Rationale of the online advertising market: a theoretical model.

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May 15, 2001

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Submitted to the Department of Economics
on 17 April 2001, in partial fulfillment of the
requirements for the degree of Bachelor of Economics

Abstract

Online advertising is a new industry that is growing at an enormous pace, and that has received a lot of coverage in the media. This work gives economic reasoning to the events that have been happening in this sector. It models the industry structure by postulating different types of firms producing goods that are perfect substitutes. We analyze the implications of the existance of economies of scope and of saturation bounds in the production of online ads. We find that technology plays a fundamental role in determining which types of firms exist, and that demand for advertising is also important, when advertising production becomes saturated.

Acknowledgements

I would like to thank some people that have influenced this work. First of all, and most important, my mentor, Federico Weinschelbaum. I appreciate his dedication, comments, suggestions and open mindness. Other people helped by giving me their views on the Internet market, mainly: Alejandro G. Belluscio, Amalia Eizayaga, Andres Freire, Astrid Kowlessar, Carlos A. Menendez, Carlos Bonadies, Carlos Kiss, Charly Alberti, Daniel Rubini, Don Peppers, Edmundo Tonconogy, Eduardo Stabholz, Erasmo E. Poggi, Eric Shannon, F. Thomas Godart, Fabian Ferraro, Federico E. Agardy, Felix Lequio, Francisco de Narvaez, Gabriel Jacobsohn, Gonzalo Arzuaga, Guido Grinbaum, Gustavo Daneri, Hernán J. Kazah, Hugo E. Lavorano, Ingo Steinhaeuser, Jeremie Mani, Jerome Stoui, John Lough, Juan Alzaga, Juan Pepa, Lorena Grojsman, Luis Rodriguez Fon, Marcelo Galperin, Marco Suen Blanc, Mariana Eugui, Martin Varsavsky, Matias Alpert, Michael Gordon, Mike Warshower, Natalia Fassi, Pablo Albera, Raymond J. Oglethorpe, Renee Rosen, Roberto Souviron, Samuel Toledo, Santiago Bilinkis, Sergio Postigo, Todd Moran, Walter De Boever and Wenceslao Casares.

Thesis supervisor: Federico Weinschelbaum

1. Introduction

One of the most important happenings of the nineties has been the popularization of the Internet. Only from this decade has this medium become massive. Accompanying this wave, a handful of web companies has been founded, attracting the attention of millions of users. New brands like Yahoo or Altavista became well known. The foundation of companies boosted from mid nineties, when all types of contents and services became available for free. All of these companies have something in common: they are advertising reliant. Through different types of business models they try to capture the attention of navigators in order to generate ads.

Last years have shown great changes. We have seen a lot of concentration in the industry, based on firms diversifying their products and services, and horizontal mergers. Furthermore, a group of firms was forced to downsize and even ran out of business. The industry has become fiercely competitive.

Until now all the events that have been happening around this industry have not been given a consistent rationale. We are baffled by the resulting industry structure that is to be found in the long run. We also want to answer questions such as:

· What factors can explain the trend towards concentration in this industry?

· Why do we find horizontal mergers between some types of firms?

· Can business models so weird as paying users for their attention, or offering free internet access subsist?

· How can we explain the existence of some small firms competing with enormous corporations?

We will achieve our goal by postulating a simple mathematical model. First of all we will describe the origins of online advertising, who is using the web, the different types of online advertising that are found these days and the different types of firms generating advertising. Knowing the different characteristics of the industry, we will be able to postulate the most appropriate assumptions for our mathematical model. The development of the model will be done in phases,

adding restrictions one at a time so the problem can be understood in a clearer way.

2. The World of Online Advertising.

2.1. Advertising in the eyes of economists

Hardly any business practice causes economists greater uneasiness than advertising - L. Telser

An excellent introduction to advertising analysis has been made by Kaldor (1943). There exist two approaches. The first approach states that advertising is informative, it informs about product price and quality, reducing informational costs for consumers. In this line we find work by Telser (1964), Nelson (1974), Stegeman(1991), Shapiro (1984). The other approach states that advertising is persuasive, it distorts consumer tastes. In this line we find writings by Dorfman & Steiner(1954), Dixit(1978), Stigler y Becker(1977), Nichols (1985).

We are not interested in understanding the nature of advertising. We want to analyze the industry characteristics and structure. Our approach is based on works by Baumol, Panzar and Willig (1982), on Bailey and Friedlander (1982), on MacDonald, Glenn and Slivinski (1989), on Bailey, Silk and Berndt (1994), and on standard industrial organization theory, basically on the book by Carlton and Perloff (1989).

2.2. Origins of online advertising

Nobody doubts advertising is an integral part of our lives. Advertising for products and services constantly bombards us in different ways. We see advertising in the streets, on TV, on the radio, in the papers and magazines, on buses and trains, receive junk mail in our mailboxes. Advertising has existed for a very long time, albeit its commercial relevance has started on the twentieth century. Today billions of dollars are spent each year in advertising, and millions of persons are

employed in this industry. Advertising is very linked to technology advances and morphs at its pace.

Its latest form is online advertising, advertising linked to the web. Although advertising efforts have been made from the start of the net, online advertising is relevant in a commercial sense since 1996. We are sure this particular industry is worth investigating, that is, it is large enough in terms of revenue. We can appreciate online ad spending evolution in the following table.

Online Ad Spending by Quarter($ millions)

Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
2000	1,953	2,100	1,986	NA
1999	693	934	1217	1,700
1998	351	423	491	656
1997	129	214	227	336
1996	30	52	76	110

Source: Pricewaterhouse Coopers

The rate at which online advertising is growing is really tremendous. Jupiter Communications expects online advertising revenues to reach $28 billion by 2005. The main source of this growth will be the rise in number of Internet users from the 200 million today to the 600 million in 2005.

2.3. What makes online advertising different from traditional advertising?

First of all, online advertising offers the possibility to measure results. This is a subject that is under a big debate nowadays, as people are trying to see what is the best way to measure results, if there exists any. There are many techniques in which online advertising effectiveness can be measured.[1] All of these have problems. For example, brand awareness creation, an important effect of online ads, is difficult to deal with. In spite of the dispute, it is crystal clear that results can be measured more effectively in this new media. This characteristic is really important as there is less uncertainty about the price and quality of the product.

Internet's interactivity is also crucial. The companies that sell online advertising have to deal with different worries that traditional advertisers could ignore.

[1] Articles can be found at http://www.wilsonweb.com/webmarket/

For example, advertisers that work on TV have concern about ratings, how many people watch their show. In online advertising, the objectives are different. Interactivity allows companies to offer a wider variety of services. It is not only important how many persons are getting to the web page. It is important how long they are staying. Long-term relationships are paramount in this type of media.

Last, Internet permits micro segmentation of advertising. This is a very important characteristic of online advertising, but nowadays companies are unable to exploit this characteristic as technologies are in their birth stage. We will come back to this issue later.

We will now describe Internet population. We believe it is important to understand people's tastes and habits as they are the real advertising generators.

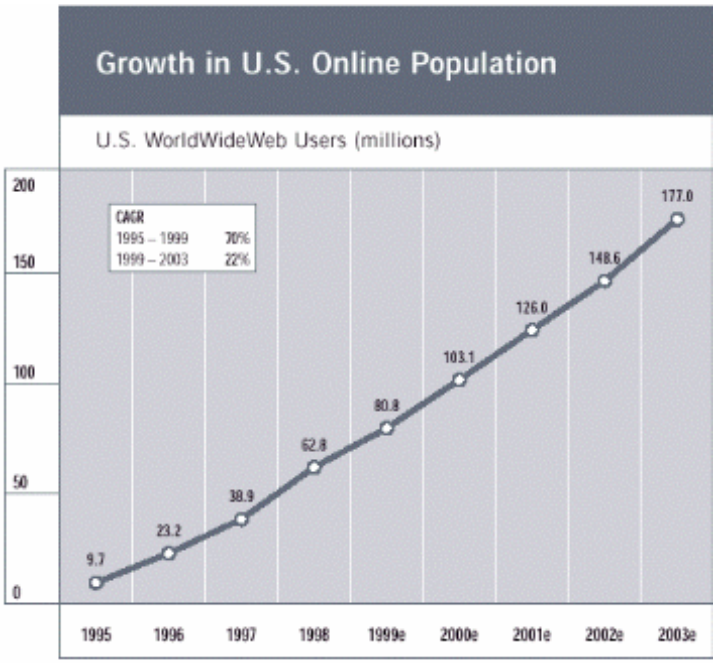
2.4. Who is navigating?

Advertising cannot exist without an adequate audience. The rate of growth of the e-population has been enormous. The explosive growth in the online population will continue over the next few years, as can be seen in the following figure. While some ten million people were on the Internet in 1995, there could be as many as 177 million users by 2003. There are actually three distinct waves of online adopters, each defined by their online tenure. Each has a distinct set of demographics, online behaviors and attitudes:

o **The Pioneers:** These users are the first wave of online consumers. They are the 23.2 million users who have been online for three years or more and now comprise 29% of the online population.

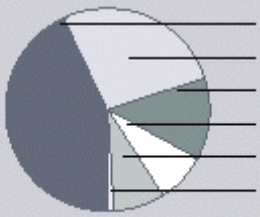
o **The Early Followers:** These consumers have been online for more than one but less than three years. They number 39.6 million and represent almost half of the current online population.

o **The First-of-the-Masses:** These are the most recent consumers to go online, having made the leap only in the last year. They represent 18 million users, or 22% of today's online population.



We are definitely interested in finding out what people are doing online. This will be of use to determine which services are the greatest advertising generators. The following table sheds light on this issue. It shows that Communication is the most popular function on the net. Email ranks first, with an impressive 33 % of time devoted. We shall be warned that more than 50% of the time devoted to it is not linked to advertising. As will be seen later, only webmail - a special interface to check email - generates publicity. From the following figure, we can conclude that a great part of the time people are online they are exposed to advertising, as people devote much time to content websites; these represent 57% of time spent online.

Time Spent Online by Activity



	% of Time	Hrs./Week
Communication	43	1.2
Information Gathering	27	0.7
Entertainment	13	0.4
Finance	8	0.2
Shopping	8	0.2
Other	1	<0.1
	100%	2.7 hours

Communication (% of time)	
• E-mail	33
• Instant messaging	4
• Bulletin boards/news groups	3
• Chat	3
Information Gathering (% of time)	
• Research	17
• Read news/check sports scores	8
• Search for employment	2
Entertainment (% of time)	
• Play games	6
• Visit entertainment sites	2
• Adult entertainment	2
• Visit sports sites	1
• Listen to music	1
• Web page design	1
Finance (% of time)	
• Check investment portfolio	3
• Financial reading/research	2
• Online banking	2
• Check stock/fund quotes	1
• Trade securities	<1
Shopping (% of time)	
• Research purchases	4
• Online purchasing	2
• Online auctions	1
• Classified ads	1
• Sell items online	<1

Source:
% of time breakdown from BCG Proprietary Consumer Database;
aggregate time spent online from Mediametrix (July 1999)

We will now give a bit more information about the product that is being sold,

so we can understand its characteristics better.

2.5. Types of advertising

Banners are the inch-high straps found at the top of a web page. They are the workhorse of Internet advertising, accounting for almost 50% of all online advertisements, according to IAB/PricewaterhouseCoopers. Banners usually carry a company name, a message and an enticement to click. They can be static or animated, but they are not interactive, and they carry you to another website if you click on them. Although banners remain the most popular form of web advertising, they are the least likely to elicit a response.

Permanent buttons are smaller than banners and are enduring features of a site. They can also sit close to relevant content; and response rates can reach 15%. For example, E*Trade, an online broker, can put its button next to a share tip on a financial site. However, most buttons are not interactive and, like banners, take you away from the website if you click on them.

Interstitials are advertisements that pop up on their own article in between content pages. For the most part, users cannot click on them. Although they offer features such as video and audio, they have fallen from favour because they are so big that they can take as long as two minutes to download, irritating users.

Superstitials are new, improved interstitials that download politely in the browsers short-term memory so that they do not interrupt users. Richard Hopple, chief executive of Unistat, which launched the technology last year, thinks superstitials can match the quality of television for brand-building advertising on the Internet.

Rich-media expanding banners use technology such as Flash, Enliven, Shockwave and Java to combine video, audio, animation and photographs and let the viewer click on them without leaving the original web page. They take live website information directly to the viewer, allowing him to shop, register for information and interact, without ever leaving the original site. However, websites dislike them because they cover content, take time to download and, at worst, can crash the site.

E-mail is one of the cheapest, most effective marketing methods on the Internet, with response rates of between 5% and 25%. And yet e-mail represents only 1% of online-advertising revenue. Like rich-media banners, e-mails bring an offer or product information direct to consumers. The problem is to avoid spam and clutter.

Prizes and cash. Users enter sweepstakes to win prizes, get discounts or, increasingly, cash in exchange for telling a marketer who they are, ie, registering. Although Internet software can track movement on the web, it cannot get personal information such as addresses and age.

Affiliate deals split an advertisers revenue with the site in exchange for free advertising. Forrester estimates that, by 2004, half of all online advertising revenue will be based on performance. Sponsorships or co-branded deals usually involve payment up-front whether or not there is a sale.

Nowadays, according to I.A.B.[2], banner ads represent 46 percent of all online ads. Sponsorship agreements represent 27 percent, followed by classifieds (9 percent), referrals (6 percent) and interstitials (4 percent). Rich media ads, keyword searches and e-mail ads round out the list, at 2 percent each.

Having explained this, we pass on to analyze the different types of businesses that have emerged.

2.6. Business Models

The online advertising model is an extension of the traditional media-broadcasting model. The broadcaster, in this case, a web site, provides content (usually, but not necessarily, for free) and services (like e-mail, chat, forums) mixed with advertising messages. The broadcaster may be a content creator or a distributor of content created elsewhere. The advertising model apparently works when the volume of viewer traffic is large or highly specialized. The different business models are:

Free Model – Give users something for free: free email [Iname, Hotmail, Net@dress], site hosting [ex: FreeMerchant], web services, Internet access, free hardware, electronic greeting cards [BlueMountain]. Freebies create a high volume site for advertising opportunities. Feasibility is in doubt when these are based purely on advertising revenue.

Horizontal Portal – high-volume traffic – typically tens of millions of visits per month – driven by generic or diversified content or services (ex: search engines and directories like Excite, AltaVista and Yahoo! or content driven sites like AOL). The high volume supposedly makes advertising profitable and permits further diversification of site services. Competition for volume has led to the

[2]Internet Advertising Bureau, www.iab.net

packaging of free content and services, such as stock portfolio, message boards, chat, news, and local information.

Specialized Portal – Also called a "vortal" (i.e., vertical portal). Here volume is less important than a well-defined user base (perhaps 0.5-5 million visits per month). For example, a site that attracts only golfers, or home buyers, or new parents, can be highly sought after as a venue for certain advertisers who are willing to pay a premium to reach that particular audience. Advertising is not assumed to represent the primary source of revenue.

Personalized Portal – The generic nature of a generalized portal undermines user loyalty. This has led to the creation of portals (ex: My.Yahoo!, My.Netscape) that allow customization of the interface and content. This increases loyalty through the user's own time investment in personalizing the site. The profitability of this portal is based on volume and possibly the value of information derived from user choices. Personalization can support a "specialized portal" model.

Attention / Incentive Marketing – the "pay for attention" model – pays visitors for viewing content and completing forms, or sweepstakes, or frequent flyer-type point schemes. The attention marketing approach has the most appeal to companies with very complex product messages, which might otherwise find it hard to sustain customer interest.

Bargain Discounter – the most notable example is Buy.com, which sells its goods typically at or below cost, and seeks to make a profit largely through advertising.

We will now describe thoroughly the most popular services.

2.7. Free Models

As has been noted, there are several free models. Albeit there are a wide variety of these, the most important is webmail. Free Internet access has been a curious business model too. In general, these services generate untargeted advertising, as do horizontal portals.

2.7.1. Web-based e-mail

Webmail is an application that functions entirely on the Internet. It is, therefore, accessible from any Internet-connected terminal in the world. Your web-based e-mail account physically resides on some web server somewhere, and responsibility

for it lies with the company (such as Excite, Yahoo, Microsoft, or Netscape) who is providing the web-based e-mail account.

With standard (POP) e-mail, by contrast, you are using the "mail server" of your Internet Service Provider or workplace. To manage your POP-based mail accounts, users typically use a "mail client" or e-mail software such as Microsoft Outlook, Netscape Mail, or Eudora Pro. Standard email is usually free of advertising.

Accounts are free, they are advertising supported. More than this, they have acted as a marketing tool for the companies that offer them. Hotmail, an early entry into this field, grew so rapidly because the tagline at the bottom of every e-mail sent, "Get your free, web-based e-mail today at http://www.hotmail.com," multiplied around the world, giving Hotmail great early success. The term "viral marketing" was thus born. In addition to advertising, addictive applications like free e-mail can help the companies that own them retain users. Users may also give permission to receive periodic e-mail publications or product pitches. Some of the web-based e-mail programs offer free upgrades for additional services or larger mailbox capacity. These premium services are another source of revenue for webmail firms.

The main companies that provide email are nowadays linked to horizontal portals, although a couple of years ago they were standalone companies. Yahoo! Mail and Hotmail are the principal webmail services. Netaddress, Myownemail, Iname are the biggest companies that still remain functioning by themselves. Their business model relies on subscription fees for premium email accounts.

2.7.2. Free Internet Access

Instead of charging fees for access to the Web or e-mail, Free Internet Service Providers (FISPs) ask that subscribers submit some personal information and put up with having an advertisement floating somewhere on their screen. The ad window is about the size of a banner ad, and can be dragged around the screen and positioned to be as unobtrusive as possible. If a user tries to kill the ad window, the Internet connection will also be cut.

For almost two years, from late 1998 until last spring, free Internet access was the fastest-growing business in the world. It had a populist message, an audience that grew by millions of people each month and a price that couldn't be beat. 14 million people were using a free Internet service, according to industry research report TR's Online Census.

The central conceit behind the free ISPs - the concept behind pretty much all the ventures conceived at the height of the Internet boom, for that matter - was that the facade mattered more than cash flow. In other words, if you could absorb losses while attracting millions of new customers, a viable business model would eventually take shape.

The death of the free ISPs is really alarming and requires a deep look. In the States just three survivors - BlueLight.com, Juno and NetZero - offer some form of free Internet access. But only NetZero is trying to remain a free Internet service. And it's not clear how long NetZero can stay free. "I think of the free ISP like milk," says BlueLight CEO Mark Goldstein. "Nobody makes money on milk, but you keep it in the far left corner of the store so people have to pass by other stuff to get to the milk and, hopefully, buy something else along the way."

The thought of Mark Goldstein makes us think that free ISPs cannot exist standalone. Economies of scope are experienced with other services, as the audience of this service is heterogeneous, as that of, for example, horizontal portals. We will come back to this issue later.

2.8. Portals

The rapid growth of new ways of leveraging the Internet for communal and corporate purposes has spawned at least four common meanings for the term portal. We can identify four types of portals (1) generalized or horizontal portals (2) corporate portals or Enterprise Resource Portals; (3) vertical, affinity, or niche portals; and (4) industry or B2B portals. We are interested in horizontal portals and vortals as these rely in advertising revenues.

2.8.1. Horizontal portals

The distinction between vertical and horizontal portals was necessary to distinguish the mega-portals from the more topically focused portals. It is generally acknowledged that there can only be a few major horizontal portals.

Portals are often the first page your web browser loads when you start up your web browser, Netscape Navigator, Microsoft Internet Explorer, etc. The term "web portal" began to be used to describe mega-sites such as Yahoo, Excite, MSN, Netscape Netcenter and AOL because many users used them as a "starting point" or "entry point" for their web surfing. The term "search engine"

had become inadequate to describe the breadth of the offerings of these leading Internet destinations, although search and navigation are still pivotal to most people's online experience. (AOL is a bit different: it's always been an Internet access provider in addition to being a network of proprietary Internet content and services).

The major consumer web portals are still the most heavily visited sites on the Internet. Yahoo, AOL and MSN are the giants but the next seven or eight after that are significant as well. All command stock valuations in the billions. AOL Time Warner is worth several hundred billion dollars. Along with these, other Internet search engines and directories, like AltaVista, Excite, Open Text, Magellan, Infoseek, and Lycos are well known horizontal portals.

Portals offer a wide range of customization options and functionality including: Internet search and navigation; customized news, email, weather, sports, and horoscopes; planners, calendars, and contact managers; bookmark managers to save favorite web sites; real-time chat; message boards; original content on every imaginable topic; shopping; free home pages; "clubs" which function as makeshift intranets; small business services; and much more.

The advertising being sold by these companies is not targeted. The audience of these websites, in contrast to vortals, is heterogeneous. The technology available today is unable to target advertising efficiently these days. Horizontal portals rely heavily in advertising revenues. Yahoo currently receives 90 percent of its revenue from ads. Among the major portals, only AOL, which gets 64 percent of its revenues by selling access to the Internet, does not rely heavily on income from click-through ads.

Most of the above horizontal portals have benefited in some way by the explosive popularity of the Web. All of these sites started off as merely search engines or directories, but when they began experiencing page views numbering in the millions each day, most realized they could use their popularity by offering more features that would keep people at their sites once the user got done searching for something. The portals would group similar subjects together to entice users to check them out.

Portal companies began purchasing other companies for their technology, content, or unique business models, as Yahoo did when it purchased the Internet white pages company Four11, which allows the user to look up addresses, phone numbers, e-mail addresses and the like. By 1999, most of the larger Internet companies had become capable of financing deals of breathtaking size. Go2Net and Lycos are amongst those who have grown quickly through a blistering pace of

acquisitions. Others, like Infoseek (now part of Disney's Go Network) and Snap (now part of NBC Internet), sold out to major media conglomerates in order to accelerate their expansion. MSN bought the popular webmail service Hotmail.

All these mergers and acquisitions seem logic, one based on economies of scope. Two factors generate economies of scope. The first is cost sharing. There are many costs shared between the different businesses that are being united. The main cost is advertising costs. If the target of the companies being merged is the same, then investing 2 dollars on a unified company will yield more than investing 1 dollar on each of the separate companies. It is clear that the audiences of webmail and horizontal portals are similar. Vertical portals have a different base and experience weaker economies of scope with either webmail or horizontal portals. The second factor that is important is brand awareness. Having only one brand empowers the companies, raises the intangible asset valuation, and increases marketing efficiency.

2.8.2. Vertical portals

Vertical or niche portals are what we might have called web sites in the past. Today, however, certain category-leading web sites in a given topical category, or catering to a given demographic, are such significant players that many call them portals. The list of very popular and economically significant vertical portals is growing rapidly. The main categories of vortals are Financial, Technology news, Job hunting, Art and collecting, Books and Music, Cars, Food, Housing, Perfect Gifts, Wines, Fashion, Fun & Games, Health, Parenting, Dating, Youth, Sports. Examples include I-village (aimed at women); guru.com (for independent professionals); and Boatscape (for boat enthusiasts).

Demographically focused portals (with portals being launched to cater to specific ethnic groups, specific age groups, alternative lifestyles, religions, and other groups which are perceived to form a community or market) are now being called affinity portals by some analysts. It is that "vertical" content, community, and commerce seem to enjoy increasing favor in the marketplace.

In each category, we find different types of websites competing. Job recruiting services are a good example. There are very general and big websites (Monster.com, Hotjobs.com, Headhunter.com) and tens of niche web sites (for example Latpro.com, which places people from Latin America in the US market).

The advantage of covering specific topics permits targeting advertising and charge a premium in the advertising rates. The disadvantage is that the volume

of advertising sold is low compared to general portals. The scale of vertical portals varies greatly, and it depends on the scope of each portal. The business model of vertical portals targets ecommerce and premium services more than advertising, although ads still contribute largely to the revenues of these companies.

It is interesting to mention a particular website. About.com, which has now reached the top ten in the rankings of the most heavily trafficked web properties, bills itself as the world's largest network of vertical sites led by expert human guides.Suite 101 is another popular "community of communities" led by volunteer editors. Some might think that About.com demonstrates that economies of scope exist between vertical portals. Moreover, we don't think so. About.com's different topics don't qualify as vertical portals. They have a different business model and a more limited offer than vertical portals have. Notice, then, that in this case, About.com's 700 "verticals" are highlighted, but they are being called a "network." The notion of a loose confederacy of relatively independent "states" under the same banner makes a lot of sense. In this instance, portal may not be the most descriptive term.

2.9. Cost considerations

According to Hagel in Net Gain the costs these companies face can be divided into Member acquisition, Advertisier acquisition, Technology related costs, Content costs, Customer Service, General and Administrative costs. Webmail firms and FISPs have a high percentage of technology costs, FISPs also have high customer service costs. Horizontal portals and vertical portals have higher share of content costs. In general, all these companies have a large share of Member acquisition and Advertiser acquisition costs. This costs range between 35% and 50% of total costs.

If we consider page views as the products firms generate, we might speak about cost per unit. Webmail firms seem to have less minimum average costs that web directories. Cleary FISPs have the highest minimum average costs. Horizontal portals, by integrating different services that share costs, that is, by taking advantage of strong economies of scope have the least minimum average costs. This cost saving is one of the principal reasons for the existance of economies of scope in this industry.

2.10. The current situation

The actual internet map shows that concentration has taken place with companies aiming at heterogeneous audiences. Almost no independent search engine exists, and standalone webmails rely on premium services to survive. Free Internet services tend to disappear no matter if they have been founded by a standalone company or by a horizontal portal. We also find many vertical portals functioning healthily. We want to explain the situation using a simple mathematical model. We are now in a position to postulate realistic assumptions and sketch our model.

3. The model

The first thing we must specify is the product firms will be selling. Selecting this product ill be selling is not trivial, some simplifications must be made. Firms produce advertising by investing in different factors. Portals create content, webmail firms release new tech features. All firms spend part of their budgets in marketing themselves. One possibility would be to use banners as product. This has several problems.

The first problem is that firms produce more than one type of advertising, as has been noted previously. Banners are losing space today to other ad forms. This problem can be solved if we just say firms produce advertising. The problem with using "advertising" as a product is that we are missing a time measure. One of the fundamental inputs of our firms is marketing, which affects the amount of page views shown today and also in the future.

We must rethink the product. Firms will attract users. At first it might seem uncomfortable to use this product, as we are dealing with people. The firm's revenue depends on the quantity of users it attracts. Firms sell the advertising users produce.We will avoid the time problem. In addition, we will be able to treat business models that are not exclusively reliant on advertising, like the vortals' model.

What is the price of each user? This will be the present value of all the ads that the user will be generating as long as they stay on the website. Obviously users are different; we will use the average user. We are not interested in numerical results. But numbers have been calculated to construct various dot coms business plans, using variables such as standard average navigation times and churn rates.

We will assume only three types of firms: horizontal portals, web directories and webmail firms. It is possible to explain what is really happening in the industry with only three firms. We will then generalize the model in order to include n services.Webmail and directories / search engines are the most popular free web services, and that is why we have chosen these to represent free services. These firms will be producing users of different kinds. We will call the respective

products "horizontal users", "directory users" and "webmail users". We will exclude from the discussion vertical portals and will focus on horizontal portals and free services because these sell untargeted advertising, which makes the analysis more interesting. Different type of firms will be selling perfect substitute users. This happens because the firms have the same type of audience, an heterogeneous one, and advertising buyers care about this fact above all. This concept must be adapted to the product we are handling, users. Horizontal and webmail users will be perfect substitutes but not in a one to one ratio. Moreover, we will normalize variables to consider the products one to one perfect substitutes. This will simplify analysis.

We will reasonably assume perfect competition. There is free entry and free access to technology. There are plenty of companies selling untargeted advertising, at least twenty companies with huge revenues. There is also a large number of buyers. The companies do not have a market share that enables them to affect prices too much, so we can assume that they are price takers. There is plenty of information about the price and quality of the product, facilitated by the ability to measure results of online advertising. Brynjolfsson (2000) strenghens our view by analyzing in detail the efficiency of the internet medium. His view can be summarized in a quote found in his work:

> *"The Internet is a nearly perfect market because information is instantaneous and buyers can compare the offerings of sellers worldwide. The result is fierce price competition, dwindling product differentiation, and vanishing brand loyalty."*
>
> Robert Kuttner in Business Week, May 11, 1998

A downward sloping demand curve for users will also be assumed. The demand curve is generated by online and offline companies that want to sell their products and services. The derivation of this curve is an interesting exercise but we will not get into it as we are interested in the supply side. The demand for users represents the price people are willing to pay in order to buy users. What is really being demanded are page views, but an user can be interpreted as a group of page views. When price of online advertising rises, less users are demanded.

We will develop our analysis in steps. First we will consider the case in which there are only directories and webmail firms, and no horizontal portals. This resembles the situation that was experienced some years ago in the Internet map.

It is useful to analyze this case in order to understand better what is going on now. Then we will introduce a multiproduct technology. We will assume economies of scope by using the Marshallian case of joint production. Joint production arises mainly because one factor, advertising, once acquired for use in producing one good, becomes available costless for use in the production of the other good. After exploring the feasible and sustainable industry configurations, we will introduce the vertical portals. We will not assume economies of scope in the production of vertical users. We have already seen that vertical portals have different audiences, homogeneous audiences that are captured with specific advertising.

3.1. Equilibrium when no diversified firms exist.

It is useful to begin by reviewing the manner in which a free-entry competitive equilibrium in the market without joint production is characterized. This is a theoretical case, that shall be of use later on. First, consider the supply side. We will be using u-shaped cost curves. It is a reasonable assumption, because firms at first take advantage of economies of scale. These surge basically because there are several fixed costs. At some point of production, diseconomies of scale surge. The principal cost firms face is advertising. Firms maximize profits $\pi_i = pq_i - F_i - v_i(q_i)$, $i \in \{w, d\}$ where p is the common price of the goods[1], q_i quantity of users of type i (w stands for webmail and d for directory), F_i is a fixed cost, and $v_i(q_i)$ is a variable cost function, assumed to be increasing and strictly convex with $v_i''(q_i)$ continuous. Variable costs are mainly user and advertiser acquisition costs. Market demand $D(p)$ is assumed to be continuous and monotonically decreasing in p. Letting $c_i(q_i)$ be the total cost function, N_i be the number of operating firms, free-entry equilibrium values of N_i, q, and p must satisfy[2]

$$p - c_i'(q_i) \begin{cases} = 0 \text{ if } q_i > 0 \\ \leq 0 \text{ if } q_i = 0 \end{cases} \tag{3.1}$$

$$pq_i - F_i - v(q_i) \begin{cases} = 0 \text{ if } N_i > 0 \\ \leq 0 \text{ if } N_i = 0 \ \forall q_i \end{cases} \tag{3.2}$$

[1] As we have said we normalize one of the products in order to make them perfect substitutes in a one to one ratio.

[2] The number of firms is treated as a continuous variable. Nothing of consequence in the analysis depends on this approach.

$$D(p) = N_w q_w + N_h q_h \tag{3.3}$$

The first states that the choice of output must be profit maximizing - equating marginal cost to price if positive output is chosen, and marginal cost at zero output equaling or exceeding price otherwise. The second requires profits to be zero if firms operate and not positive otherwise. The third states the equality of market demand and total output. We will also assume $v_i'(0) = 0$ to simplify matters.

Under this configuration, there will only exist one type of firm, unless both firms have the same minimum average cost. This happens because we have assumed that webmail users and directory users are perfect substitutes. If both products are perceived the same, then it is logic to produce only the cheapest. The firm type with least minimum average costs will be the only one that survives.

The following graph reflects this situation. On the x axis we have quantity of users produced. As users are perfect substitutes we can sketch the different types of firms in the same graph. We suppose webmail average costs inferior to directory costs. The blue line reflects the industry supply curve. Under these conditions, only webmail firms exist.

However, we must introduce two additional considerations about the market that might change the resulting equilibrium. First of all, there is a limit with respect to the amount of users that can be affiliated. Lets state a saturation condition, an upper bound $\bar{Q}_i$. When $N_i q_i = \bar{Q}_i$ then q_i cannot rise any more.

The other additional consideration that we shall make is related to the most important input firms are using, advertising. Firms gather users by investing in advertising. Advertising attract new users until all population has been converted into users. Up to this point we have assumed that advertising from one firm does not affect other firms. We will now relax this assumption. Firms' success is affected by the amount of advertising other firms buy. There is a negative externality here, similar to the famous "tragedy of hte commons". This effect is stronger when the market has been saturated. We will assume that when the market becomes saturated, there can be new entrants who will 'snatch' users from the other firms. The other effect will be disregarded.

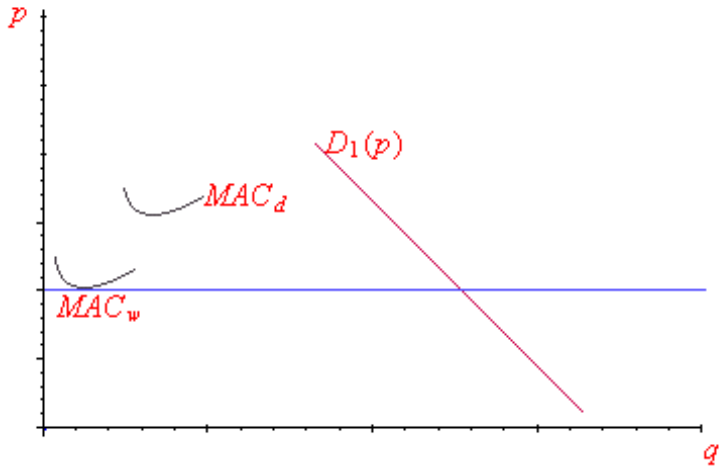


Figure 3.1:

This situation is similar to the one arising in unregulated fishing banks. Suppose N fishing boats are catching all the stock of marketeable fishes in the bank, making normal profits. Now suppose that the price of fish rises. The firms inside the bank will be making extraordinary profits. There will be entry of firms into the fishing bank until these have been squeezed. The quantity of fishes caught will not change, but we will have entry of firms until profits have been squeezed.

If the saturation condition is binding, that is, if the market demand when price equals the minimum average cost of the most efficient firm cannot be cleared, the price of users will start rising following increasing minimum average costs for firms. The price of advertising will rise until the market is cleared, or until the minimum average cost of the other type of firm is reached. In the most efficient type of firm sector, there will be more firms than what would be efficient.

The following graph represents this situation. In this case only webmail firms exist:

If the saturation condition is not binding in the inefficient sector, those firms will be producing efficiently. Both types of firms will be generating normal profits. It shall be said that if the saturation condition is not binding then we will only find one type of firm in equilibrium, as we learned before.

Let's use an example to characterize the situation. Assume the firms profit function is $pq_i - (a_i q_i^2 + F_i)$, a_i will be a special function:

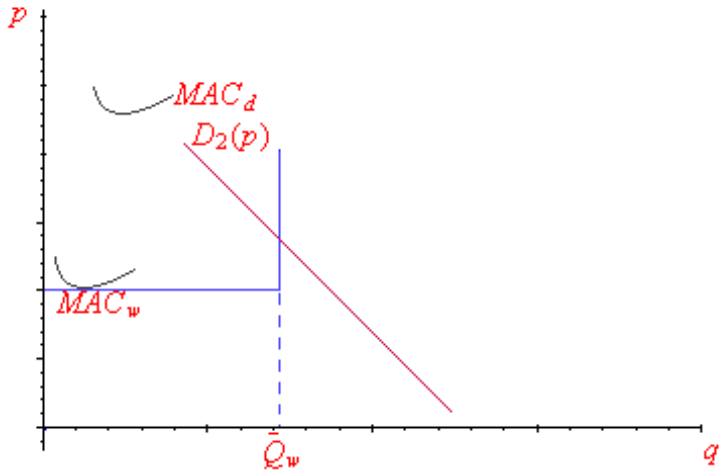


Figure 3.2:

$$a_i = \begin{cases} F_i(\frac{N_i^*}{\bar{Q}_i})^2 \text{ if } N_i \leq N_i^* \\ F_i(\frac{N_i}{\bar{Q}_i})^2 \text{ if } N_i > N_i^* \end{cases} \tag{3.4}$$

with $N_i^* = \frac{\bar{Q}_i}{q_i^*}$, q_i^* being the output at which average cost is minimized when there is no saturation. N_i^* is a limit to optimum production; if more firms enter costs minimum average costs start rising for all firms. Resources will be wasted, as firms struggle for the scarce user base. Average cost function for firms of type i is:

$$a_i q_i + \frac{F_i}{q_i}$$

which exhibits a global minimum when output equals $\sqrt{\frac{F_i}{a_i}}$. Average minimum cost is equal to $2\sqrt{F_i a_i}$.Depending on the demand function and the imposed upper bound for users $\bar{Q}_i$ we will find different equilibria. Assume the demand function for users is $D(p) = L - \tau p$.

For simplicity we will also assume that average minimum cost for webmail firms is smaller than average minimum cost for web directories. That is to say,

$F_w a_w < F_d a_d$. Then if $D(2\sqrt{F_w a_w}) = L - 2\tau(\sqrt{F_w a_w}) < \bar{Q}_w$ only webmail firms will operate. Price will be equal to $2\sqrt{F_w a_w}$, N_w will be equal to $\frac{L-2\tau(\sqrt{F_w a_w})}{\sqrt{\frac{F_w}{a_w}}}$.

If $D(2\sqrt{F_w a_w}) = L - 2\tau(\sqrt{F_w a_w}) > \bar{Q}_w$, then the saturation condition will be binding. Price will rise, and will be determined, while it does not reach $2\sqrt{F_d a_d}$, by $D(p) = \bar{Q}_w$. Knowing the equilibrium price, it becomes easy to determine N_w and q_w from the following equations:

$$q_w = \frac{\bar{Q}_w}{N_w}$$

$$p = a_w q_w + \frac{F_w}{q_w}$$

Solving we find that N_w $(> N_w^*)$ will be equal to $\frac{\bar{Q}_w p}{2F_w}$ and q_w equal to $\frac{2F_w}{p}$.

If price rises up to $2\sqrt{F_d a_d}$, the minimum average cost for web directories, these firms will start appearing. N_d will be equal to $\frac{L-2\tau(\sqrt{F_d a_d})-\bar{Q}_w}{\sqrt{\frac{F_d}{a_d}}}$. Knowing the equilibrium price, it becomes easy to determine N_w and q_w from the following equations:

$$q_w = \frac{\bar{Q}_w}{N_w}$$

$$p = 2\sqrt{F_d a_d} = a_w q_w + \frac{F_w}{q_w}$$

Solving we find that N_w $(> N_w^*)$ will be equal to $\frac{\bar{Q}_w p}{2F_w} = \frac{\bar{Q}_w 2\sqrt{F_d a_d}}{2F_w}$ and q_w equal to $\frac{F_w}{\sqrt{F_d a_d}}$.

We can visualize the different possibilities by using a graph. Minimum average costs for webmail forms (MAC_w) are smaller than for directories (MAC_d). The blue line shows minimum average costs for the industry. Different demand curves generate different equilibriums. If $D_1(p)$ is the demand function only webmail firms exist and firms are efficient. If $D_2(p)$ is the demand function only webmail firms exist, but they are producing at a higher average cost. Finally, if $D_3(p)$ is the demand function both types of firms will exist in equilibrium.

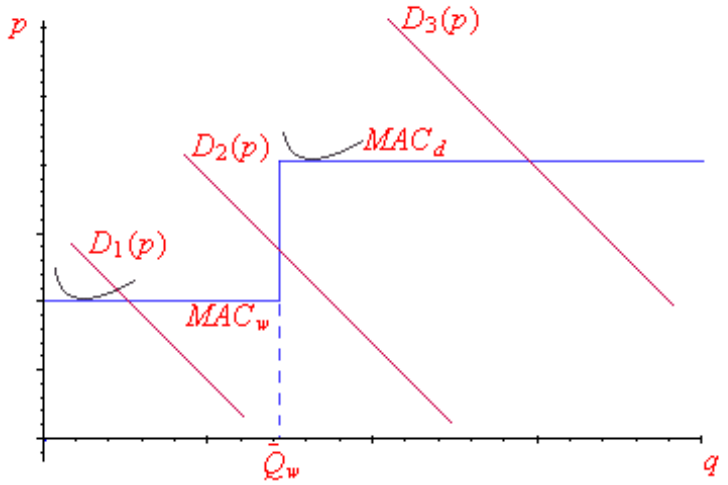


Figure 3.3:

3.2. Economies of Scope and the Emergence of Horizontal Portals.

We will now introduce horizontal portals. These firms will just have a technology that jointly produces webmail users and directory users. The demand function used will have the same characteristics as before. Any firm may produce either both goods or just one. If it produces both goods, it will be referred to as a diversified firm, or horizontal portal. If it produces only one good it will be specialized. A specialized firm faces total costs

$$c_i(q_i) = F_i + v_i(q_i) \tag{3.5}$$

where F_i is a fixed cost and $v_i(q_i)$ an increasing and strictly convex variable-cost function with v_i'' continuous. Total costs for a diversified firm are

$$c(\tilde{q}_w, \tilde{q}_h) = F + v(\tilde{q}_w, \tilde{q}_h) \tag{3.6}$$

where $\tilde{q}_i$ is the output of product i (the tilde indicating that the output is produced by a diversified firm), F is a fixed cost, and $v(\tilde{q}_w, \tilde{q}_d)$ is the variable-cost function. $v(\cdot)$ is assumed to be increasing and strictly convex with continuous

second partial derivatives. The conditions for equilibrium under this configuration are:

$$\begin{cases} p - c_i'(q_i) \begin{cases} = 0 \text{ if } q_i > 0 \\ \leq 0 \text{ if } q_i = 0 \end{cases} \\ p - \frac{\partial}{\partial \tilde{q}_i} c(\tilde{q}_d, \tilde{q}_w) \begin{cases} = 0 \text{ if } \tilde{q}_i > 0 \\ \leq 0 \text{ if } \tilde{q}_i = 0 \end{cases} \end{cases} \tag{3.7}$$

$$\begin{cases} pq_i - F_i - c_i(q_i) \begin{cases} = 0 \text{ if } N_i > 0 \\ \leq 0 \text{ if } N_i = 0 \ \forall q_i \end{cases} \\ p(\tilde{q}_w + \tilde{q}_d) - c(\tilde{q}_d, \tilde{q}_w) \begin{cases} = 0 \text{ if } N > 0 \\ \leq 0 \text{ if } N = 0 \ \forall \tilde{q}_i \end{cases} \end{cases} \tag{3.8}$$

$$D(p) = N(\tilde{q}_w + \tilde{q}_d) + N_w q_w + N_d q_d \tag{3.9}$$

We will introduce two further assumptions:

$$v_i'(0) = 0 \tag{3.10}$$

$$\tilde{q}_i = 0 \Rightarrow \frac{\partial}{\partial \tilde{q}_i} v(\tilde{q}_d, \tilde{q}_w) = 0 \ \forall \ \tilde{q}_k, k \neq i \tag{3.11}$$

For all $\tilde{q}_k$,the marginal cost of producing good i is low for small $\tilde{q}_j$. Imposition of these additional conditions permits us to treat the first condition as a system of three equalities, irrespective of which types of firms operate.

When we are dealing with a multiproduct firm it is difficult to give a meaning to a concept such as average cost. There is no unambiguous measure of average cost. If one specifies the proportions in which products are made, it is possible to define an average cost concept, called ray average costs. Luckily, we can deal with this problem in a smart way due to the fact that our products are perfect substitutes. We will assume local economies of scope in the production of users. That is, $c(\tilde{q}_w^*, \tilde{q}_d^*) < c_w(q_w^*) + c_h(q_d^*)$, where q_w^* and q_d^* are levels of output of users when minimum average costs are minimized. We also assume that $c(\tilde{q}_w^*, 0) > c_w(q_w^*)$ and $c(0, \tilde{q}_d^*) > c_d(q_d^*)$. Depending on the intensity of the economies of scope and the cost structure of specialized firms, we might find two results: that the diversified

firm produces users at a minimum average cost lower than the two specialized firms, or its the minimum average cost might fall between the costs of specialized firms. We believe that horizontal portals attain minimum average costs smaller than most specialized firms. It might seem doubtful when we put it this way, with only two types of firms being merged. But when many types of firms get merged, and economies of scope get stronger, it seems like a reasonable answer. We will however analyze both possibilities, as there might be some low scale services that might have lower costs that horizontal portals.

3.2.1. Horizontal portals have the least minimum average costs.

Under this circumstances only diversified firms will exist in equilibrium. Let's try out an example.

Suppose the cost function for specialized firm is the same as before. That is $c_i(q_i) = a_i q_i^2 + F_i$. The cost function for the diversified firm that we will use will be $c(\tilde{q}_w, \tilde{q}_h) = a_w \tilde{q}_w^2 + a_d \tilde{q}_d^2 - a\tilde{q}_w \tilde{q}_d + F$. The diversified firm maximizes the function $p(q_w + q_d) - a_w \tilde{q}_w^2 + a_d \tilde{q}_d^2 - a\tilde{q}_w \tilde{q}_d + F$ and from first order conditions we get:

$$\tilde{q}_d = k\tilde{q}_w = \frac{2a_w + a}{2a_d + a}\tilde{q}_w \tag{3.12}$$

Knowing this fact we can rewrite our cost function in terms of q_w, $c(q_w, q_d) = a_w q_w^2 + a_d k^2 q_w^2 - akq_w^2 + F$. The *average cost function* in terms of the sum of q's will be:

$$AC = \frac{(a_w + a_d k^2 - ak)\tilde{q}_w^2 + F}{\tilde{q}_w(1+k)} = \frac{s\tilde{q}_w^2 + F}{\tilde{q}_w(1+k)} \tag{3.13}$$

which exhibits a global minimum when output equals $\sqrt{\frac{F}{s}}$. Average minimum cost is equal to $\frac{2\sqrt{Fs}}{1+k}$. Multiproduct firm exist when minimum average cost for this type of firm is inferior to the minimum average cost of specialized firms, i.e. $\frac{Fs}{(1+k)^2} < F_i a_i \forall i$. As we can see it depends on the parameters chosen. Variable costs as well as fixed costs are relevant. Assuming the demand function for users is $D(p) = L - \tau p$, then $D(\frac{2\sqrt{Fs}}{1+k}) = L - \frac{2\tau}{1+k}(\sqrt{Fs})$. Price will be equal to $\frac{2\sqrt{Fs}}{1+k}$, N will be equal to $\frac{L - \frac{2\tau(\sqrt{Fs})}{1+k}}{\sqrt{\frac{F}{s}}}$. In this situation, we find there is no room for specialized firms.

However, we have not analyzed what happens when there is an upper bound $\bar{Q}_i$ to the amount of users that can be affiliated, the saturation condition. The result in this case is not trivial, and depending on the characteristics of the cost functions and the demand curve, we can find different equilibria. Diversified firms will enter until one of the user bounds is satisfied. Suppose the webmail market becomes saturated, that is, webmail users production reaches $\bar{Q}_w$. When this point is reached, minimum average costs for webmail firms as well as for multiproduct firms will start rising as new firms enter. In our example, a_w will start rising. The relationship in which multiproduct firms produce webmail users and horizontal users will change (k in our example). Aggregate user production will rise, because horizontal portals start producing more directory users. We will now analyze the different outcomes that theory expects to find.

Least efficient user production becomes saturated.

When the saturation condition is met in the market where the firms with higher minimum average costs the equilibrium is rather simple. There are two possibilities. In one of these, only multiproduct firms exist in equilibrium, the resulting price will be lower than minimum average cost of the most efficient specialized firm. In the other case, multiproduct firms will exist in conjunction with the most efficient specialized firms. Let's assume webmail firms have minimum average cost inferior to directories.

In this situation, when $\bar{Q}_d$ is reached, a_d will start rising, and k will rise too. Let's define AC^* , the minimum average cost for diversified firms at which demand is satisfied completely by multiproduct firms.

$$AC^* = \frac{2\sqrt{F(a_w^* + a_d\frac{2a_w^*+a}{2a_d+a} - a\frac{2a_w^*+a}{2a_d+a})}}{1+\frac{2a_w^*+a}{2a_d+a}}$$

At this point $Q^* = D(AC^*) = L - \tau AC^*$. We must compare AC^* with minimum average cost for webmail firms, $2\sqrt{F_w a_w}$. If $AC^* < 2\sqrt{F_w a_w}$ then only multiproduct firms will exist in equilibrium. If $AC^* > 2\sqrt{F_w a_w}$ then equilibrium price will be $2\sqrt{F_w a_w}$ and we will find in equilibrium diversified firms and horizontal portals. Equating minimum average costs we can solve for a_w, which we will call a_w^e. We will also find k^e, and total output for multiproduct firms.

$$\tilde{q}_d^e = \frac{\bar{Q}_d}{N} \tag{3.14}$$

$$\tilde{q}_w^e = \frac{\bar{Q}_d}{Nk^e} \tag{3.15}$$

and as a consequence N_w will be equal to $\frac{L-2\tau(\sqrt{F_w a_w})-\frac{1+k^e}{k^e}\bar{Q}_d}{\sqrt{\frac{F_w}{a_w}}}$ and N_d equal to 0.

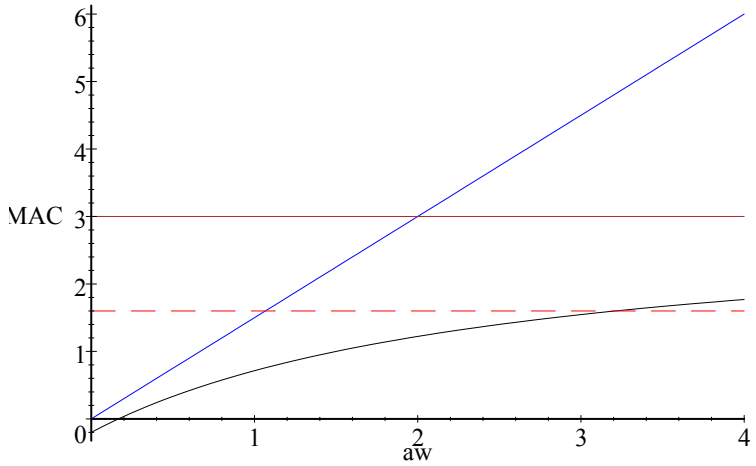
Most efficient user production becomes saturated.

When this situation arises more equilibria are found. First let's understand what is going on. When the upper user bound is reached, costs will start rising for diversified firms as well as for webmail firms. We distinguish three cases.

It might happen that as k changes, as in one of the cases seen in the last subsection, the diversified firms' output becomes enough to satisfy the demand. This happens when $AC^* < AC_w^*$[3]. Depending on the cost functions we choose we can have the minimum average cost function for diversified firms increasing at a faster or at a lower pace than the webmail's firm function. If costs increase at a slower rate, the equilibria that will emerge are analogous to the case in which horizontal portals were the most efficient businesses, that is, or we find diversified firms only or diversified firms and directories. In the case in which costs increase at a faster rate for diversified firms, if $AC^* < 2\sqrt{F_w a_w^*}$ webmail firms will find the opportunity to enter the market. It might even be the case that horizontal portals enter the market, if the demand is large enough.

Let's check out a numerical example for our cost function in order to get a better understanding. We have to be careful to select parameters consistent with our assumptions. Webmail firms have inferior minimum cost than web directories ($F_w a_w < F_d a_d$). Without saturation diversified firms have the least minimum average costs ($\frac{Fs}{1+k} < F_w a_w$). Fixed costs are higher for diversified firms $F > F_i$. Example parameters that satisfy these inequalities are $F = 2$,$F_w = \frac{3}{2}$,$F_h = 1$, $a_w = 1$, $a_d = \frac{3}{2}$, $a = 1$. We plot the squares of minimum average cost for multiproduct firms and for webmail firms when as a_w rises.

[3]Note that $AC_w^* \neq 2\sqrt{a_w F_w}$ because $a_i^* > a_i$



The blue line shows minimum average costs for webmail firms while the black curve shows minimum average cost for multiproduct firms. The relevant domain of the graph is when $a_w \geq 1$. We can see that in this case minimum average cost for diversified firms never reaches minimum average costs for webmail firms. We have also drawn two cases for fixed costs of directories. The brown horizontal line represents minimum average costs when $F_d = \frac{3}{2}$ and the red line when $F_d = \frac{16}{15}$. Both fixed costs satisfy the conditions imposed. In the first case diversified firms will be the only type of firms that operate. In the second case, we can find any of the equilibria describe in the last subsection, that is, web directories might exist in equilibrium but webmail firms cannot.

We can visualize the different possibilities by using a graph. Minimum average costs for horizontal portals (MAC_h) are smaller than for webmail firms (MAC_w) and directories (MAC_d). The different cost curves that we have drawn must be interpreted in the following way: they are the minimum average cost attainable given the current production of users in the market. Minimum average costs for directories are constant because they are not affected by the saturation condition being met in the webmail business. Different demand curves generate different equilibria. This is because there exists a negative externality. If $D_1(p)$ is the demand function only horizontal portals exist and firms are efficient. If $D_2(p)$ is the demand function only horizontal portals exist, but they are producing at a higher average cost. Finally, if $D_3(p)$ is the demand function directories can exist,

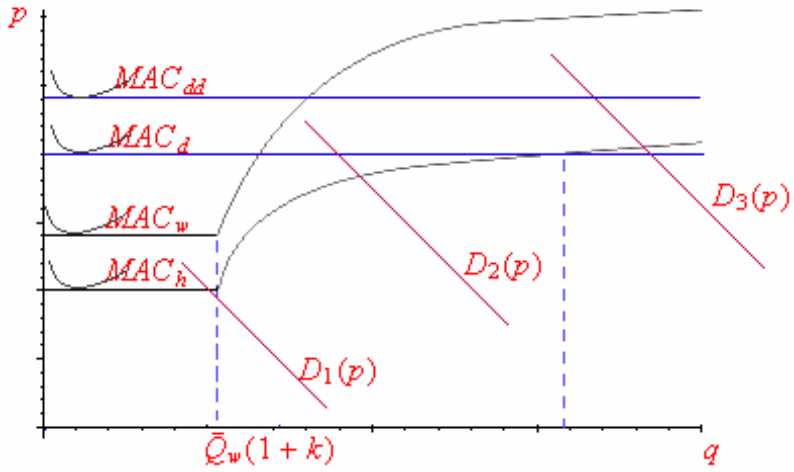


Figure 3.4:

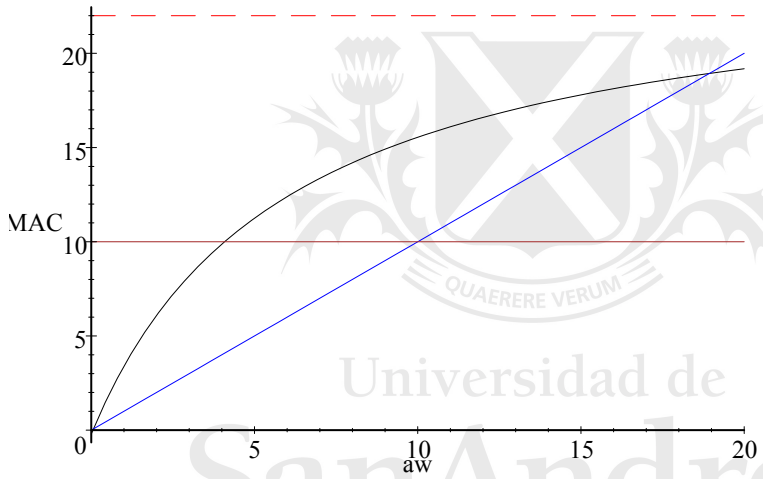
if their minimum average costs are MAC_d. Webmail firms cannot exist under the parameters we have chosen.

3.2.2. A specialized firm has the least minimum average costs.

We have said that some particular specialized firms might have minimum average costs smaller than horizontal portals. If the upper saturation bound is not met the specialized firm will be the only one operating, as was seen before introducing the diversified firm. If the saturation condition for the efficient firm is reached, the analysis becomes more complex. When the saturation condition is met price of advertising will start rising following rising costs of the specialized firm. The cost of diversified firms will rise, too. Again, we can find different equilibria. The minimum average cost of the specialized firm might reach the minimum average cost of the diversified firm. If the demand is not covered up to this point, the diversified firm will start having a cost advantage and put the specialized firm out of business. It might also happen that the minimum average cost of the other specialized firm is reached. When this happens, the situation is the same as the case we described when there did not exist diversified firms. We might also find diversified firms and the least efficient type of firm operating in equilibrium. If we chose parameters carefully, we might even find the three firms operating in

equilibrium. This equilibrium would not contradict our model, but we can say that is very unlikely, its probability is null.

Let's check out a numerical example of our example cost function in order to get a better understanding. We have to be careful to select parameters consistent with our assumptions: webmail firms have the least minimum average costs and horizontal portals have inferior costs than web directories ($F_w a_w < F_d a_d$); without saturation diversified firms have the least minimum average costs ($\frac{Fs}{1+k} < F_w a_w$);fixed costs are higher for diversified firms $F > F_i$. Example parameters that satisfy these inequalities are $F = 5$,$F_w = 1$,$F_d = 1$, $a_w = 1$, $a_d = 5$, $a = 1$. We plot the squares of minimum average cost for multiproduct firms and for webmail firms when as a_w rises.



The blue line shows minimum average costs for webmail firms while the black curve shows minimum average cost for multiproduct firms. The relevant domain of the graph is when $a_w \geq 1$. We can see that in this minimum average cost for diversified firms intersect minimum average costs for webmail firms. If this point is reached horizontal portals displace webmail firms. We have also drawn two cases for fixed costs of directories. The brown horizontal line represents minimum average costs when $F_d = 2$, and in this case the resulting equilibrium is with specialized firms only. This is an interesting case. In spite of having economies of scope, saturation inefficiencies have permitted this equilibrium to exist. The red line represents when $F_d = \frac{9}{2}$, and in this case, web directories are not feasible.

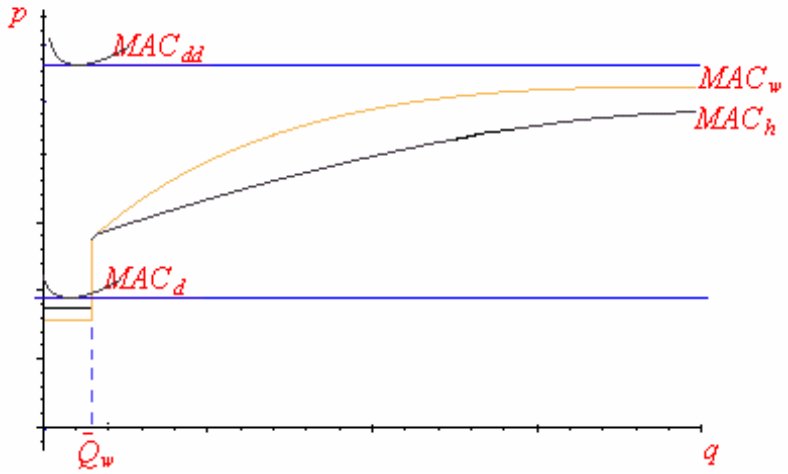


Figure 3.5:

We can visualize the different possibilities by using a graph. Minimum average costs for webmail firms (MAC_w) before saturation are smaller than for horizontal portals (MAC_h) and directories (MAC_d). The different cost curves that we have drawn must be interpreted in the following way: they are the minimum average cost attainable given the current production of users in the market. Minimum average costs for directories are constant because they are not affected by the saturation condition being met in the webmail business. To keep the graph simple, we have not drawn demand curves. We can find webmail firms only, horizontal portals only, webmail firms and directories, or horizontal portals and directories, depending on the demand function and the minimum average cost for directories. It is worth noting the equilibrium in which both specialized firms exist. It might seem counterintuitive, because we have seen the existance of economies of scope. Moreover, the economies of scope are local. When costs changed, economies of scope vanished.

Letting H stand for horizontal portals, W for webmail firms, D for directories, and MAC for minimum average cost, the cases we have seen are summarized in the following table[4]:

[4]We have ruled out the cases in which the three types of firms operate in equilibrium. As we have alread said, this equilibrium is feasible but very unlikely.

Situation	Firms in equilibrium	
	no saturation	with saturation
Without H W has MAC	W	W W and D
With H H has MAC	H	Directory becomes saturated H H and W
		Webmail becomes saturated H H and D H and W W W and D
With H W has MAC	W	Webmail becomes saturated W W and D W and H H H and D

Figure 3.6:

3.3. Many firm types that produce users which are perfect substitutes.

After having seen the possible equilibria with two firms it is not difficult to analyze the situation that arises when more firms selling perfect substitutes appear. The procedure to find the equilibrium is quite simple. First, minimum average cost for each possibile configuration should be found. When there are 2 technologies there will be 3 types of firms possibilities, when 3 there will be 7, in general if there are n technologies, the total amount of possibilities is denoted by $2^n - 1$. After this has been done, the firm type with minimum average costs will be the prevailing configuration. While saturation bounds are not met, it will be the only firm type operating in equiilbrium. When saturation limits are reached, other types of firms might start appearing, in the same fashion as we have seen when we analyzed the two services case.

4. Further considerations.

4.1. Free Internet Access

We have already spoken about the fragile situation about Free Internet Access. Now that we have developed a model that explains the advertising market we are in a better position to predict under what conditions free Internet can exist. In terms of our model, free Internet has high minimum average costs due to high bandwidth costs, and they experience powerful economies of scope with other general companies such as horizontal portals. This compatibility between internet access and internet services has existed for a long time, but with paid Internet access. There are many examples of buyouts and mergers. For example, when El Sitio bought Impsat, at that time the biggest ISP in Argentina. The merger between Home and Excite to form Excite@Home is another example. Alliances between ISPs and web companies seem really productive, they are made to incorporate economies of scope.

In few words, we believe that Free Internet Access nowadays is not feasible. The situation might change in the future. If we experience a FISP revival, it will emerge linked to a horizontal portal. The problem with free Internet access is not little demand for the service, as it has proved to be very popular among consumers. Three changes might bring FISPs back into the scene.

The first is a reduction in the cost of bandwidth. This is the principal cost FISPs have to deal with. New technologies might bring down the cost of bandwidth and make the business profitable.

The second is an increase in the demand for advertising. It is clear that other services are cheaper advertising producers. But in case the demand curve heavily shifts to the right, other services might reach a saturation condition. We are still expecting heavy traditional media advertisers to start shifting part of their budgets onto the online media.

The third is targeted advertising. FISPs might be able to target advertising in a very efficient way, when technology becomes available, as they know each

of the actions of the people that are navigating. These might raise the price of advertising heavily. It might as well arise some privacy issues, but it is still an interesting possibility.

4.2. Earn per view

There is another business model that has attracted the attention of investors, the earn per view system. The pioneer and leader is Alladvantage.com. Alladvantage's customers agree to submit information about their interests, allowing advertisers to target ads at them. Members download free software, which places a one-inch-high horizontal "viewbar" on their screens. The company then sends out a variety of ads to match that member's interests, and pays members according to how much time they spend surfing.

Response to the idea of getting paid to surf was initially overwhelming - so much so that the company had to pay out more cash to members than it could attract from advertisers. During the first three months of 2000, the company paid $32.7 million to members but took in just $9.1 million. The company has spent more than $100.0 million since its inception.

Other companies with similar models have fared poorly. BePaid.com attracted investors' and consumers' interest but has struggled to get its act together. Boulder, Colo.-based Epidemic Marketing, which paid people to put ad graphics at the bottom of their e-mail messages, shuttered its business last winter.

The Earn per View can be analyzed in a very similar fashion to the FISP model. Instead of having to deal with the bandwidth cost, they have to deal with direct cash costs. The only difference with FISPs is that these companies set limits on customers' earnings, for example $20 a month. It should also be said that Earn Per View services must learn how to deal with cheating. This is an important cost of these companies nowadays.

With respect to economies of scope, some persons might think that this service markets itself, that is, it does not have advertising costs. This statement could be supported by Alladvantage's campaign, a viral marketing campaign that offered referral commissions. It is misleading, as the company is paying for the traffic generated through referral comissions. We believe that there exist strong economies of scope between Earn per View services and other generalized services, due to shared advertising costs.

4.3. The pager business

Pagers are a very rapid growing business. Pagers are software that permit different users to communicate instantaneously. Conversations with friends, family and coworkers can be held in a very efficient way. The first pager, ICQ (I seek you), grew at the fastest rate ever known, only passed by Napster. AOL messenger used its gigantic network of users to spread its software. Then AOL bought ICQ, to handle 90% of the pager business. Yahoo Messenger and Microsoft's Pager started late, and are still really lagged. The pager business is getting really big, it is a large scale business with small average costs. The million dollar question is how will companies make money out of this business. It seems really difficult to charge subscription fees, as these networks depend on network externalities. So advertising seems like the best answer. We believe that all companies should be including advertising in the form of banners or other variants in order to be profitable. ICQ has started experimenting with banners in their last release, ICQ2000b. These pager networks are composed of heterogeneous users, just as many services we have already seen. They experience economies of scope with other services. The market depuration has already merged standalone companies with important networks. It has also left some small companies out of business, for example Pow Wow!

4.4. Vertical portals

The previous model we have developed is not useful to understand vertical portals. We have already seen that the business model of these firms is generally based upon other revenue sources, mainly commerce, events and subscriptions. The reader might ask why we have included these firms in our analysis. The answer is plain simple, these companies find advertising a very important revenue source nowadays. Why is this happening? People take some time until they are accustomed and confident with online transactions. That is why the principal revenue sources have not been exploited in their full extent.

The case of vertical portals is a case of joint production. These firms are trying to sell products, services or subscriptions. But at the same time they generate a residual product, that is, advertising. The market today shows that companies that have relied heavily on advertising are getting off business, or must rethink their whole strategy. The construction of these websites, the skills required to

produce valuable information are too expensive to be supported only through advertising.

4.5. When one to one marketing arrives

We have said that one of the differences between online and traditional advertising was the possibility to target the advertising broadcasted. The first websites that can manage targeted advertising might be able to profit in the short term. When targeting technology becomes widespread we might expect firms to compete in the same way they are competing right now. The only difference we will find is that horizontal portals and vertical portals will compete in a more fierce way, as they will be selling the same type of advertising.

4.6. Portal mutation

Portals, like all emerging companies in the technology field, are starting to develop a range of innovative business models and expect to earn revenue from a variety of revenue streams. An attentive, registered base of users is seen as a valuable asset. On average, a loyal user will spend a certain amount on e-commerce, emerging branded services like online banking, or other services. And of course there is always that advertising. Internet analysts suggest that the larger and more influential Internet companies act as "platforms" for e-commerce. Steve Harmon has compared AOL to a "digital nation."

Many Internet companies deliberately resist revenue-generating opportunities so that their growth in market share is not impeded. But eventually the most successful companies will have many revenue opportunities that aren't apparent in today's balance sheets. Yahoo, for example, is now highly profitable after several years of losing money. Due to its size and strong brand, it's likely to become highly profitable in the future, as there are likely many unrealized revenue opportunities associated with its vast audience.

The business of portals is becoming extremely complex and difficult even for qualified analysts to fathom. A large number of customers has always been seen to be the goal of the "portal wars," as the companies involved believed that they could "monetize the eyeballs" later. With the global expansion of these audiences, the rollout of high-speed DSL, cable, and wireless services, convergence with television broadcasting, and mega mergers such as the AOL Time Warner

deal, portal companies will continue to grow and evolve, and it will take serious expertise to understand what makes them tick.

4.7. Conclusion

We have investigated a complex industry, online advertising. We have reviewed the explosive growth of online advertising revenues since 1996, which convinced us of studying this industry in further detail. We researched the special characteristics of online advertising: measurability, which provided precise information about the product being sold; interactivity, which fostered economies of scope between different web services; microsegmentation, which has not yet been developed thoroughly but can permit product differentiation.

We understood the behaviour of web navigators and their allocation of time, which allowed us to establish services' popularity and saturation bounds. We looked into different types of advertising trying to find the best measure for our model, although we ended up defining our product in a different way. We then described the different types of business models. We identified the most important models, horizontal portals, vertical portals and free services, and analyzed them thoroughly.

We understood that it was worth postulating a model which would cover free services and horizontal portals, excluding vertical portals, which had a different business model based on other sources of revenues and different type of advertising. Perfect competition turned out to be a reasonable assumption, and we also posed a downward sloping demand curve. We selected as our product "present value of advertising revenues generated by user".

We started by analyzing two free services, producing perfect substitutes. We found out that only the most efficient company existed in equilibrium, but that both services could exist if the production of the efficient company became saturated. Then we introduced the horizontal portal, a multiproduct firm that produced both free services, experiencing economies of scope based on shared costs and brand recognition effects. Depending on the cost structure and the demand size, many equilibria could appear. We found out that although horizontal portals might have higher minimum average costs than some services, they could still exist given those cost efficient services became saturated. Our model has some resemblance with the electricity industry. In this industry, there are several types of plants that can produce electricity, each with different cost structures. Examples are nuclear plants, hydroelectric plants, gas plants, each with different

fixed and variable costs. During different periods of the day demand changes. When demand is low, only the most efficient firm generates electricity providing the whole market. As demand rises, these firms are unable to meet demand as they cannot produce more electricity. More inefficient firms fulfill the demand. In our case, we don't have the timing issue seen on the electricity industry, but we do have the industry configuration depending heavily on demand.

We have found from our model that technology is crucial in determining which types of firms exist in equilibrium. If the market for "navigators' attention" has not been fully exploited, in the sector with minimum average costs, then only one type of firm exists in equilibrium, the most efficient. We have also found that when "navigators' attention" has been exhausted such that no more advertising can be sold through one type of product, demand for advertising becomes really important in determining which types of firms exist in equilibrium. We can find different equilibriums, depending on the cost functions and the demand functions. One interesting case is the one in which both specialized firms operate in equilibrium, but diversified firms don't. This equilibrium can occur when economies of scope for the diversified firm become exhausted. Another interesting equilibrium is found when diversified firms displace specialized firms from the market. This happens when the market for the specialized firm becomes saturated and costs for this firm rise more rapidly than costs for the diversified firm.

We then expanded our model to N services, and suggested a procedure to determine what market structure would be found. The structure that is found nowadays is one in which horizontal portals provide most of the advertising. Some specialized firms exist nowadays. Some are cost efficient, others are about to merge with horizontal portals, the key players in this industry. What is clear is that standalone companies which are not cost efficient are bound to disappear.

We also applied our model to FISPs and Earn Per View models, and established under what conditions these services might be profitable. We have seen that these companies are quite similar. They are likely to be found linked to other services. In order to become feasible, there have to be some changes: they need to lower costs, differentiate their product or need a boost in demand. We also tried to shed some light on changes that are likely to occur in the near future, mainly the widespread use of one to one marketing. We have seen that competition between horizontal portals and vertical portals will become more intense. It is however quite difficult to forecast what will happen with certainty, because this medium is really dynamic and has been through a great transformation in few years. Nevertheless, we believe that we have depicted the current situation

with precision.

5. Mathematical Apendix.

5.1. No diversified firms and existance of a saturation bound

Firms maximize $pq_i - (a_i q_i^2 + F_i)$ with

$$a_i = \begin{cases} F_i(\frac{N_i^*}{Q_i})^2 \text{ if } N_i \leq N_i^* \\ F_i(\frac{N_i}{Q_i})^2 \text{ if } N_i > N_i^* \end{cases}$$

Given the market conditions, firms operate in the long run at the point where Price = Marginal cost = Average cost

Total cost of the firm is $a_i q_i^2 + F_i$, so average cost is $AC = a_i q_i + \frac{F_i}{q_i}$. To find the minimum average cost we differentiate this expression

$$\begin{aligned} a_i - \frac{Fi}{q_i^2} &= 0 \\ Fi &= a_i q_i^2 \\ q_i^* &= \sqrt{\frac{F_i}{a_i}} \\ MAC_i &= a_i\sqrt{\frac{F_i}{a_i}} + \frac{F_i}{\sqrt{\frac{F_i}{a_i}}} = 2\sqrt{\frac{F_i}{a_i}} \end{aligned}$$

Given a demand function $D(p) = L - \tau p$, and assuming $F_w a_w < F_d a_d$ we start finding the equilibriums. If $D(p) = D(2\sqrt{F_w a_w}) = L - 2\tau(\sqrt{F_w a_w}) < \bar{Q}_w$ only webmail firms will operate. Price will then be $2\sqrt{F_w a_w}$.

To find N_w, we divide the total demand $D(2\sqrt{F_w a_w}) = L - 2\tau(\sqrt{F_w a_w})$ by the optimal output $q_w^* = \sqrt{\frac{F_w}{a_w}}$to find, replacing a_w by its value

$$N_w = \frac{L - 2\tau(\sqrt{F_w a_w})}{\sqrt{\frac{F_w}{a_w}}} = \frac{L - 2\tau(\sqrt{F_w^2(\frac{N_w}{Q_w})^2})}{\sqrt{\frac{1}{(\frac{N_w}{Q_w})^2}}}$$

If $D(2\sqrt{F_w a_w}) = L - 2\tau(\sqrt{F_w a_w}) > \bar{Q}_w$, then the saturation condition will be binding. Price will rise, and will be determined, while it does not reach $2\sqrt{F_d a_d}$, by $D(p) = \bar{Q}_w$. Knowing the equilibrium price, it becomes easy to determine N_w and q_w from the following equations. The first states that webmail market has reached the saturation limit and the second states that average cost equals price.

$$q_w = \frac{\bar{Q}_w}{N_w}$$

$$p = a_w q_w + \frac{F_w}{q_w} = (\frac{N_w}{\bar{Q}_w})^2 q_w + \frac{F_w}{q_w}$$

Solving we find that N_w $(> N_w^*)$ will be equal to $\frac{\bar{Q}_w p}{2F_w}$ and q_w equal to $\frac{2F_w}{p}$. If price rises up to $2\sqrt{F_d a_d}$, the minimum average cost for web directories, these firms will start appearing . To determine N_d we first determine the total output of directories. Directories provide advertising the advertising webmail firms cannot provide. The amount will be equal to $L - 2\tau(\sqrt{F_d a_d}) - \bar{Q}_w$. Dividing by the optimum output, and replacing for a_d we find that

$$N_d = \frac{L - 2\tau(\sqrt{F_d^2(\frac{N_d^*}{Q_d})^2}) - \bar{Q}_w}{\sqrt{\frac{1}{(\frac{N_d^*}{Q_d})^2}}}$$

. Knowing the equilibrium price, it becomes easy to determine N_w and q_w from the following equations:

$$q_w = \frac{\bar{Q}_w}{N_w}$$

$$p = 2\sqrt{F_d a_d} = a_w q_w + \frac{F_w}{q_w}$$

Solving we find that N_w $(> N_w^*)$ will be equal to $\frac{\bar{Q}_w p}{2F_w} = \frac{\bar{Q}_w 2\sqrt{F_d a_d}}{2F_w} = \frac{\bar{Q}_w 2\sqrt{F_d(\frac{N_d^*}{Q_d})^2}}{2F_w}$ and q_w equal to $\frac{F_w}{\sqrt{F_d a_d}}$.

5.2. Diversified firms have minimum average costs and there exists a saturation bound

Using the same cost function for specialized firms, $c_i(q_i) = a_i q_i^2 + F_i$, we introduce the cost function for diversified firms: $c(\tilde{q}_w, \tilde{q}_h) = a_w \tilde{q}_w^2 + a_d \tilde{q}_d^2 - a\tilde{q}_w \tilde{q}_d + F$. The diversified firm maximizes the function $p(q_w + q_d) - c(q_w, q_d)$ and differentiating we get:

$$\begin{aligned}
\frac{\partial}{\partial \tilde{q}_w} &\rightarrow p = 2a_w \tilde{q}_w - a\tilde{q}_d \\
\frac{\partial}{\partial \tilde{q}_d} &\rightarrow p = 2a_d \tilde{q}_d - a\tilde{q}_w \\
2a_w \tilde{q}_w - a\tilde{q}_d &= 2a_d \tilde{q}_d - a\tilde{q}_w \\
\tilde{q}_d &= k\tilde{q}_w = \frac{2a_w + a}{2a_d + a}\tilde{q}_w
\end{aligned}$$

Knowing this fact we can rewrite our cost function in terms of q_w, $c(q_w, q_d) = a_w q_w^2 + a_d k^2 q_w^2 - akq_w^2 + F$. To get the average cost of the firm we must divide by total production $\tilde{q}_w + \tilde{q}_d = \tilde{q}_w(1+k)$ that gives us:

$$AC = \frac{(a_w + a_d k^2 - ak)\tilde{q}_w^2 + F}{\tilde{q}_w(1+k)} = \frac{s\tilde{q}_w^2 + F}{\tilde{q}_w(1+k)}$$

To find out the global minimum for this expression we differentiate it:

$$\begin{aligned}
\frac{s}{(1+k)} - \frac{F}{(1+k)\tilde{q}_w^2} &= 0 \\
F &= s\tilde{q}_w^2 \\
\tilde{q}_w^* &= \sqrt{\frac{F}{s}} \\
MAC &= \frac{s\frac{F}{s} + F}{\sqrt{\frac{F}{s}}(1+k)} = 2\sqrt{\frac{Fs}{(1+k)}}
\end{aligned}$$

Multiproduct firm exist when minimum average cost for this type of firm is inferior to the minimum average cost of specialized firms, i.e. $\frac{Fs}{(1+k)^2} < F_i a_i \forall i$. As

we can see it depends on the parameters chosen. Variable costs as well as fixed costs are relevant. Assuming the demand function for users is $D(p) = L - \tau p$, and if the neither of the saturation bounds are met, then $D(\frac{2\sqrt{Fs}}{1+k}) = L - \frac{2\tau}{1+k}(\sqrt{Fs})$. Price will be equal to $\frac{2\sqrt{Fs}}{1+k}$. To calculate the amount of diversified firms N we divide total demand by optimal output of the firm to get $\frac{L-\frac{2\tau(\sqrt{Fs})}{1+k}}{\sqrt{\frac{F}{s}}}$. In this situation, we find there is no room for specialized firms.

As we have already seen all the different equilibria, we will only describe one as these do not present mathematical complications. We will view the case in which saturation bound in the least efficient type of firm is met. As we have seen, there are two possibilities. In one of these, only multiproduct firms exist in equilibrium, the resulting price will be lower than minimum average cost of the most efficient specialized firm. In the other case, multiproduct firms will exist in conjunction with the most efficient specialized firms. Let's assume webmail firms have minimum average cost inferior to directories.

In this situation, when $\bar{Q}_d$ is reached, a_d will start rising, and k will rise too. Let's define AC^* , the minimum average cost for diversified firms at which demand is satisfied completely by multiproduct firms. Replacing k and s by their values, we get

$$AC^* = \frac{2\sqrt{F(a_w^* + a_d\frac{2a_w^*+a}{2a_d+a} - a\frac{2a_w^*+a}{2a_d+a})}}{1+\frac{2a_w^*+a}{2a_d+a}}$$

At this point $Q^* = D(AC^*) = L - \tau AC^*$. We must compare AC^* with minimum average cost for webmail firms, $2\sqrt{F_w a_w}$. If $AC^* < 2\sqrt{F_w a_w}$ then only multiproduct firms will exist in equilibrium. If $AC^* > 2\sqrt{F_w a_w}$ then equilibrium price will be $2\sqrt{F_w a_w}$ and we will find in equilibrim diversified firms and horizontal portals. Equating minimum average costs we can solve for a_w, which we will call a_w^e. We will also find k^e, and total output for multiproduct firms.

$$\tilde{q}_d^e = \frac{\bar{Q}_d}{N} \tag{5.1}$$

$$\tilde{q}_w^e = \frac{\bar{Q}_d}{Nk^e} \tag{5.2}$$

To calculate N_w we first need to find the total quantity of users that will be provided by diversified firms. This will be equal to ill be equal to $N(\tilde{q}_w^e + \tilde{q}_d^e) =$

$N(\tilde{q}_d^e + \frac{\tilde{q}_d^e}{k}) = N\tilde{q}_d^e\frac{(1+k)}{k} = \bar{Q}_d\frac{(1+k)}{k}$. Then, webmail firms will provide the residual demand at price $\sqrt{F_w a_w}$. $\frac{L-2\tau(\sqrt{F_w a_w})-\frac{1+k^e}{k^e}\bar{Q}_d}{\sqrt{\frac{F_w}{a_w}}}$ and N_d equal to 0.

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