrimination in one-sided markets. This is so because in such markets, the value of the platform to participants on one side depends on the number of participants on the other side. Thus, when discriminatory pricing on one side of the platform expands the volume of participants on that side, the inter-side feedback effects buoy demand on the other side of the platform, which triggers additional expansion. In other words, to increase valuations in the market in which it can price discriminate, the seller has an incentive to lower prices (and thereby increase demand) in the related market. This feedback effect is magnified when price discrimination is allowed on both sides of the market. An important converse of this observation is that a ban on price discrimination on one side of the market, because it can impede the efficient extraction of surplus, will reduce, or perhaps even eliminate, the seller's incentive to keep prices low in the related market. Thus, in the presence of inter-platform externalities, price discrimination can deliver benefits even to those customers who, because of their high willingness to pay, might otherwise experience reduced benefits from price discrimination.

Given that price discrimination generally enhances economic welfare and is not an exclusionary practice other than in certain limited settings, there is no sound economic or public policy justification for treating price discrimination as per se unlawful. Nevertheless, net neutrality rules recently propounded by the Federal Communications Commission seek to do just that: the proposed rules – if implemented – would prevent providers of broadband access in their business interactions with suppliers of content and applications to offer different qualities of service at different prices.

Support for such a measure necessarily must rely upon the view that the Internet is sufficiently unique relative to economic markets more generally so as to justify the imposition of a different set of rules governing price discrimination strategies in all of their many variants. Such a view is unfounded. Indeed, the Internet's inherent ability to facilitate the collection and dissemination of information can and does actually facilitate price discrimination strategies, and the welfare gains that arise from such strategies.

Contrary to the position taken by some net neutrality proponents, the Commission's proposed ban on price discrimination can have a significant deleterious effect on the incentives of broadband access providers to undertake necessary investments in network innovation and expansion. Similarly, proponents are incorrect to claim that the Commission's proposed ban is needed to protect the economic interests of certain groups of content suppliers. In our view, while a ban on price discrimination may aid the entry and expansion of some content suppliers, it will certainly interfere with the business objectives of other suppliers, and will, more importantly, likely reduce the pace and scope of innovation in content and applications, to the ultimate detriment of consumers. Finally, there is no credible basis to claim that net neutrality rules are needed to safeguard against hypothesized anticompetitive conduct on the part of access providers. To date, instances of such conduct have been rare. Such conduct, should it occur in the future, can be readily assessed under extant and well-developed antitrust and consumer protection laws.

Introduction

Price discrimination is ubiquitous in market economies. It arises because buyers typically differ in their willingness or ability to pay for the goods and services that are available to them.[1] Buyers also typically differ in their willingness to pay for enhancements (increased quality) to a given good or service.

Given these differences, it is not surprising that sellers often resort to price discrimination strategies in pursuit of profits and as a means of recovering their fixed costs of providing the goods and services.[2] Examples abound in which different buyers (i) pay different average prices for the same good or service, (ii) select different tiers of a base good or service (at prices that yield differing markups over cost), or (iii) choose different bundled options whose component parts may or may not be available for purchase separately.

Sellers that engage in price discrimination cannot be easily characterized on such dimensions as their "market power," nor can the markets in which they operate.[3] Price discrimination is practiced by sellers that have a high degree of market power and earn substantial profits and by sellers that have little market power and earn little or no economic profits. It is engaged in by sellers large and small, and by those with a single product and large product lines. The prices offered by a seller to one buyer can be different from the prices offered by the same seller to another buyer, or the seller may offer the same menu of prices or options to all buyers.

It is also not always possible to determine which side in any given instance – the buyer or the seller – initiated the price discrimination. The terms may be 'posted' by a seller and accepted as given by buyers, offered or insisted upon by buyers, or negotiated in private between buyer and seller.

In popular usage price discrimination can have a pejorative connotation; but not so in economics. Price discrimination is generally welfare enhancing and is an essential feature of many sectors of the market economy. For example, in many cases, price discrimination may be necessary for sellers to remain economically viable. For those initiating the discrimination, the extra profit or surplus obtained may be required to reach a minimum viable scale of operation, recoup prior investments, or make a new investment, say in R&D or network expansion and upgrades, feasible (in the expected value sense).

Price discrimination can also benefit buyers in a number of ways. For example,

a) It can open up new markets, giving more buyers the opportunity to purchase a seller's goods and services.

b) It can incentivize sellers to offer a broader variety of goods and services, thus enabling buyers to select those offerings that best match their current and future needs, as opposed to having to settle for a one-size-fits-all product or service.

c) It can benefit buyers who demand multiple units of a good or service, and who thus can take advantage of efficiency-enhancing quantity discounts, by allowing them to make socially efficient quantity choices (purchase out to the point where their valuations equal the seller's incremental cost of provision).

d) It can benefit buyers who are, on average, more price-sensitive by allowing them to purchase goods and services they might otherwise have to forego.

e) Finally, price discrimination can benefit buyers by sharpening competition among sellers.

Although price discrimination can be disadvantageous to some buyers (e.g., those who are less price sensitive on average) in the short run, it is generally beneficial to other buyers, and is likely to be beneficial in the long run when the stimulative effects on a seller's investments in product quality and service are considered. Moreover, when competing sellers engage in price discrimination, lower prices can obtain for all buyers, irrespective of the relative sensitivities of their demands to price.

A very important distinction should be made between price discrimination that may be anticompetitive in the sense that it differentially handicaps the ability of some buyers to compete (e.g., discrimination that has the effect of excluding upstream providers from offering products and services that compete with a downstream firm's affiliated business (or businesses)), and price discrimination that primarily is designed to shift rent or extract surplus (which could be harmful to some – but not all –buyers in the short run, but is likely beneficial in the long run). The former requires, at a minimum, a substantial degree of market power in the downstream market, whereas the latter is a common feature of competitive markets.

The remainder of this section focuses on price discrimination that is designed to transfer surplus between and among buyers and sellers. We reserve comment until the next section on price discrimination that arises when firms with monopoly power use price discrimination strategies to exclude or to weaken rivals.

Types of Price Discrimination

Price discrimination typically is classified by economists according to one of three broad categories, depending upon the quality of the information available to the seller(s). The usual nomenclature is to refer to these different variants of price discrimination as first-degree (or direct) price discrimination, second-degree (or indirect) price discrimination, and third-degree (or semi-direct) price discrimination.

From an expositional point of view, it makes more sense to discuss the different types of price discrimination in an order corresponding to the degree of information about buyers' demand characteristics that sellers possess or have available to them. Most textbooks and survey chapters on the subject, for example, begin with the case in which sellers can directly discriminate among individual buyers because of information available concerning individual buyers' demand characteristics. Covered next is the case in which sellers can directly discriminate only among groups of buyers, i.e., the available information on demand characteristics is less granular and only permits sellers to target groups of buyers with different offerings and different prices. Discussed last is the case where sellers can only indirectly discriminate among buyers, i.e., sellers have no direct information about buyers' demand characteristics and thus resort to strategies that require buyers to reveal their preferences by self-selecting from the menu of choices offered by the seller. Consistent with this approach, we leave for last the discussion of the economics of second-degree price discrimination.

First-degree price discrimination

First-degree (direct) price discrimination refers to a situation in which a seller's price (or prices) to an individual buyer reflects that individual buyer's willingness to pay. Although some economists define first-degree price discrimination as a situation in which the seller fully extracts the buyer's surplus,[4] it more generally refers to any situation in which prices are individually tailored to buyers, whether or not buyer surplus is fully extracted. For example, first-degree price discrimination arises whenever a buyer and seller enter into one-one-one negotiations over price. It is in both parties' interests to reach an efficient agreement in this case, and the particular division of surplus that arises will depend upon the bargaining strength of the parties, among other factors.

The salient characteristic of first-degree price discrimination is that its implementation requires detailed knowledge on the part of the seller about the demands and preferences of individual buyers. Note also that it implicitly assumes that buyers cannot engage in arbitrage; if they could, a buyer who is offered a low per-unit price, for example, could purchase the good or service and then resell it to a buyer who is offered a high per-unit price, making both herself and the other buyer better off.

An example of first-degree price discrimination in end-user markets is provided by a contractor who charges different prices for his or her services depending upon information about each buyer's willingness to pay that can be inferred from observable characteristics such as the buyer's neighborhood and which the buyer has no financial incentive to game.[5]

Third-degree price discrimination

Third-degree price discrimination refers to a situation in which the seller can divide buyers into groups of two or more and then charge a different price (or offer a different price schedule) to each group. This type of price discrimination is sometimes referred to as semi-direct price discrimination because it presumes that the seller can determine which buyers are in which group but cannot distinguish among buyers within each group. Hence, the seller's prices are group specific as opposed to consumer specific.

The salient features of this type of price discrimination are: (i) the seller must be able to identify distinct groups of buyers based upon observable and immutable characteristics (e.g., geographic location, age, gender, bandwidth requirements, etc), and (ii) the groups must differ in terms of their sensitivity to price, with buyers in the more price sensitive group paying a lower per-unit price relative to buyers in the less price sensitive group. As with first-degree price discrimination, it is implicitly assumed that buyers cannot engage in arbitrage.

Instances of third-degree price discrimination are common throughout the economy. For example, movie theaters often extend discounts to students, some restaurants provide discounts to senior citizens, and some nightclubs charge a higher entrance fee to men. In business-to-business transactions, buyers are often offered different prices depending upon their geographic location (and hence the operative market conditions that influence prices) or the industry in which they operate. For example, merchants often pay different merchant discount fees depending on the industry.

Second-degree price discrimination

Second-degree price discrimination refers to a situation in which a seller offers options to all buyers and allows each to self select his or her most preferred option from the menu. The different options might correspond to a schedule of discounts off a base price when certain quantity thresholds are reached, or, alternatively, they might correspond to different qualities of service or different qualities of goods, where higher qualities of

service or goods are offered at higher price points. A necessary condition for second-degree price discrimination is that the seller possesses some information about the willingness to pay of buyers in general (e.g., the approximate value the market places on different qualities of service), but is either unable or unwilling to discriminate directly based on the buyer's group identity or on the individual characteristics that correlate with the buyer's willingness to pay.

The key difference between second- and third-degree price discrimination is that with the latter, the seller's pricing strategy is based upon a direct signal about buyer demand that is correlated with the willingness to pay, e.g., students are presumed to be more price-sensitive than non-students, and thus are offered a discounted price for movie tickets, whereas with the former, the seller effects a price-discrimination strategy through a self-selection process undertaken by consumers in response to the menu of purchase options made available by the seller. That is, buyers sort themselves into purchase options that the seller consciously designed for them.[6]

This type of price discrimination is sometimes called indirect price discrimination because it presumes that buyers pay different prices only when they reveal their preferences through their behavior, i.e., the choices they make. When the different options correspond to a schedule of discounts based on quantity thresholds, for example, the seller is able to charge different prices to buyers not because of characteristics observable to the seller ex ante, i.e., before purchase, but rather because of the quantities they elect to consume. When the options presented to buyers instead correspond to different qualities of service, the dynamic is much the same, except here the seller's ability to price discriminate arises because buyers reveal their preferences based on the differences in their willingness to pay for the enhanced features or functionality.

The salient features of this type of price discrimination are: (i) the seller is unable or unwilling to identify individual buyers or even distinct groups of buyers based upon observable indicators, but instead relies on the buyers' incentives to truthfully reveal their preferences through the choices they make from the menu of available options, and (ii) there must be variation in willingness to pay across buyers that can be exploited, typically either via different configurations of quantity or quality. Arbitrage is less of an issue with second-degree price discrimination when it is implemented through quality differences because every buyer has access to the same menu of price/quality combinations.[7]

Second-degree price discrimination is ubiquitous. Examples include the offering of quantity discounts that only some buyers select, and a practice known as versioning, e.g., coach class versus business class and overnight mail service versus first class mail service. Second-degree price discrimination occurs when a retailer sells both a private-label brand and a name brand, and it occurs when a software vendor sells both a deluxe version and a premium version of its software, with or without free updates and technical support.

Price Discrimination and Market Power

When a seller engages in price discrimination, at least one of its prices must exceed marginal cost. This markup over marginal cost is often taken to imply that the seller enjoys some degree of market power. One might imagine, therefore, that price discrimination and market power go hand-in-hand and thus are positively correlated in the sense that greater market power confers a greater ability to engage in price discrimination, and vice versa. However, there is no theoretical or empirical work to support this conjecture, and casual observation suggests that price discrimination is quite common even in markets that appear to be highly competitive.

Consistent with the empirical evidence, many economists and antitrust scholars now take the position that price discrimination is the norm rather than the exception in many competitive industries.[8] Scholarly work in this area has shown that price discrimination can arise when individuals belong to groups (e.g., households) and purchasing decisions are made at the group level (e.g., household level),[9] and it can arise in highly competitive industries that are characterized by price rigidities and demand uncertainty.[10]

Moreover, in many industries goods and services are produced under conditions of joint and common costs (i.e., where costs such as R&D, advertising, and distribution and marketing, are shared among several products), which lead to scale and scope economies.[11] In the presence of these scale and scope economies, it is well known that even sellers in highly competitive markets will need to adopt discriminatory prices or product strategies in order to survive. In particular, sellers constrained by competitive conditions will find it necessary to engage in price discrimination as a means of recovering common costs among consumers in the least output-restricting way. In these cases, one cannot infer market power simply from observed price discrimination.

Along similar lines, it is widely recognized that price discrimination is necessary in competitive industries in which there are high fixed costs and entry barriers are low.[12] In such industries, sellers might not be able to charge prices that are always equal to the pertinent marginal costs, but nevertheless, these sellers may only be earning competitive profits and need not have market power in any relevant sense. Indeed, as some

eminent scholars have pointed out "it is the very presence of competition, rather than monopoly power, that often is responsible for the prevalence of discriminatory prices." In a variety of market scenarios, price discrimination is thus necessary to ensure survival and does not necessarily imply market power.

In short, price discrimination can be low when the degree of market power is high and high when the degree of market power is low. Thus, there is no necessary correlation, as a matter of economic theory or in practice, between the extent of price discrimination and degree of market power.[13]

Welfare Effects of Price Discrimination

Similarly, it is not appropriate to view price discrimination as invariably harmful to total social welfare (measured as the sum of consumer surplus and profits). In fact, in a wide range of market settings, price discrimination is conducive to social welfare, especially when the long-run effects are taken into consideration. It is, thus, important to recognize that price discrimination should not be viewed as presumptively harmful. These conclusions are widely supported in economics textbooks and in the scholarly literature,[14] particularly as applied to instances of first-degree price discrimination or where price discrimination is practiced by sellers in an effectively competitive market.

First-degree price discrimination

The welfare benefits of price discrimination are most evident when sellers engage in first-degree price discrimination. And, as is well known, the welfare gains from this type of price discrimination hold irrespective of the competitiveness of the market, even if the seller is a monopolist. This follows because buyers whose willingness to pay for the seller's products or services exceeds the seller's cost of supplying the products or services will buy, and buyers for whom this is not true will not buy. Total surplus, and thus total welfare, necessarily is maximized in these cases.

When the product at issue is an input, maximization of the buyer's and the seller's combined profits would not be possible if the seller were constrained to offer all buyers the same per-unit price, irrespective of the buyers' purchase volumes, potential profits, or other salient considerations. Without an ability for buyers and sellers to contract efficiently , buyers would purchase less (or, even worse, not at all) from sellers than they otherwise would, thereby leaving foregone surplus on the table, decreasing buyer/seller joint profits, and harming end users through higher prices for the finished goods.[15]

Third-degree price discrimination

The welfare effects of third-degree price discrimination are, in general, somewhat less clear, when the seller is a "monopolist." This follows in part because a monopolist seller's volume of sales under third-degree price discrimination, relative to the case where such discrimination is absent, will depend upon a variety of considerations (including the behavior of the buyers' demands with respect to price) that affect the magnitude of sales increases in some markets (or some groups of consumers) relative to the size of the decreases in some other markets (or some groups of consumers), and on whether entirely new markets will be served if the monopolist is allowed to price discriminate (if new markets are served, then welfare is likely to be higher).[16]

The concern that third-degree price discrimination may not always increase welfare is attenuated in markets characterized by effective competition. There are two reasons for this. First, effective competition mitigates the concern because a seller's attempt to extract greater amounts of surplus through price discrimination is constrained by risk of the diversion of its customers to rival sellers. Obviously, in the extreme case where the products or services offered by sellers are perfect substitutes, third-degree price discrimination is not possible. However, when products are not perfect substitutes, but competition is vibrant nonetheless, so that a seller's ability to extract surplus is limited by the availability of competitive offerings, price discrimination can be socially desirable, especially when the first-best marginal cost pricing is simply not feasible. Second, as we discuss below, effective competition among sellers may lead to lower prices for all buyers.[17] In this case, it is not necessary to weigh gains and losses across markets.

As noted above, welfare likely increases when third-degree price discrimination makes it possible to serve new markets. The reason is simple: serving new markets is likely to increase overall output. Consumers obviously gain when output increases, and since the seller is also likely to be better off (which is always true when the seller is a monopolist), it follows that welfare is likely to be higher.

However, it is important to note that an increase in output is not a necessary requirement for welfare to increase.[18] In fact, welfare may increase even when total output contracts under an important extension to the well-studied case of a monopolist seller: the case in which two or more competing sellers with different costs engage in price discrimination.

Suppose, for example, that a high-cost seller competes against a low-cost seller. In this case, relative to uniform pricing, price discrimination tends to work to the low-cost seller's advantage because, with price discrimination, a greater portion of total industry sales will shift away from the high-cost seller. The gain that

arises from the redistribution of output can increase welfare, notwithstanding any consumption inefficiencies that might otherwise arise.[19]

Welfare is also more likely to increase when third-degree price discrimination is practiced by competing sellers, irrespective of whether their costs are heterogeneous. The reason is that third-degree price discrimination undertaken by competing sellers can, in some cases, lead to more intense competition, resulting in lower prices for all buyers.[20] This gain from lower prices can arise, for example, when each seller tries to capture additional sales by giving discounts to customers who switch from their rivals, thereby forcing competing sellers to react with lower prices of their own, and ultimately resulting in a `prisoner's dilemma'. Or, more generally, this gain can arise whenever the consumer demand perceived by one seller as relatively elastic is perceived by a rival seller as relatively inelastic. As noted above, these differing perceptions are likely to hold, for example, when each seller can target its rivals' new and established customers with lower prices.[21] Price discrimination in such cases, and in these markets, makes all consumers better off.

Second-degree price discrimination

As with third-degree price discrimination, the welfare effects of second-degree price discrimination are, in general, ambiguous, though likely to be positive, especially when markets are competitive. This is because competition limits sellers' ability to extract surplus and constrains them (even more so than in the case of a monopolist seller) to offer only those options that are highly valued by consumers and/or that provide the best value for the price.

There are two broad classes of cases to consider: (i) the case in which buyers differ in their willingness to pay for quantity, and (ii) the case in which buyers differ in their willingness to pay for different qualities of service (e.g., enhancements to the base service).

The case of sorting buyers by quantity demanded is perhaps the more clear cut of the two cases. Discounting in this case, based upon quantity demanded, is generally regarded as welfare enhancing because it tends to increase the total output sold.

The welfare effects of sorting by quality hinge upon which version the seller will offer if it cannot offer both versions – will it offer the lower-quality version (base version), the higher-quality version (base version with enhancements), or some intermediate level of quality? If it offers the higher-quality version only, also relevant is the question of whether it will charge a relatively low price to maximize sales, or alternatively, a relatively high price to extract surplus from the relatively price inelastic segment of buyers.

Importantly, the reduction in welfare that may arise when the seller is constrained to offer a single version is not due to the seller possibly electing to sell the higher quality service, but rather a consequence of the seller possibly choosing to sell the higher quality service only to the less price elastic segment of the market. A different outcome might obtain in cases where the differences in the willingness to pay of different groups of consumers are more closely matched. The lesson to be learned here is that an inability to offer different levels of service quality at different prices can lower consumer surplus.[22] As a result, it would be misguided to ban this type of price discrimination based upon a concern that only the "haves" can afford to purchase the higher-quality service when price discrimination is allowed. Indeed, in the absence of price discrimination, it is possible that the seller will only offer the high-quality service and the "have-nots" will be excluded from purchasing altogether.

Price Discrimination and Investment Incentives

Limitations on the ability of firms to engage in price discrimination (or more so in the extreme case of an outright ban) likely will impact firms' incentives to undertake investments in new capacity or research and development (R&D). In the case of a process innovation (i.e., one that lowers a firm's marginal costs), for example, the expected return on investment will be proportional to the number of units the firm expects to sell. If the firm expects a price discrimination strategy, relative to no price discrimination, to lead to greater sales, then the firm's incentives to undertake the investment will be more potent. Conversely, if the firm expects price discrimination, relative to no price discrimination, to result in fewer sales, then the firm will have less incentive to undertake the investment. As a consequence, for first- and second-degree price discrimination (and for third-degree price discrimination when the practice allows for new markets to be served), it should be presumed that a ban on price discrimination will have a deleterious effect on investment incentives.

When investment incentives are explicitly taken into account, the welfare benefits associated with price discrimination may be sufficiently large such that all consumers may benefit, even those who are discriminated against. A recent paper on this topic suggests that because investment in cost-reducing activities will be higher when the seller can price discriminate,[23] marginal costs will be lower, and the profit-maximizing prices (in the case of third-degree price discrimination) that are charged to the different consumer groups reflect this. With uniform pricing, however, less investment is undertaken, and the common price charged to all consumers is based on the

seller's higher marginal cost. The paper shows that this common price may sometimes exceed the higher of the two prices that would have arisen through price discrimination, which means that a ban on price discrimination can substantially lower welfare.

The effect of price discrimination on incentives to engage in new product (as opposed to new process) innovation is even more clear-cut. In this case, a firm's investment incentives are influenced directly by the present discounted value of the sum of the returns it expects to earn on those investments. Insofar as price discrimination, whether it be first, second, or third degree, is expected to provide the seller with a greater ability to extract surplus from buyers, i.e., earn greater profits, it can be readily concluded that the ability to price discriminate has a stimulative effect on investment.[24]

Conclusion

The association of price discrimination with market power is in most cases inapt. While price discrimination is not feasible under the textbook conditions of perfect competition, such conditions are irrelevant to the understanding of pricing in modern network industries. In such industries, sophisticated pricing strategies (such as price discrimination) may be necessary simply for the seller to maintain its viability even in a highly competitive market, particularly when the demand from buyers is uncertain, fixed costs are high and shared with other products and services, and consumers have a wide range of needs and willingness and/or ability to pay for the product or services at issue.

Price discrimination can also be welfare enhancing under many circumstances, even in concentrated markets. It can lead to higher output when new markets are served (giving more buyers the opportunity to purchase a seller's goods and services), or when buyers are encouraged to consume higher quantities. Having the ability to price discriminate creates incentives for sellers to offer a range of goods and services from which buyers can select depending on their current and likely future needs. Price discrimination can benefit a wide range of buyers, in particular those who are on average more price sensitive, by allowing them to purchase goods and services they might otherwise have to forego. Price discrimination can also intensify competition, leading to lower prices for all buyers. Finally, banning price discrimination can have adverse consequences on sellers' investment incentives, resulting in reduced product and process innovation.

Price Discrimination and Two-sided Markets

The value buyers derive from a good or service sometimes depends not only on their own consumption but also on the consumption of other buyers. A textbook example of this arises in the case of public goods (e.g., highways, public parks, public swimming pools), where end-users impose negative externalities on each other (i.e., the utility an end-user receives from consuming a public good is often lower the greater is the overall level of usage – because of the increased congestion). More recently, however, there is increasing recognition that there are also many instances in which buyers impose positive externalities on each other.

As an example, take the case of a nightclub that offers lower-priced (or free) admission to women relative to the charge required for admission by men. This pricing policy falls under the category of third-degree price discrimination. It is likely that more men would attend if they could avail themselves of the less expensive entrance fee. It is also likely that fewer women would attend if they were required to pay the higher entrance fee. However, the social inefficiency that can result from fewer men in attendance can be more than offset by the presence of more women, even if the overall attendance does not change when the nightclub engages in price discrimination. This outcome is possible because of the higher value most men assign to an incremental woman's attendance at the margin relative to an incremental man's attendance. Other examples in which the consumption of buyers with low willingness to pay provides positive externalities to others include:

a) Madonna concerts – where organizers have to resist pricing the concerts so high that only older (relatively more affluent on average) people can afford tickets, which can lead to a relatively subdued audience that degrades the concert experience.

b) Designer clothes – fashion designers often want young and/or hip people (publicly) to wear their clothes, but these potential buyers often cannot afford high fashion if the clothes are priced too high.

c) Student admissions – schools often seek to fill an entering class with a talented and diverse mix of students, which imparts positive externalities on other students. This provides a rationale for scholarships even if there is excess demand at the full tuition price.

In each of these examples, welfare and consumer surplus increase when the seller is able to price discriminate among buyers. Price discrimination in these cases can be beneficial not only to the seller but also to society because it affects the mix of consumption in ways that are highly valued by the disfavored buyers.[25] If price discrimination were banned, there would be fewer women in attendance at nightclubs; Madonna concerts likely would be relatively staid affairs; the supply of designer clothes could constrict; and the training of future business leaders would suffer due to less stimulating classroom experiences.

The benefits of price discrimination are likely to be even more pronounced when all buyers share in the positive externalities. In the examples above, the externalities flow in only one direction, from one group of buyers to another group of buyers. They are special cases that fit within the general economic framework of two-sided markets.

In its most general form, positive externalities flow both ways in two-sided markets. Examples of such two-sided markets with a common seller (generally referred to as a "platform") include (a) credit-card payment systems, with card-holders on one side of the market, card merchants on the other side, and the card network as the "platform" or common seller, (b) video game consoles, with game users on one side, game suppliers on the other side, and the maker of the console as the common seller, and (c) the Internet, with Internet users on one side, content and applications suppliers on the other side, and an Internet service provider as the common seller. The benefits that flow from one side of the platform to the other are termed "inter-side" externalities and the benefits that flow among economic agents on a given side are termed "intra-side" externalities. One economic challenge to the platform owner (operator) is to find a way for overcoming the "chicken or the egg problem" so that from a zero start, participation on each side can be induced. Another economic challenge is to establish a structure of prices to be charged to each side so as to maximize the objective function of the platform owner.

As is widely recognized, the Internet properly is viewed as a two-sided market with attendant inter-side and intra-side externalities: subscribers' willingness to pay for Internet access from a broadband ISP will depend in part on the quality and breadth of available content, and the willingness of content suppliers to pay for distribution on a given broadband ISP (and to invest in the development of content in the first place) will depend in part on the size of the available audience, i.e., the number of subscribers.[26] The above examples suggest that these interdependencies can (and likely do) have important implications for assessing the welfare effects of price discrimination in each of its three forms.

The unique characteristics of two-sided markets have only recently been highlighted and studied in the scholarly literature. In cases where this literature considers the effects of price discrimination, it has been argued that "price discrimination is likely to be even more beneficial in two-sided markets than it is in the standard one-sided market."[27] The economic intuition behind this observation is that a seller who can price discriminate on one side of the market (e.g., to content

and application suppliers) will have an incentive, in many cases, to lower prices to buyers on the other side of the market (e.g., to subscribers), resulting in additional benefits over and above those that price discrimination would generate in a one-sided market. In particular, if such price discrimination boosts subscribership on one side of the platform, that imposes a positive externality on the other side of the platform and creates a virtuous cycle of enhanced benefits.

The intuition underlying this conclusion can be illustrated with the help of a simplified example which we give in the appendix. The essence of the example is that the two markets are linked in the sense that each buyer's willingness to pay is increasing in the number of units sold in the other market (this is the most straightforward way to capture the externalities inherent in two-sided markets).

In the case of two-sided markets, a relevant, and important, consideration is whether price discrimination is allowed on one or both sides of the market. Typically, as illustrated in our example, the greatest gains will arise if price discrimination (whether it be first, second, or third-degree) is allowed on both sides of the market.

As reflected in our example, which begins by focusing on the case of third-degree price discrimination, a comparison of welfare levels across the various cases reveals that aggregate welfare and consumer surplus are highest when the discrimination is practiced on both sides of the market. The next best outcome occurs when the discrimination is allowed on only one side of the market, and the worst outcome obtains when the discrimination is banned entirely. In particular, buyer valuations are highest when price discrimination is allowed on both sides of the market. Buyers on one side stand to gain the most when price discrimination is allowed on the other side, and vice versa.

There is also a feedback effect in two-sided markets that is not present in one-sided markets. The seller can more easily extract surplus in the market (or markets) in which it can price discriminate, and because of this, it will often want to alter its pricing strategy in the related market in order to increase output and thereby boost valuations in the market in which it is utilizing price discrimination. Thus, for example, in addition to practicing price discrimination in the first market, the seller often will want to lower prices in the second market (which helps to raise valuations in the first market that can then be at least partially – if not fully – captured) and vice versa. The end result is a win-win outcome for buyers and sellers. The seller in this case clearly gains from the ability to price discriminate and the buyers gain as well because more buyers are served in each market, which increases valuations in each market.

The benefits of price discrimination in two-sided markets are not limited to instances of third-degree price discrimination, but apply as well in cases involving first- and second-degree price discrimination. This is illustrated in our simple example in the appendix by supposing that the highest valuation buyers in each market have strong demand for high quality of service and little or no willingness to pay for low quality of service, whereas the lowest valuation buyers in each market have quite weak demand for the high quality service. In this case, it is easy to see that the seller can effectively replicate the outcome under third-degree price discrimination by offering its discriminatory prices in the form of a menu of different quality options available at different price points. Such a strategy is designed to effectively induce, through buyer self-selection, the desired price discrimination.

In the case of first-degree price discrimination, one can again conceptualize the gains from price discrimination into those that would arise if the discrimination were only allowed on one side of the market, and the gains that would arise if the discrimination were allowed on both sides of the market. With reference to our simplified example in the appendix, it is easy to show that, as in the case of second- and third-degree price discrimination, welfare is highest with first-degree price discrimination when the seller is free to practice price discrimination on both sides of the market.

The common theme that emerges from these insights is that price discrimination in two-sided markets is likely to deliver benefits beyond those available through price discrimination in one-sided markets because of the inter-side feedback effects that price discrimination on one side of the market has on buyer valuations (willingness to pay) on the other side of the market. In other words, to increase valuations in the market in which it can price discriminate, the seller has an incentive to lower prices (and thereby increase demand) in the related market. This feedback effect is magnified when price discrimination is allowed on both sides of the market.

An important converse of this observation, of course, is that an imposition of a ban on price discrimination on one side of the market, because it impedes the efficient extraction of surplus, will reduce, or perhaps even eliminate, the seller's incentive to keep prices low in the related market. The reason is that the seller will have little incentive to try to increase valuations in the constrained market if these increased valuations cannot be partially or fully extracted by the seller.

In the context of the Internet, the import of this conclusion should be clear. If an access provider is foreclosed from utilizing price discrimination strategies vis-à-vis suppliers of applications and content (or, even worse, is compelled by regulatory fiat to charge a uniform zero price), the predicted outcome on the subscriber side of the market is higher prices (relative to a regime in which the access provider could price discriminate on both sides of the market).

Price Discrimination On The Internet

Introduction

Given that price discrimination is likely to be on balance welfare enhancing in a wide range of realistic market scenarios, it makes no public policy sense to regard price discrimination as being presumptively anticompetitive (in the welfare reducing sense). Indeed, we are not aware of an instance in which a regulatory authority has enacted a per se prohibition on price discrimination.

Under existing antitrust doctrine in the United States, allegations of price discrimination are assessed using a rule of reason framework that examines, among other factors, whether the pricing practices under challenge likely injured competition. Under European Union competition law, firms judged to have a "dominant position" face limits on their ability to price discriminate in response to competitive pressure from smaller rivals, e.g., by selectively cutting prices offered to customers who are being targeted by competing suppliers. However, price discrimination is not treated as per se unlawful, even for dominant firms, but rather is not allowed only when it engenders exclusionary effects.

Nevertheless, the Federal Communications Commission recently has begun to inquire into the policy merits of doing so: i.e., proscribing the ability of broadband access providers to implement price discrimination strategies vis-à-vis suppliers of applications and content.[28] Support for such a proposition necessarily must be based upon the view that the Internet is sufficiently unique relative to economic markets more generally so as to justify the imposition of a different set of rules governing price discrimination strategies.

Price discrimination is already pervasive on the Internet. Its pervasiveness is hardly surprising. The Internet facilitates the collection of information that provides sellers with the ability to gauge consumer demand preferences, in some cases down to the level of individual consumers, and to tailor their price/quality offerings accordingly. In addition, the Internet provides a platform upon which sellers can design and implement marketplaces through which they can efficiently offer their goods and services to consumers across a continuum of price/quality combinations. Similarly, on the buyer side, the Internet represents an effective channel for research and information gathering that allows consumers to build awareness of the available range of products (or services) that reasonably might satisfy their demand. In short, the Internet, because of its efficiency as an information dissemination and collection tool for both buyers and sellers, makes possible a wide range of price discrimination practices in a series of markets, many of which are two-sided and at least most of which are competitive. The Internet thus facilitates the welfare gains that, as we discussed earlier, can arise from such practices.

In what follows, we provide several Internet-based examples of each of the three types of price discrimination. This discussion is intended to be illustrative, but by no means exhaustive.

First-degree price discrimination

Search advertising is the perhaps the most obvious example of first-degree price discrimination on the Internet. The predominant transaction mechanism used to sell search advertising is the generalized second price (GSP) auction. The number of advertisements that a search engine can display to a user is limited, and different positions on the search results page have different values for advertisers. Hence, the GSP auction can be viewed as the mechanism used to allocate display positions to advertisers.[29] In the simplest form of a GSP auction, for a specified keyword, advertisers submit bids that represent their maximum willingness to pay for a click. Advertisements are then displayed in descending order based on bid amounts, e.g., the advertisement with the highest bid is placed on top. The "second price" aspect of the auction derives its name from the fact that an advertiser does not pay its own bid per-click but rather the next highest bid.[30]

Firms other than search engine companies employ similar auction models. For example, Facebook's system, like Google's ranks the display of advertisements based upon bid amounts and past performance of the advertisement. The difference is that Facebook, rather than using keyword targeting like Google, employs an algorithm that permits an advertiser to target its message according to a Facebook member's demographic information, including gender, age, relationship status, location, interests, and so on.

Another example of first-degree price discrimination on the Internet is provided by the transit contracts negotiated between internet service providers (ISP) and internet backbone providers (IBP). The resulting prices in these contracts depend in large part on the value that each side brings to the other. Similarly, many applications and content suppliers negotiate with ISPs over prices for connection to the Internet, and with various other services, e.g., content delivery networks like Akamai and BitGravity. This type of negotiation occurs often in business-to-business transactions, where buyers and sellers have repeated interactions with each

other and can select contract terms that ensure that all gains from trade are realized (i.e., the joint surplus of the parties is maximized).

Third-degree price discrimination

When sellers have less information about buyers, and less control over resale, possibilities for first-degree price discrimination might be limited to nonexistent. It does appear that instances of third-degree price discrimination on the Internet are the least common among the three types, likely due to frequently insignificant barriers to arbitrage and difficulties verifying a consumer's identity, i.e., verifying that a consumer does, indeed, belong to the group (e.g., students) that is being claimed. Nevertheless, third-degree price discrimination is practiced by business on the Internet. For example,

a) Many companies charge different prices to buyers based upon their organizational status or affiliation. For example, Dell Computer's pricing differs according to a buyer's specific grouping: student, employee, home user, small and medium sized business, public sector, and large enterprise.

b) Amazon.com offers bundled discounts on books to individual buyers based upon the books in which they have indicated a possible interest in purchasing. For example, expressed interest in a travel guide for France might trigger the offering of discounted pricing linked to the purchase of one more additional travel guides.

c) Third-degree price discrimination is also practiced with reference to geographic location of customers. For example, Craigslist.org charges employers in certain geographic areas for listing offers of employment; in other areas, available positions can be advertised on Craigslist at no charge.

d) Some adult relationship websites allow women to post personal advertisements and/or communicate with other subscribers free of charge, while male subscribers are required to pay for these same services.

Second-degree price discrimination

Second-degree price discrimination strategies are employed with regularity on the Internet. A few examples follow.

a) Internet service providers like Comcast, AT&T, and Verizon offer access plans to residential subscribers at different prices according to available download and upload speeds. For example, Comcast currently offers plans ranging from $24.95/month (download speed up to 1 Mbps/upload speed up to 384 Kbps) to $99.95/month (download speed up to 50 Mbps/upload speed up to 10 Mbps).[31]

b) Internet service providers similarly offer access and ancillary services to business customers at different prices, according to download/upload speeds, IP configuration option (static IP vs. VPN), number of e-mail accounts, number of network users, level of Internet security, backup volume and speed, and web hosting.[32]

c) Many websites offer free access to their content if displayed alongside advertising, and paid access with advertising omitted. For example, Slashdot.org is an aggregator of news and current affairs relating to science and technology. The company offers access to users at no charge, but content is displayed with advertising. The company's subscription service entitles a user to advertising-free displays, as well as the ability to view news stories in advance of their publication on the website.[33]

d) Services provided by many websites are offered free of charge subject to usage caps, and for a positive fee for unlimited (or greater allowed usage). One example is Flickr.com, a hosting website that allows users to post images and video online for purposes of sharing with the web community. Flickr.com offers a subscription free service that allows users to upload as much as two videos and 100MB of images per month. Users who elect to pay an annual subscription of $24.95 are entitled to unlimited uploads of photos and video, as well as unlimited storage.[34]

An Economic Assessment of the FCC's Net Neutrality Proposals

Introduction

Despite the fact that various types of price discrimination are already pervasive on the Internet, the FCC's net neutrality proposals would introduce a general prohibition on discrimination on one side of the market (as between broadband access providers and suppliers of content, applications and services). The remainder of our paper considers the merits of such proposals in light of the analytical framework outlined above.

As a quick aside, it is worth noting that while the FCC's proposed ban on price discrimination targets only one side of the market (interactions between content suppliers and access providers), the ban has implications for welfare on both sides of the market, i.e., access subscribers as well. This is the case because of the effects the ban likely would have on the economic incentives of suppliers to invest in the development of new and innovative content, applications, and services, and on the economic incentives of broadband network operators to invest in network upgrades and expansion.

We begin our discussion with the issue of investment incentives because here a ban on price discrimination imposed on either side of the market likely would deleteriously affect the incentives of broadband access providers to undertake network investments. In later sections, we assess the economic validity of various arguments advanced by net neutrality proponents that pertain specifically to price discrimination practices as between network operators and content suppliers.

The Effect of Price Discrimination on Incentives to Invest in Network Upgrades and Expansion

The impact of proposed net neutrality regulation on broadband access providers' investment incentives has rightly been a centerpiece of the debate regarding the benefits (and costs) of the proposed net neutrality rules.[35] These concerns would arise irrespective of whether the prohibition applied to one or other side of the market, or to both. As discussed above, price discrimination strategies generally enhance a firm's ability to collect a higher share of the available surplus made possible by its activity, i.e., earn higher profits. Inasmuch as the ability to price discriminate increases the profits a firm can expect to earn on its investments, it strengthens the incentives to undertake such investments in the first place. This is especially true when there is competitive pressure from other firms who are vying for the same end-users and are striving to attract content and applications suppliers onto their networks. Under such conditions, it is more likely that increased profits made possible by price discrimination strategies will be "plowed back" into socially useful investments.

Applied to the FCC's proposals, the significance of this basic idea is obvious: If the ability to engage in price discrimination serves to increase an access provider's expected return on investments in network innovation and expansion, the provider has more potent incentives at the margin to undertake those investments, and to undertake them more quickly, to the benefit of both access subscribers and suppliers of applications and content.

Network neutrality proponents respond to this argument by noting that investments in network capacity have been undertaken in the past in the absence of price discrimination (and because of its absence),[36] and that there is no reason to believe that incentives to undertake future investments will be compromised by an inability to price discriminate. Such an argument misses the mark. To date, the Internet has benefited from an oversupply of capacity arising from the economic boom of roughly a decade ago. It is only recently that broadband network operators have faced congestion and capacity challenges, and thus only recently have they begun to devise pricing strategies whose implementation will help to support the next round of necessary investments. In other words, the fact that capacity investments have been made in the past in the absence of price discrimination does not justify the assertion that investment levels will continue to keep pace with the accelerating capacity demands of content suppliers. Indeed, sophisticated pricing models are being devised coincident with the emergence of greater congestion on broadband networks

The Economic Impact of Discrimination or "Access Tiering" on Content Suppliers

A second set of concerns advanced by net neutrality proponents relates to business strategies often referred to as "access tiering." Generally speaking, access tiering involves the setting of prices for access to a broadband network's subscribers based upon one or more quality of service attributes (e.g., speed, reliability, priority). Price discrimination through access tiering theoretically can take the form of first (individual negotiations between access provider and content supplier over level of service quality and price, second (access provider makes available to all content and applications suppliers a menu of service quality options and prices), or third-degree (access provider makes available to a group of content suppliers sharing a common, relevant characteristic, e.g., extent of required bandwidth, a service quality level at a particular price) price discrimination.

Access tiering is also observed in differential pricing of service quality by access providers to their subscribers (see Section III(D) supra). We understand that the FCC is not proposing a ban on such discrimination on the subscriber side of the market, and consequently, we do not assess the welfare effects that would arise from such a ban. However, the FCC's exclusive focus on the content supplier side of the market suggests that the Commission does not view price discrimination on the Internet in general as warranting per se condemnation. It is also important to note that the net neutrality rules proposed by the FCC are agnostic with respect to the various price discrimination practices that access providers might decide to implement in their business interactions with content and applications suppliers. That is, the FCC's proposed blanket ban makes no attempt to distinguish between price discrimination practices that are generally welfare enhancing and other forms whose welfare effects tend to be ambiguous. Nor does the FCC's proposal make any allowance for the degree of competition disciplining the behavior of an access provider – it would apply with equal force in market settings characterized by effective or even intense competition for subscribers and for content to be transmitted and in market settings where such competition might be less robust. Thus, as proposed, the Commission's net neutrality rules seek to proscribe conduct without any consideration to its likely welfare effects or to the competitive conditions under which such pricing behavior may actually occur. As such, the FCC's proposed rule is a rather blunt instrument aimed at preventing market conduct that can be in a variety of market settings in the interest of subscribers and suppliers of content and applications.

According to proponents of net neutrality, access tiering will permit broadband network operators to charge applications and content suppliers for enhanced levels of service, and consequently will: (i) weaken access providers' incentives to invest in network upgrades and expansion, (ii) degrade the performance of applications and content that do not pay such fees, (iii) reduce innovation and investment in content and applications, and (iv) allow access providers to utilize their purported gatekeeper status in last-mile access to achieve anticompetitive advantages in various markets for content and applications.

Before addressing these claims in order, it is worth noting briefly a general response to this line of argument that a requirement to offer enhanced quality of service at no incremental cost amounts to a subsidy.[37] It is well understood in economics that subsidies produce misallocations of resources. In the current context, zero-price priority services would induce excess consumption of bandwidth-hungry content relative to the socially optimal level, i.e., the level at which the marginal cost of providing the final unit of priority service equals the price. In essence, the proposed restriction on price discrimination is an administrative decision relating to resource allocation, and it should be clear that it is not "neutral." To the contrary, it creates a subsidy that benefits certain suppliers (and users of their content) and disadvantages other suppliers (and users of their content).

The "Damaged Goods" Hypothesis

Net neutrality proponents contend that the ability to price discriminate will weaken the incentives of broadband network operators to undertake the next round of investments in broadband capacity. This argument borrows from the "damaged goods" model expounded in the Industrial Organization literature.[38] The basic idea behind this economic model is quite straightforward. It builds on the obvious observation that in order to implement second-degree price discrimination, the supplier has to induce buyers into self-selecting the options "designed" for them by the supplier. In order to do so, the supplier has to present an appropriate menu of choices[39] such that buyers reveal their true willingness to pay for the good or service. In order for the high willingness to pay customer to reveal its true willingness to pay for the "correct" option, the alternatives must be sufficiently unpalatable. From this perspective, then, constricting capacity and creating congestion in the low-priced tier of broadband network access creates the needed incentive for high willingness to pay customers to voluntarily sign up (and pay more) for the high tier of service. It is this contrived congestion that gives the access provider ability to earn incremental profits through price discrimination.

Degradation in performance

As an initial matter, it is important to understand that access tiering has no impact on performance unless there exists a non-trivial degree of congestion. If network capacity is sufficiently ample so that all content can reach end users subject only to relatively infrequent interruptions or distortions, then content suppliers will be unwilling to pay a substantial premium, if any, for anything other than the "base" quality of service. Indeed, in some sense, with only limited and infrequent congestion on the network, the whole notion of prioritized access becomes meaningless.[40] In a more realistic case where some level of congestion is present, the access provider may be able to charge a premium for a higher quality of service. The magnitude of that congestion depends, in part, on the amount of installed access capacity and on the prices charged for access, among other economic variables.

When material congestion is present, it becomes necessary to ration bandwidth in some way. In other words, some traffic must inevitably be delayed or degraded when broadband networks become congested. Access tiering simply represents one mechanism to deal with congestion, and as such, it properly is understood not as a creator of degradation but rather a re-distributor across content and applications of the inevitable effects of congestion.

By opposing access tiering, the proponents of net neutrality are really challenging the use of prices as the rationing mechanism, based upon the fear that charging for priority service will benefit deep-pocketed incumbent suppliers of applications and content (the "haves") and disadvantage new entrants and smaller firms whose financial resources are more limited and allegedly will not be able to afford higher quality of service (the "have nots"). To be blunt, a desire to protect or prop up certain competitors in no way justifies a ban on access tiering. Protection of competitors has been rejected repeatedly has a legitimate goal of competition policy precisely because pursuit of such a goal would interfere with marketplace rivalry and the consumer benefits that such rivalry engenders. Because price is the only mechanism that accounts for the costs of various quality of service offerings, and content and application suppliers' willingness to pay for such offerings, the use of any other mechanism to assign priority has the potential to impose substantial total welfare losses and can be subject to various kinds of manipulations.[41]

It is also worth reiterating a point made above that firms in many markets differentiate their services by speed and/or quality, by offering faster service at a higher price to those customers who sufficiently value the enhanced offering. One obvious example is United States Postal Service, which offers Express Mail (faster delivery at a higher price) and First Class mail (slower delivery at a lower price), as well as Third Class mail. One surely cannot claim that only deep-pocketed companies can afford Express Mail.

The Postal Service example also highlights a form of differential pricing that net neutrality proponents seem not to consider, specifically a pay-as-you-go pricing scheme, i.e., intensive users of higher quality of service will pay more in the aggregate than users that require priority service on a less frequent basis or for smaller traffic volumes. This is somewhat surprising inasmuch as one would expect such pricing models to be prevalent in a setting in which prices are used as the basis for the provisioning of a scarce resource. Pricing that is usage-based need not place smaller suppliers of content and applications at a disadvantage relative to their more deep-pocketed counterparts – indeed, they are both paying the same price per unit of service. That larger suppliers might pay more in the aggregate in no way suggests that smaller suppliers operate at a disadvantage.

One obvious problem with the "damaged goods" argument in the present context is that it seems to disregard the presence of effective competition among access providers to draw content and applications suppliers onto their networks and with them subscribers who have high willingness to pay for high bandwidth content (as laid out in the discussion of two-sided platforms). In its original version, the argument focused on the incentives of a monopolist to provide a distinctly inferior product to induce the high willingness to pay customers to select a higher priced and more profitable superior product. What the model does not answer is how well these incentives survive in a world of effective competition among access suppliers.[42]

The "damaged goods" argument for network neutrality also seems to implicitly assume that broadband access providers are limited to second-degree price discrimination, which (it will be recalled) entails offering to all content and applications suppliers the same range of differentially-priced service quality options,[43] with the goal of inducing profit-maximizing self-selection. This is, however, a limiting and unrealistic assumption. Access providers have available various technologies that allow them to distinguish among different types of content and applications.[44] As a result, access providers can identify suppliers of content and applications according to their likely willingness to pay for enhanced service quality and directly negotiate differentiated fees for higher quality of service.[45] This ability to distinguish among suppliers based upon their willingness to pay for higher quality service, in principle, enables a broadband access provider to engage in first-degree price discrimination or third-degree price discrimination without at the same time resorting to tools and strategies that are required for self-selection that drive second-degree price discrimination. Thus, it cannot be claimed that access providers will restrict investment in broadband capacity once they are able to charge differential prices for access of different qualities.

Importantly, in neither case is it necessary that the access provider make its standard service available to the high willingness to pay suppliers of content or applications.[46] Thus, the theoretical incentive to artificially degrade

standard service in order to induce self-selection simply does not apply in situations where the access provider can deploy more direct and more finely tuned types of price discrimination. Economic theory would predict that when an access provider can identify suppliers based upon their likely requirements for service quality, the access provider can earn higher profits (ceteris paribus) by engaging in first- or third-degree price discrimination relative to second-degree price discrimination.[47]

Reduced innovation and investment

Another claim made by net neutrality proponents is that access tiering will retard innovation and investment in content and applications. The apparent theory behind this claim is that a content supplier, faced with the need to pay for the quality of service necessary to make its business economically viable, will either (i) elect not to enter (or expand) or (ii) re-direct its efforts toward content that has lower quality of service requirements. While it is reasonable to expect that content and applications suppliers will alter their innovation and investment decisions under a system of access tiering, the real question is whether the overall net effect harms consumer welfare.

Under access tiering, some content and applications suppliers likely will determine (in an expected value sense) that they are unable to recoup their investments once they are required to pay for the priority service their businesses require. However, this inability to recoup is a function of the value that consumers place on their applications and content – those valuations generate an expected revenue stream, net of costs, insufficient to justify the investment.[48]

On the other hand, it is not at all clear how, in the absence of access tiering, suppliers of content and applications that need prioritized service could arrange for it with broadband access providers. More to the point, under best-efforts provisioning of network capacity, a would-be supplier of bandwidth hungry content or applications is unable to contract with a broadband access provider to ensure the necessary quality of service. Without an assurance that it can obtain higher service quality from access providers, it necessarily follows that the supplier's incentives to invest in its chosen business model are dampened.

Allowing price discrimination will stimulate the incentives for entry among some suppliers at the expense of the entry incentives of other suppliers. A ban on price discrimination will effect different content suppliers in similar ways. However, while either regime (price discrimination or no price discrimination) chokes off supply from certain content suppliers, there is no obvious reason to believe that the suppliers who elect not to enter in the absence of price discrimination would add less to total welfare as compared to those suppliers who would not enter if price discrimination were allowed.

Vertical Foreclosure

Inasmuch as broadband access providers have market power as the gatekeepers to their subscriber populations, net neutrality proponents have voiced concerns about their incentives and ability to disadvantage upstream suppliers of applications and content which compete with the access providers' own affiliated content and applications. While theoretically plausible, vertical foreclosure arguments in favor of net neutrality are dubious.

To begin with, traditional foreclosure theories have the most traction in circumstances where the provider of access has substantial market power over access to a well-identified group of broadband subscribers. Here this condition is not satisfied in general because suppliers of broadband access vie strenuously for broadband subscribers and, therefore, are concerned about the effects of foreclosing content that appeals to its subscriber base. In the presence of effective competition, it is at best highly unlikely that, despite the ability to do so, an access provider would have the incentive to leverage its market power in access to impair or destroy competition in the upstream markets for content and applications. To do so would hinder its ability to compete for subscribers to its broadband network, for the simple reason that the breadth and depth of content and applications available to its subscribers would become relatively less desirable.

Importantly, the two-sided nature of the broadband marketplace serves to amplify this effect. If foreclosure of rival content and applications suppliers weakens subscriber demand for the access provider's network and results in a smaller subscriber base, the access provider's network becomes less attractive to content and applications suppliers, prompting reductions in the breadth and depth of content, and so on. In addition, assuming that access providers are permitted to charge content suppliers for different quality levels of service, those charges presumably would generate less revenue as the subscriber base shrinks.

Proponents of network neutrality might assert that successful foreclosure would force the exit of the targeted content supplier, so it makes no sense to claim that the offending broadband access provider will sustain a relative reduction in the breadth and depth of its content – the foreclosed content would no longer be available to other providers of broadband access. But this argument is incomplete. It implicitly assumes that a decision by one access provider to foreclose a particular content (application) supplier will, in fact, induce the supplier's exit. There is no evidence on the record that this is likely to be so in realistic settings. And even if it were, the competitive concern can be cured by the application of appropriate antitrust rules against exclusionary conduct. The proponents have not demonstrated that the risk of successful exclusionary conduct is so high that it is best remedied ex ante as opposed to ex post, that is in the event that exclusionary conduct has or likely will occur.

The NPRM, and the position advanced by net neutrality proponents, considers the imposition of a ban on business strategies that are currently permissible. It is important to distinguish this situation from one in which the lifting of an existing ban is the issue under study. There, a focus of the analysis will be placed on the question of whether removal of the ban likely will lead to anticompetitive behavior that the ban explicitly prohibits. But here, one can already observe the marketplace outcomes that occur in the absence of a ban, and from that type of evidence one should be able to draw robust conclusions regarding the prudency and necessity of switching course and imposing a ban.

The available evidence, when viewed in the most favorable light for proponents, clearly indicates that actual instances of alleged anticompetitive vertical foreclosure are extremely rare. The case that net neutrality proponents trot out in support of their position on the issue involves Madison River Communications, a broadband access provider that was accused of blocking its subscribers' ability to use voice over Internet Protocol (VoIP), a service that competed with Madison's telephone service.[50]

Madison River Communications is significant in two respects. First, the fact that so many proponents rely on it only indicates the paucity of other instances of the conduct at issue. Indeed, vertical foreclosure is rare because it is rare that the incremental costs of such a strategy are lower than the incremental benefits. Simply put, proponents' concerns in this area are specious at best absent a richer body of empirical evidence. Second, the Madison River case involves a rather common situation where a broadband access provider's VoIP services and/or affiliated telephone services compete with VoIP services that utilize broadband networks. In other words, as a matter of economic theory, there are many situations in which broadband access providers might have an incentive to implement a vertical foreclosure strategy, and yet the implementation of such strategies appears to be quite infrequent. Indeed, rather than discriminate against competing VoIP operators, it appears that broadband access providers have sought ways to differentiate their own VoIP offerings, for example by providing these services over their proprietary networks where they can guarantee a quality of service required by VoIP.[51]

Insofar as there remains a legitimate concern that access tiering might increase the likelihood of vertical foreclosure, a more efficient and effective solution is already available, namely the ex post enforcement of extant antitrust laws. As pointed out already, ex ante regulatory restrictions are warranted only when the conduct in question is highly likely to interfere with the competitive process and thus harm consumers, and that firms would, in the absence of these restrictions, likely engage in such practices. In the case of hypothesized vertical foreclosure strategies undertaken by broadband access providers, there is no basis upon which to conclude that either condition holds in practice.

Supra-competitive Pricing of Access

In the NPRM, the Commission also raises a concern that even in the presence of effective competition among providers of broadband access, individual providers "may charge inefficiently high prices to content, application, and service providers," even though it may be in the collective interest of all providers to charge low or zero prices.[52] There are several flaws in this argument.

First, the presence of effective competition should incentivize access providers to reach deals with content suppliers insofar as the content is valued by the access provider's subscribers. Recall that the two-sided nature of the market amplifies the incentives of broadband access providers to deliver content that is valued by their subscribers. A failure to do so have negative implications for subscriber demand, which in turn has negative implications for the network's desirability as a transmission medium for content.

Second, as noted above, price discrimination on the content side of the market can be expected to result in lower subscriber fees, and can increase total welfare in many realistic market settings. More generally, the balancing of rates to the two sides of the market is a complicated exercise driven by considerations of inter- and intra-side externalities and network effects. Often such an exercise leads to zero prices (or even subsidies) on one side of the market and positive prices on the other side. At other times, the platform provider may assess both sides but with differently structured rates (e.g., membership fees vs. usage-based rates). There is no reason to believe that charging users on only one side of the market is more efficient than charging prices to users on both sides. In any case, unless there is powerful evidence to the contrary, the decisions with respect to the structure of rates are best left to the unilateral decisions of competing platform providers. Indeed, it is well-known that while a monopolist may set the aggregate level of prices charged to the two (or more) sides of the platform at a supracompetitive level, there is no necessary presumption that it will select an inefficient structure of prices.

Finally, while it is the case that absent congestion, content is a pure public good (in the sense that one person's consumption of additional amount of content does not reduce the amount of content that another person can consume), when congestion ensues, this is no longer the case. A person's consumption of content can impose negative externalities on the ability of others to consume the content they would like to consume. Similarly, a decision of one content or applications supplier to send incremental content over the Internet

can create a negative congestion-related externality on other content providers. Incremental consumption and production of content can create congestion that imposes a negative externality on other Internet users. Thus, while price discrimination on the content side might lead some content suppliers not to enter (or not to expand),[53] a prohibition against charging differential rates for access to transmission facilities depending on required bandwidth, for example, might well lead to increased network congestion and an overall decline in total welfare.

Concluding Remarks

There is no sound basis upon which to conclude that the Commission's proposed ban on price discrimination would, if implemented, inure to the benefit of competition and, thus, consumer welfare. The many different types of price discrimination strategies targeted in the NPRM are welfare-enhancing in many settings, and in many others their welfare effects are ambiguous. Any per se restriction of such practices – particularly in the face of competition – is unprecedented, misguided and unwarranted.

Proponents of net neutrality raise a number of hypothetical concerns that marketplace realities fail to support. Extant competition in the provision of broadband access, and the acceleration of competition in the future, should be sufficient to discipline the behavior of broadband network operators, in particular given the two-sided nature of the marketplace that serves to amplify the impact on an access provider's profitability that would result from a loss of subscribers to a rival. Moreover, an empirical study of the marketplace fails to produce material evidence of the anticompetitive conduct hypothesized by proponents, even though the conditions supposedly conducive to such conduct are found in many actual settings.

The Internet is one of the defining innovations of the late twentieth century. But it has not redefined economics. The overwhelming conclusion from the economic literature, and from empirical study across many markets, is that price discrimination is often welfare enhancing, and in any case not presumptively harmful. Antitrust and regulatory authorities have, consistent with this observation, resisted the implementation of per se restrictions on price discrimination, particularly in the case of competitive markets. Net neutrality proponents ignore the wealth of scholarly and empirical support for the often welfare enhancing effects of price discrimination, and advance a series of what turn out to be ill-founded arguments in favor of ex ante condemnation of these practices with respect to broadband access providers and their business interactions with suppliers of content, applications, and services. In short, proposed net neutrality rules, if implemented, would needlessly interfere with the promotion of competition and the benefits to consumers that it delivers.

Notes

1. In what follows, we will use the term "price discrimination" to refer to the practice of charging different buyers different markups over cost. For example, price discrimination arises when two buyers pay different prices for the same good or service even though the cost of serving them is the same. Price discrimination also arises when two buyers pay the same price for the same good or service even though the cost of serving them differs. We will also use the term "price discrimination" to refer to the practice of offering buyers different qualities of similar goods and services and charging prices that do not reflect cost differences.

2. Baumol and Swanson (W.J. Baumol and D. Swanson, "The New Economy and Ubiquitous Competitive Price Discrimination: Identifying Defensible Criteria of Market Power," Antitrust Law Journal, 70: 661-685, 2003) argue that price discrimination is the only way for firms with high fixed costs in competitive markets to make the provision of goods and services economically viable.

3. Here market power means nothing more than some control over the price of the product/service that the firm sells. Technically, this means that the seller is facing a downward-sloping demand curve.

4. See, e.g., Carlton, D. and D. Perloff, Modern Industrial Organization, Pearson/Addison Wesley, 4th edition, 2005, chapters 9 and 10.

5. That is, the buyer may find it unprofitable to move to a less desirable neighborhood in order to extract a better (lower) price from the supplier.

6. It may not be feasible to sort buyers perfectly. In such a case, some buyers will be "pooled" into broader categories of customers (buyers) in a manner akin to what is observed under third-degree price discrimination.

7. When price discrimination occurs via quantity discounts, even though all buyers have access to all price/quantity combinations, arbitrage may be possible depending upon buyers' valuations of incremental units and the particular levels of discounts a seller offers.

8. See the "Symposium on Competitive Price Discrimination" in Antitrust Law Journal, 70: 593-696, 2003.

9. See Locay, L. and A. Rodriguez (1992), "Price Discrimination in Competitive Markets," Journal of Political Economy, 100: 954-965.

10. See Dana, J. (1998), "Advance Purchase Discounts and Price Discrimination in Competitive Markets," Journal of Political Economy, 106: 395-422; Dana, J. (1999), "Equilibrium Price Dispersion Under Demand Uncertainty: The Roles of Costly Capacity and Market Structure," Rand Journal of Economics, 30: 632-660; Dana, J. (2001), "Competition in Price and Availability When Availability is Unobservable," Rand Journal of Economics, 32: 497-513.

11. Levine, M. (2002), "Price Discrimination without Market Power," Yale Journal on Regulation, 19: 1-36.

12. Baumol, W.J. and D. Swanson (2003), "The New Economy and Ubiquitous Competitive Price Discrimination: Identifying Defensible Criteria of Market Power," Antitrust Law Journal, 70: 661-685.

13. See McAfee, R.P., Mialon, H., and S. Mialon (2006), "Does Large Price Discrimination Imply Great Market Power?" Economics Letters, 92: 360-367.

14. See H. Varian, Price discrimination, in the Handbook of Industrial Organization, Vol 1, North Holland, Amsterdam, 1989, and L. Stole, Price Discrimination and Competition, Vol. 3, North Holland, Amsterdam, 2008.

15. This is known in the economics literature as "double marginalization." Such distortion can be prevented (or attenuated) if the buyer and seller are not constrained to negotiate inefficiently. Indeed much of the economics literature on intermediate-user markets is dedicated to understanding how to avoid this outcome. A codification of a non-discrimination rule that impedes efficient one-on-one negotiations between buyers and sellers, where such negotiations would otherwise be feasible, not only arbitrarily impacts the division of surplus between the two parties, but also leads to inefficiencies and is inconsistent with the best learning in economics in this area. See, M. Katz, Vertical Contractual Relations, Vol 1, Handbook of Industrial Organization, North Holland, Amsterdam, 1989.

16. See Tirole, J., The Theory of Industrial Organization, 1988, "One has to weigh the losses of consumers in low-elasticity markets against the gains of those in high-elasticity markets and of the producer. The elimination of price discrimination may be particularly dangerous if it leads to closure of markets," p. 139. See also J. Hausman and J. MacKie-Mason (1988), "Price Discrimination and Patent Policy," Rand Journal of Economics, 19: 253-265.

17. See Cooper, J., Froeb, L., O'Brien, D.P. and S. Tschantz (2005), "Does Price Discrimination Intensify Competition? Implications for Antitrust," Antitrust Law Journal, 72: 327-373; and Stole, L., "Price Discrimination and Competition," in M. Armstrong and R. Porter, eds., Handbook of Industrial Organization, Vol. 3, 2008.

18. Gauging the impact on output has been a standard approach in industrial organization economics. See, e.g., Varian, H. (1985), "Price Discrimination and Social Welfare," American Economic Review, 75: 870-875; and Schwartz, M. (1990), "Third-Degree Price Discrimination and Output: Generalizing a Welfare Result," American Economic Review. See also Martin, S., Industrial Economics: Economic Analysis and Public Policy, 2nd edition, 1994..

19. See Galera, F. and J. Zaratiegui (2006), "Welfare and Output in Third-Degree Price Discrimination: A Note," International Journal of Industrial Organization, 24: 605-611.

20. See Shaffer, G. and J. Zhang (1995), "Competitive Coupon Targeting," Marketing Science, 14: 395-416; Chen, Y. (1997), "Paying Customers to Switch," Journal of Economics & Management Strategy, 6: 877-897; and Shaffer, G. and J. Zhang (2000), "Pay to Switch or Pay to Stay: Preference-Based Price Discrimination in Markets with Switching Costs," Journal of Economics & Management Strategy, 9, 397-424.

21. This condition is called "best-response asymmetry." See Corts, K. (1998), "Third-Degree Price Discrimination in Oligopoly: All-Out Competition and Strategic Commitment," Rand Journal of Economics, 29: 306-323.

22. If the difference is sufficiently large, the seller will forego transacting with the low-valuation consumers when it cannot offer both services. In cases such as this, the observed second-degree price discrimination may actually lead to a Pareto improvement in which the seller, the high-valuation consumers, and the low-valuation consumers are all better off. The seller is better off or it would not be offering different services. The low-valuation consumers are better off because absent the lower quality base service, they may not buy at all. And the high-valuation consumers are better off because the seller will have to reduce the price of the higher quality service to induce them to buy.

23. Alexandrov, A. and J. Deb (2010), "Price Discrimination and Investment Incentives," University of Rochester, mimeo.

24. This conclusion does not hold in cases where price discrimination does not make sellers better off (which may be the case when competition among sellers is intense) in an equilibrium of the game played among the market participants.

25. See Adachi, T. (2002), "A Note on Third-Degree Price Discrimination with Interdependent Demands," Journal of Industrial Economics, 50: 235; and Adachi, T. (2005), "Third-Degree Price Discrimination, Consumption Externalities, and Social Welfare," Economica, 72: 171-178.

26. Intra-side externalities can be positive or negative. For example, if a large number of subscribers to a given ISP are heavy downloaders of content (relative to the size of the network provider's pipe), these subscribers impose a negative externality on other users by slowing down transmission and deteriorating the overall subscriber experience. Similarly, a content supplier who sends a substantial volume of bandwidth heavy content will impose a negative externality on other suppliers of content by creating congestion on the network.

27. E. Glen Weyl, "The Price Theory of Two-Sided Markets," Harvard University, mimeo, (2009).

28. Federal Communications Commission, Notice of Proposed Rulemaking (released October 22, 2009), GN Docket No. 09-91 and WC Docket No. 07-52 (NPRM).

29. If a search engine offered only one advertisement per results page, this mechanism would be equivalent to the standard second price, or Vickrey-Clark-Groves (VCG) auction. With multiple display positions available, the GSP generalized the second price auction (and hence the name).

30. Determination of the actual amount paid by an advertiser is, in practice, not so straightforward. For example, prices charged by Google also take into account the quality of the advertisement, a measurement designed to capture the expected click-through-rate (and thus a component of the total revenue Google anticipates from the advertiser).

31. https://www.comcast.com/shop/buyflow2/products.cspx Prices are available to customers who also subscribe to Comcast cable and/or Comcast digital voice service.

32. http://business.comcast.com/internet/details.aspx.

33. http://slashdot.org/faq/subscriptions.shtml.

34. http://www.flickr.com/help/limits/.

35. We refer to "net neutrality rules" in this paper in the knowledge that these could embody a wide range of potential prohibitions. In this context, we regard them as synonymous only with a prohibition on discrimination, whether with respect to price or quantity/quality, or both.

36. *See* Economides, N., "Why Imposing New Tolls on Third-Party Content and Applications Threatens Innovation and Will Not Improve Broadband Providers' Investment," January 2010 (filed as Appendix A to Comments of Google Inc. in GN Docket 09-191; WC Docket 07-52) ("Economides (2010)").

37. The postal service charges more for first class service than for the third class service, and even more so for priority service. Such pricing is efficient.

38. R. Deneckere and R.P. McAfee (1996), "Damaged Goods," Journal of Economics and Management Strategy, 52: 149-174.

39. Such a menu is often referred to in the context of the net neutrality debate as "access tiering," a term which connotes the provision of different qualities of service at different prices. Beyond its application to the "damaged goods" hypothesis, we discuss in the next section additional concerns raised by net neutrality proponents that pertain to access tiering.

40. Indeed, few drivers would be willing to pay an extra fee for access to a high velocity lane on a highway if all the lanes are generally not congested. Or, to put it another way, if the "inferior" product is more than "good enough," there is very little reason to pay a premium for the "superior" version.

41. Under the best-efforts regime currently in place, which a required zero price for priority service would perpetuate, the presence of congestion creates a situation where end-user subscribers would be willing to pay for content and applications whose value is linked closely to prioritized service, but are unable to do so because suppliers of those content and applications cannot procure the quality of service needed to make their offerings viable. Put more simply, consumers would be willing to pay for content and applications that are not offered because they cannot obtain required quality of service. At the same time, applications whose value does not depend at all upon prioritized service are supplied at a level of service quality that exceeds customers' willingness to pay (in the sense that a customer would not be willing to pay any positive price for higher quality service relative to the service quality at which the value of the content is maximized). Welfare losses arise in both cases.

42. It is well-known for quite some time that the set of feasible equilibriums will differ depending on the intensity of competition. See, e.g., Stiglitz, J. and M. Rothschild, "Equilibrium in Competitive Insurance Markets: An Essay on the Economics of Imperfect Information," Quarterly Journal of Economics, 90: 629–649 (1976).

43. In particular, charging for enhanced service and not charging for standard service.

44. See, e.g., Peha, J., "The Benefits and Risks of Mandating Network Neutrality, and the Quest for a Balanced Policy," International Journal of Communication, Vol. 1 (2007).

45. For example, broadband network operators know that content suppliers who stream high-definition video require substantial bandwidth and assured transmission reliability in order to maximize the value that access subscribers place on their offerings. With this knowledge, there is no need for the access provider to make available to all content and applications suppliers a menu of service levels and prices and induce self-selection. Rather, the access provider can negotiate individually with suppliers of high-definition video streaming (first-degree price discrimination) or offer to a group of such suppliers a level of service quality at a particular price (third-degree price discrimination).

46. In other words, where individual content suppliers with higher willingness to pay for enhanced service can be identified, one can think of the offer to these suppliers as some price, p(high) for premium service and (paradoxically perhaps) and even higher price for standard service, i.e., the access provider effectively elects not to make standard service available to these suppliers. Put another way, the high willingness to pay suppliers simply will not be allowed to buy the basic service.

47. This is because these versions of price discrimination leave the high willingness to pay with less (or no) "informational rent" (which is the incentive payment required to induce self-selection).

48. To complete the thought, it follows that those suppliers who decline to invest when faced with the need to pay for prioritized service are the ones whose offerings are likely to be least socially valuable (in an expected value sense). If it transpires, however, that certain content that requires bandwidth has high social value and low ability to pay, the society should devise a set of transparent subsidies that would be made available on non-discriminatory basis and which would be paid for in a non-discriminatory fashion. This issue has been already debated many times in the context of telephony services.

49. As discussed already, quality of service offerings are available in the marketplace from firms like Akamai, and are self-supplied in some cases, indicating clearly that some suppliers of content and applications value such offerings.

50. *See,* e.g., NPRM at ¶ 32.

51. *See,* e.g., Faulhaber, G. R., "Network Neutrality: The Debate Evolves," International Journal of Communication 1 (2007), at p. 695.

52. NPRM at ¶¶ 68-69.

53. As pointed out previously, price discrimination could also facilitate the entry and expansion of certain content suppliers.

Appendix

In this appendix, we develop examples of the three types of price discrimination (first, second, and third degree) that are described in the text. For each type of discrimination, we provide one or more illustrative examples and discuss the effects on consumer surplus, profits, and social welfare.

First-degree price discrimination

Recall that first-degree (direct) price discrimination refers to a situation in which a seller's price (or prices) to an individual buyer reflects that individual buyer's willingness to pay. For example, suppose a seller's cost of providing one unit of a good or service is $1, and that one buyer is willing to pay $10 for a unit of the seller's good or service whereas another buyer is willing to pay only $4. Under this scenario, the seller is said to be engaging in first-degree price discrimination if it charges $10 to the first buyer and $4 to the second buyer. Alternatively, suppose a buyer is willing to pay $10 for one unit, $18 for two units, and $23 for three or more units. Then a seller is said to be engaging in first-degree price discrimination if it induces the buyer to purchase exactly three units for a total price of $23.

Welfare is higher under first-degree price discrimination because, in the case where the two buyers are willing to pay $10 and $4, respectively, for one unit of the seller's product, if price discrimination were not feasible, the seller's optimal strategy would be to set a price of $10 per unit and sell only to the first buyer. Total welfare would be reduced due to the deadweight loss that arises from the second buyer being priced out of the market. And similarly, for the case in which a buyer is willing to pay $10 for one unit, $18 for town units, and $23 for three or more units.

Third-degree price discrimination

Recall that third-degree price discrimination refers to a situation in which the seller can divide buyers into groups of two or more and then charge a different price (or offer a different price schedule) to each group. For example, suppose a seller's cost of providing one unit of a good or service is $1, and that three buyers with willingness to pay of $10, $8, and $5, respectively, comprise one group, and three buyers with willingness to pay of $6, $5, and $4, respectively, comprise a second group. In this scenario, under third-degree price discrimination, the seller optimally charges $8 per unit to the buyers in the group with the relatively high willingness to pay but only $4 per unit to the buyers in the group with the relatively low willingness to pay.

As noted in the text, welfare likely increases when third-degree price discrimination makes it possible to serve new markets. A straightforward explanation of this observation can be developed by modifying the example above such that three buyers with a willingness to pay of $10, $8, and $8 comprise one group (as opposed to $10, $8, and $5), and three buyers with a willingness to pay of $6, $5, and $4 comprise a second group. With this slight change, the seller's optimal pricing strategy under third-degree price discrimination, $8 and $4, remains unchanged, but its optimal uniform price becomes $8 per unit (instead of $5 per unit), an amount that exceeds the willingness to pay of every buyer in the second group. Unit sales fall from six to three in this case, suggesting that total surplus, and thus welfare, would be lower under uniform pricing relative to third-degree price discrimination.

Also, as noted in the text, welfare is also likely to increase when price discrimination undertaken by competing sellers leads to lower prices for all buyers. To illustrate this kind of `cut-throat' price discrimination, suppose that three buyers with a willingness to pay of $100, $80, and $80, respectively for one unit of access comprise one group, and that a second group consists of three buyers with a willingness to pay of $60, $50, and $30, respectively. Suppose the first seller can compete for both groups of buyers but the second seller can compete only for the second group of buyers (DSL, for example, may not be available for the first group of buyers). Under third-degree price discrimination, the first seller optimally charges $80 per unit to the buyers in the first group and, in competition with the second seller, charges "at cost" prices to the buyers in the second group. Note that competition for the buyers in the second group significantly lowers the price they pay relative to the monopoly price.

Now suppose that the first seller must charge the same price to both groups. In this case, the first seller maximizes its profit by charging $80 and the second seller, which can only sell to the second group of buyers, maximizes its profit by charging $50. With the first seller engaging in third-degree price discrimination, all six buyers will purchase. However, in the absence of this discrimination, only five buyers will purchase. The seller's ability to practice third-degree price discrimination therefore increases total welfare, and moreover, makes all buyers at least weakly better off.

Second-degree price discrimination

Recall that second-degree price discrimination refers to a situation in which a seller offers options to all buyers and allows each to self select his or her most preferred option from the menu. For example, suppose consumers A and B each demand multiple units of the relevant product (or service). Consumer A is willing to pay $8 for one unit and $12 for two units. Consumer B is willing to pay $6 for

one unit and $7 for two units. Under second-degree price discrimination, the seller optimally offers a quantity discount, setting a price of $6 for the first unit and a price of slightly less than $10 if two units are purchased together. At these prices, only consumer A purchases two units. In all three units are sold.

The availability of quantity discounts in this case increases welfare. The reason is that, under uniform pricing, the seller maximizes its profit by charging $6 per unit, which results in the sale of only two units.

As another example, suppose consumers A and B differ in terms of willingness to pay for different qualities of service. Suppose consumer A is willing to pay $10 for a seller's base service and $18 for the seller's base service plus enhancements, and that the analogous prices for consumer B are $8 and $9, respectively. Suppose further that the seller's incremental cost of provision is $1 for the base service and $1.50 for the enhanced service. Then, under second-degree price discrimination, it is optimal for the seller to offer the base service at a price that is slightly less than $8 (in order to serve consumer B) and the enhanced service at a price that is slightly less than $16 (in order to serve consumer A). At these prices, consumer A will choose to buy the enhanced service (at the higher price point), and consumer B will buy the base service.

In this example, if discrimination is not possible, the seller's optimal strategy becomes one in which it restricts its offering to the higher quality service with enhancements at a price of $18. Consumer A becomes worse off because her price paid increases from just below $16 to $18, whereas consumer B purchases nothing. Welfare is unambiguously lower as a result.

Two-Sided Markets

The intuition underlying the conclusion that price discrimination in two-sided markets is often beneficial can be illustrated with the following simplified example. Suppose there are two distinct markets and three potential buyers in each. Let the willingness to pay of the three buyers in each market be 20, 10, and 5, respectively, in the absence of any externalities between markets. That is, in the absence of any externalities between markets, the highest willingness to pay in each market is 20, the next highest willingness to pay in each market is 10, and the lowest willingness to pay in each market is 5. Suppose the seller's cost of supplying a unit of the good in each market is 3. Then, in the absence of any price discrimination, the seller will charge a price of 20 and sell to one buyer in each market, yielding a profit of (20-3)*2, or 34.

Now suppose the two markets are linked in the sense that each buyer's willingness to pay is increasing in the number of units sold in the other market (this is the most straightforward way to capture the externalities inherent in two-sided markets). In particular, suppose the willingness to pay of buyers in market A increases by one for each unit greater than one that is sold in market B, and vice versa. That is, suppose the willingness to pay of buyers in market A is (20, 10, 5) if one unit is sold in market B, (21, 11, 6) if two units are sold in market B, and (22, 12, 7) if three units are sold in market B. The same results obtain for the willingness to pay of buyers in Market B as additional units are sold in Market A.

If no price discrimination is allowed, the seller must charge the same price in each market, i.e., to each buyer on a given side of the platform (but possibly different prices across markets). Under this scenario, the seller, as before, maximizes its profit by charging a price of 20 and selling only to the highest valuation consumer in each market. As before, doing so yields a profit of 34 for the seller, and no consumer surplus. In this case, the externalities across markets are sufficiently weak that they have no bearing on the outcome. The seller's price is the same as with single-sided markets.

Clearly, this outcome is inefficient, as there are two other buyers in each market who value the seller's good or service at more than the seller's marginal cost of supplying the good. The pertinent question to now explore is whether welfare can be improved by allowing the seller to price discriminate.

In the case of single-sided markets, the answer is clearly yes, for reasons we have already discussed: price discrimination, whether it be first, second, or third degree, can increase welfare and consumer surplus by expanding sales to include new groups of buyers. For example, suppose the markets are single-sided and third-degree price discrimination is allowed. Suppose further that the seller has sufficient information to identify the two highest valuation buyers in each market as belonging to the same group and the lowest valuation buyer in each market as belonging to a different group. Then, under third-degree price discrimination, the seller will charge a price of 20 to the first group and a price of 5 to the second group, netting a profit of 2*(20-3) + 2*(5-3), or 38 across the two single-sided markets. Consumer surplus is still zero, but welfare is higher because the seller's profit is higher. Price discrimination is clearly beneficial in this case because more buyers are served.

In the case of two-sided markets, a relevant, and important, consideration is whether price discrimination is allowed on one or both sides of the market. Typically, the greatest gains will arise if price discrimination is allowed on both sides of the market. Continuing with the example third-degree price discrimination will illustrate why this conclusion obtains, i.e., why welfare and consumer surplus are likely to increase when price discrimination is allowed on both sides of two-sided markets.

As a starting point, suppose that third-degree price discrimination is allowed on only one side of the market. Under this constraint, the seller must effectively choose among one of six different pricing strategies. In the

market in which it cannot price discriminate, it must choose whether to sell to one, two, or three buyers. In the market in which it can distinguish the (20, 10) valuation buyers from the buyer with the valuation of 5, it must choose whether to sell to all three buyers or just the highest and lowest valuation buyers. It turns out that the seller can do no better than to charge a price of 21 in the first market (and sell to one buyer) and to charge discriminatory prices of 20 and 5 in the second market (and sell to two buyers). In all, it is optimal for the seller to sell to three buyers in total and earn a net profit of (21-3) + (20-3) + (5-3) = 37.

Now suppose the seller can engage in third-degree price discrimination on both sides of the market. In this case, at a minimum the seller will want to transact with two buyers in each market; it might also choose to sell to two buyers in one market and three buyers in the other market, or to three buyers in each market. Some straightforward calculations suggest that the latter option is optimal. The seller maximizes its profit by setting prices at 12 and 7 in each market. The two highest valuation buyers in each market buy at the price of 12 and the lowest valuation buyer in each market buys at the price of 7. All buyers are served, and the seller's net profit across markets is 4*(12-3) + 2*(7-3), or 44.

As discussed in the text, the case of second-degree price discrimination is analogous.

In the case of first-degree price discrimination, it is useful once again to conceptualize the gains into those that would arise if the discrimination were only allowed on one side of the market, and the gains that would arise if the discrimination were allowed on both sides of the market. Start with the example where price discrimination is permitted on only one side of the market. In this case, it is straightforward to show that the seller will charge prices of 21, 11, and 6 to the buyers on the side of the market in which it can price discriminate and a price of 12 to the buyers on the side of the market in which price discrimination is prohibited. This yields a net profit to the seller of 2*(12-3) + (21-3) + (11-3) + (6-3), or 47. Notice that in this case, relative to a scenario in which price discrimination is proscribed, the seller will serve three additional buyers (five rather than two).

Now suppose that first-degree discrimination is allowed on both sides of the market. Absent constraints on the seller's ability to price discriminate, it is optimal for the seller to serve all six buyers across the two markets. The seller charges prices of 22, 12, and 7 in each market, and earns a net profit of 2*(22-3) + 2*(12-3) + 2*(7-3), or 64. As in the case of second and third-degree price discrimination, welfare is highest with first-degree price

Notes

1. There is more than one way for the seller to accomplish this. For example, it could charge the buyer $10 for the first unit, $8 for the second unit, and $5 for the third unit; or it could package three units together and sell the bundle for a price of $23, or it could impose a fixed fee of $20 and then a per-unit price of $1 per unit.
2. Note that when the buyer is priced out of the market, that opens up a potential opportunity for a new firm to enter and specialize in serving the under-served customer.
3. Recall that a seller's cost of providing one unit of a good or service is assumed to be $1.
4. The price for two units is slightly below $10 (and not $12) because consumer A values the second unit at $4 and is able to purchase the first unit for $6.
5. If the price of the enhanced service were higher, consumer A would join consumer B in buying the base service.
6. A similar result can also be shown to hold for first and second-degree price discrimination.
7. Recall that two units sold to buyers on one side of market increases by one the willingness to pay of buyers' on the other side.
8. The seller has two other strategies that can do just as well. It can offer a price of 11 in the first market (and sell to two buyers) and offer prices of 21 and 6 in the second market (and sell to two buyers), or alternatively, it can offer a price of 12 in the first market (and sell to two buyers) and offer prices of 11 and 6 in the second market (and sell to all three buyers in this market). Under both of these alternative strategies, the seller's net profit is 37.