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It plans now to focus solely on the "content" of its service—news, ads, pictures and games—and leave to someone else the job of delivering all the material to subscribers' computer screens.
The Washington Post, September 9, 1997 [2].

Internet Service Providers, Proprietary Content, and the Battle for Users' Dollars

*Rajiv M. Dewan,
Marshall L. Freimer, and
Abraham Seidmann*

That "someone else" mentioned in the newspaper item reprinted here is WorldCom, a giant telecommunications company that owns UUnet and is a major provider of Internet backbone and connectivity services. AOL announced it was selling its pioneering network division ANS, the part of AOL that provided customers with local access, to WorldCom in a three-way deal that also split up H&R Block's CompuServe. In return, AOL added CompuServe's 3 million customers to its 8-million customer base, received all of CompuServe's content, and \$250 million. WorldCom added AOL's and CompuServe's networking divisions, ANS and CNS, respectively, to its already large Internet services. This complex deal exemplifies the vertical disintegration of proprietary content provision into content and access services by specialized companies.

There are several technological and economic factors that underlie the trend of vertical disintegration. Foremost among these are the changes in the telecommunication industry. Declining hardware prices make it cheaper to compress, process and switch signals. These changes, combined with deregulation, have resulted in reduced telecommunication

costs at the wholesale level. Further, increased standardization, decreased hardware cost, and use of common protocols have made it easy to bring these price reductions to the retail level. This makes the business of providing access much more competitive; and the providers, who have lower costs, gain market share. Telecommunication companies have a cost

advantage because they have large modem pools, concentrators and dedicated networks. They can offer reliable connectivity at a lower cost [3]. In fact, AOL expects its connectivity costs to decrease from \$0.90 per hour to \$0.45 per hour with WorldCom managing the network.

Content provision, on the other hand, remains like the business of providing other information goods such as software and movies: high development costs and low variable costs. This is especially true for proprietary content such as medical abstracts (Medline), legal proceedings (Lexis/Nexis), scientific citations, forums, chat rooms, and so forth. Very few firms compete in the same area and thus these proprietary content providers have near monopolies [6].

There are a number of attributes of the Internet in general, and the World-Wide Web in particular, that make it particularly attractive to proprietary content providers. The global reach, distance and content independent pricing, standard browsers, and easy advertising via Web links make it easy for firms to market and sell content to a large marketplace.

The changes in the telecommunications industry and the attractiveness of the Internet as a distribution channel for proprietary content have resulted in an unbundling of services provided by content providers. While these firms initially offered these services bundled with proprietary access methods, most are moving to the Internet and focusing on content alone. The AOL, WorldCom, and CompuServe deal that was described earlier is an example of this trend.

In this article we refer to Internet Service Providers (ISPs) that primarily provide access services and content as *access providers* and *content providers*, respectively.

The technological and regulatory changes described here have also made it easier to become an access provider. Reuters reports that the number of ISPs that provide access doubled in 1996 [7]. While

a few ISPs such as America Online and AT&T WorldNet have millions of customers worldwide, the local market for connectivity is very crowded. Although each of the local access providers has only a few thousand customers on average, they collectively have a much larger market share than national providers such as AOL [1]. This wide availability of access services impacts the prices and profits of the

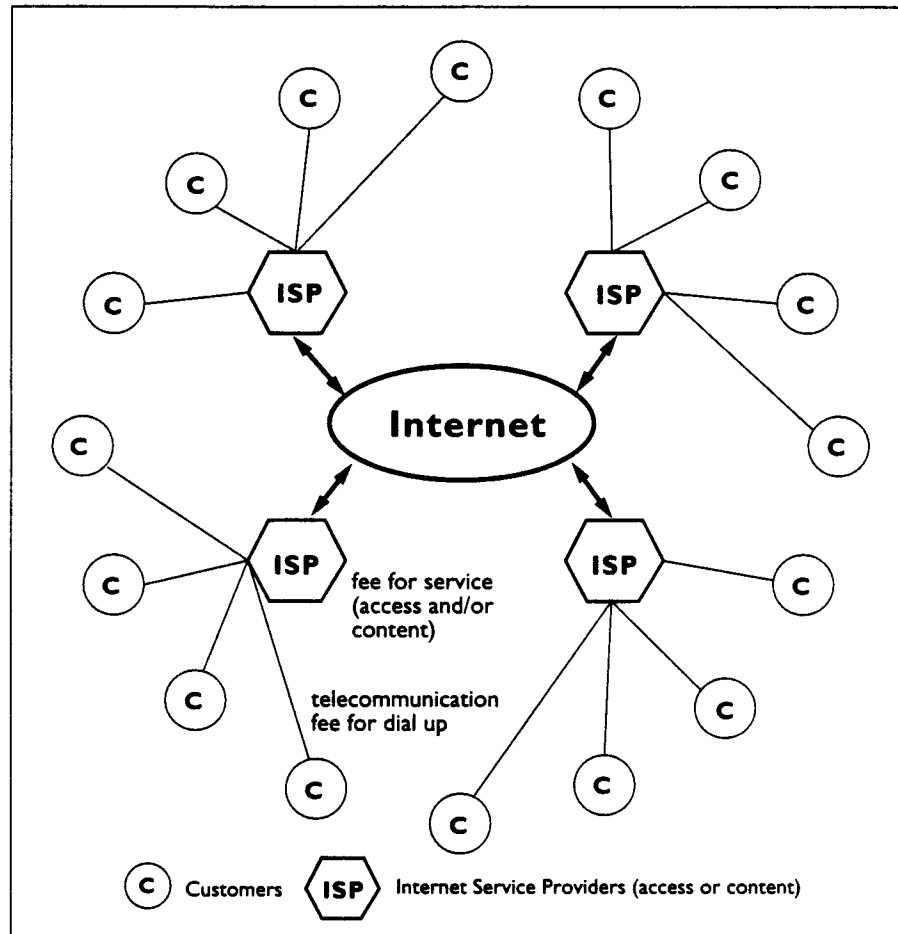


Figure 1. A simplified model of the Internet economy

service providers, and customers' net benefit. As the local competition heats up for providing dial-in locations for customers, also known as points of presence (POPs), the access providers make less profit. Content providers, on the other hand, gain from this increased competition for access. Their market coverage increases and it costs the customers less to get to their offerings. Customers also benefit from the increase in numbers of local access providers.

Another important player in the battle for users' dollars is the U.S. government. Specifically, we show how taxes on access fees have a deleterious effect on the Internet economy as a whole. In particular, with an increase in access-fee taxes, the

number of points of presence in any one locality decreases, content providers' profits decrease, and the total net benefit to customers decreases as well. Reduced profits for content providers may result in large discontinuous changes—a content provider may stop updating and providing new content as taxes make it unprofitable.

The Internet Economy

To analyze the impact of changes in technology and regulation, we consider a simplified model of the Internet economy that is shown in Figure 1. A customer desiring proprietary content dials up a local point of presence maintained by an access provider, gets on the Internet and accesses proprietary content. The customer pays a telecommunications company for local dial-up, an access provider for using the POP, and the proprietary content provider.

In this simplified model, the Internet economy comprises:

- *Customers* who value proprietary data. Customers choose services that maximize their *net* value, that is, the value of data less the local telecommunication charges, access fees, and content fees.
- *Access providers* who set up local points of presence to dial into, support users, and provide generic software and Internet services. They charge for services so as to maximize their own profits.
- *Content providers* who collect, process, organize, index, update, and provide the data in a format usable by customers. They set a fee for their services so as to maximize their profits.

The cost of services—access and content—to a customer depends on his location and the prices and locations of the service providers. If the value of content to the customer exceeds the cost, then the customer will obtain Internet services. Further, the customer will obtain Internet access from a provider that minimizes the sum of access fees and local telecommunication charges. Similar decisions by other customers determine the volume of customers and the profit for the service providers. Each service provider picks its price and location to maximize its profit. The detailed analysis of this joint maximization problem and other related issues are provided by Dewan, Freimer, and Seidmann in [4].

The complex interrelationships among all these decisions are illustrated by Figure 2, in which the profit for an access provider is plotted against its

price and the price set by the content provider. The model cited here is used to estimate the profit for the access provider for every 1,000 potential customers. Note that at a given content provider price, the access provider's profits increase and then decrease as it increases its price. The access provider will pick a price to maximize its profit. This is denoted by the bold line along the ridge of the profit surface.

Note that as the content provider raises its price, the access provider must lower its profit maximizing price. The access provider's profit will always decline with a price increase by the content provider. A similar scenario holds for the content provider and its profit. However, the impact of any access provider changing its price is smaller, as the connectivity market is quite competitive and there are many access providers [4].

In equilibrium, the content and access providers

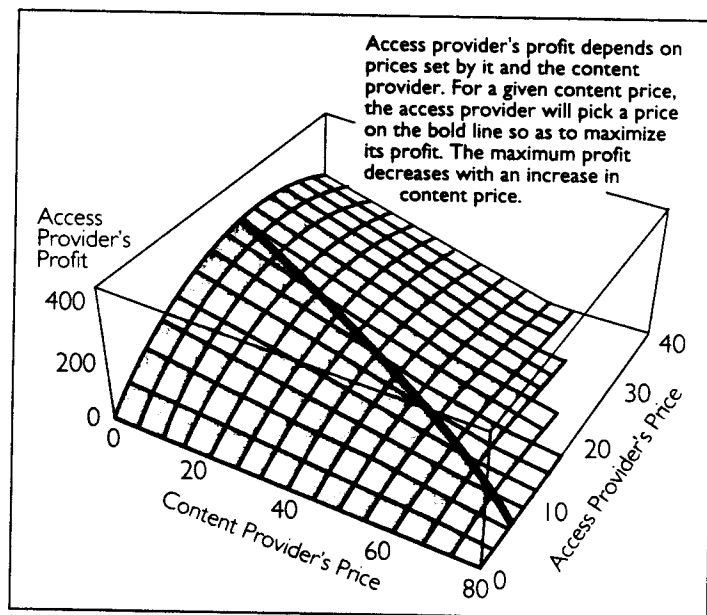


Figure 2. Impact of content provider's price on access providers' profit

expect each other to behave in this fashion and the prices are determined by their joint actions to maximize their profits. This equilibrium is analyzed further in the following sections.

Entry of Additional ISPs

The local competition for providing access services is quite intense [1]. Here, we examine the impact of increasing the number of access providers as they expand their geographic scope and compete more vigorously in local markets.

As additional access providers join a given terri-

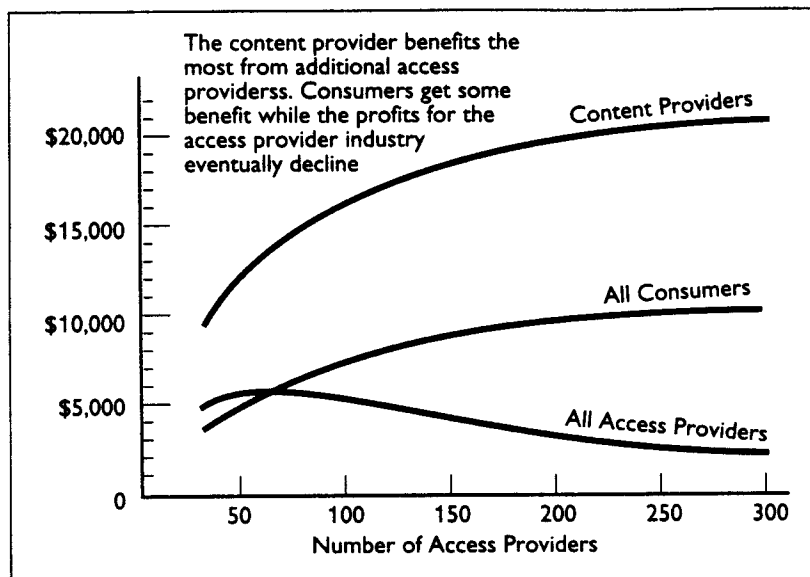


Figure 3. Impact of increasing the number of access providers on consumer surplus and revenues of the access and content providers

tory, some customers will switch from their current access providers to new ones that are closer to their location. Some of these savings in Internet access costs are captured by the content provider, which raises its price. As shown in Figure 2, the access providers in turn must reduce their prices to maximize their profit in the face of this higher content provider price for content. Overall, the individual access providers are worse off, while the content provider and the consumers benefit from the introduction of additional access providers into the same territory. A detailed mathematical characterization of this is contained in [4].

As the number of access providers increases, consumers see two benefits: reductions in their telecommunication charges because they find closer POPs, and reductions in the fees charged by access providers. On the other hand, the content provider raises its fees. Overall, we find that this fee increase is smaller than the sum of the reductions previously described. The foregoing discussion is summarized in Figure 3, in which the economic surpluses of the content provider, the consumers and the access providers are plotted as a function of the number of access providers. It shows how the content provider and the consumers benefit from the increase in the number of access providers.

While the profit for *each* access provider decreases monotonically as the number of access providers increases, the profit for the *whole* access industry initially increases. However, as the number of access providers increases further, the overall industry profits decline. In contrast, the content provider uniformly does bet-

ter as the number of access providers increases.

These results provide an important insight into a hotly debated social issue: free access to the Internet. If the government, or any other agency, wants to provide free access, it will have to pay for the local communication costs and the fees charged by the various access providers. From a consumer perspective we reach a situation similar to the one described. The content provider will charge its monopoly price and, despite subsidized universal access, a fraction of

customers will still be priced out of the market. Access subsidies benefit the content providers, the access providers, and the telecommunication companies. In contrast, we find that customers who cannot afford higher content prices, or some of the customers who are located closer to the content provider, will be worse off with the subsidies. Therefore, even a complete subsidy of Internet access will not result in universal access to proprietary data.

Taxing Internet Access

In recent months, politicians and other public figures have been deliberating various options for taxing economic activity in cyberspace. Nine states in the U.S. levy taxes on Internet access today. Others are actively debating it [9]. Some members of the Organization of Economic Cooperation and Development (OECD) have formed a group to study "bit taxes" on computer data flow on public networks [8]. It has been argued that the exact location of content, or merchandise providers, in the cyberspace economy does not matter much since they are free to move in a manner that is transparent to the end user. Companies can move their warehouses or databases from country to country to reduce their tax load while still maintaining the same URL used by customers to obtain content. The access providers, on the other hand, must provide a physical point of presence, which reduces their mobility and makes them an easy target for various tax proposals. The content provider, access providers, and customers are all part of the Internet economy, and taxes on any of these entities affect them all. Here we explore the effect of proportional taxes on access fees and their indirect effect on all members of the Internet economy.

We begin our analysis by considering a locality that has a saturated access market: there are so many access providers that if another one joined the locality then none of the access providers would make a profit. A proportional tax on access fees at the rate of t reduces the profit of an access provider by the factor $1/(1+t)$. In a saturated market, such a tax will prevent the access providers from recovering their fixed costs. Consequently, some of the access providers will exit the market, and the profits of the remainder will increase to a point where they once again cover their fixed costs. The net effect of this tax is a reduction in the total number of access providers. Customers will no longer have as many conveniently located POPs.

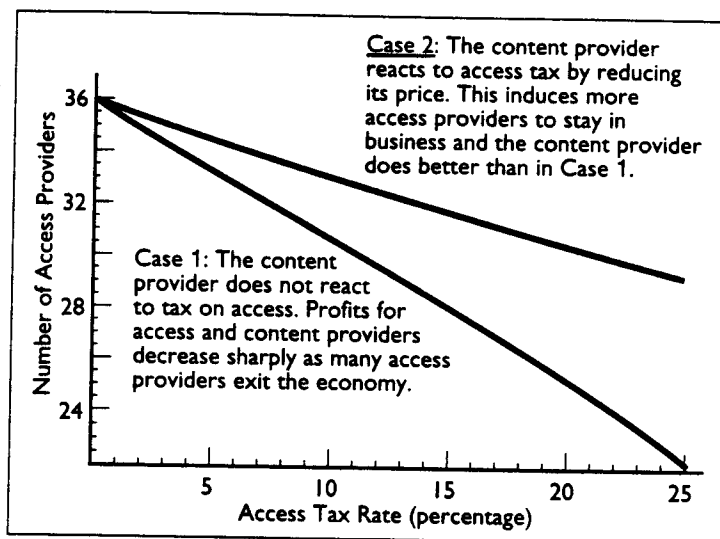


Figure 4. Impact of tax on number of access providers

It is worth noting that the content provider is not an idle bystander. We have shown that decreasing the number of access providers reduces its profit dramatically.

Therefore the content provider reduces its prices to allow a greater number of access providers to remain in the market. In effect, the content provider finds it economically viable to share some of the access tax burden. This is shown by the upper curve in Figure 4. The lower curve shows the number of access providers if the content provider does not discount its fee. The impact of a fee reduction by the content provider becomes more significant as the tax rate increases. For example, at a 20% tax rate on access, we observe that the number of access providers grows from 25 to 30 if the content provider reacts to the tax. As is to be expected, a tax on access reduces the profit of the content provider.

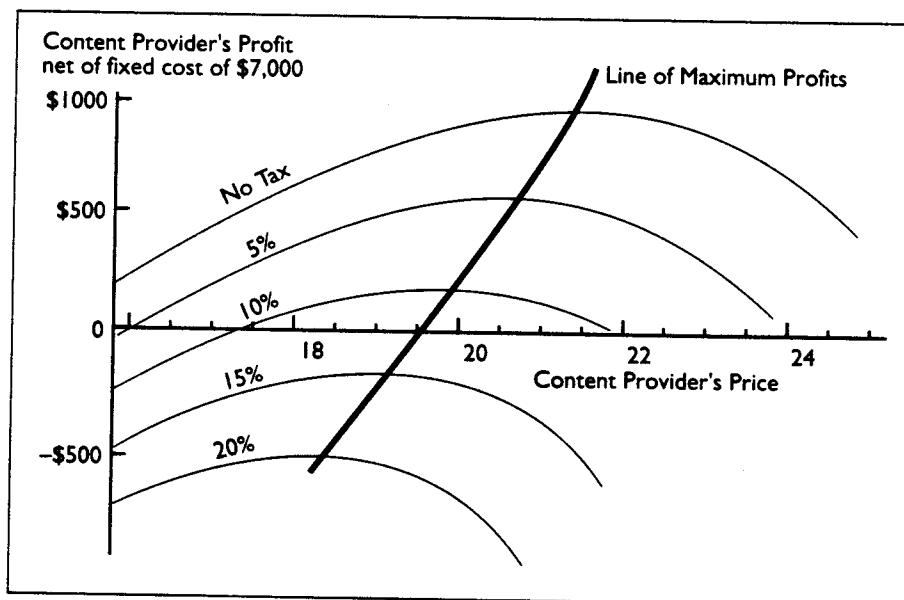


Figure 5. Impact of tax content provision

Decreasing profits for the content provider can be especially troublesome. For Internet content, as for most information goods, there is a large fixed cost to developing and providing the content. In such a setting, increasing taxes beyond a certain threshold may have a disproportional negative impact, as shown in Figure 5. We show the profits for a content provider when the fixed cost of providing content is \$7,000 (scaled for 1,000 customers) and the locality is saturated with access providers. Profit curves are drawn for

five different tax rates. The top curve is for a zero tax rate. The profit curves move down and to the left as the tax rate increases. For each tax rate, the content provider picks a price to maximize its profit. A bold line is used to connect the points on the curves at which the profit is maximized. At a 10% tax rate, the content provider still makes a small profit. However, beyond a certain tax rate too many access providers will drop out of the market and the content provider will see profits decline to a point where it ceases to provide content on the Internet. For instance, at a 15% tax rate, the best the content provider can do is to incur a loss and is likely to log off.

Managerial Implications

Increasing standardization in browsers and communication protocols, decreasing hardware costs, and deregulation of the telecommunication industry have led to increasing commodification of access provision on the Internet. Increasing numbers of access providers result in greater competition for customers, resulting in decreasing prices for connectivity and reduced profits for the access providers.

Content providers do better with increased competition in the access market. Their monopoly is strengthened and customers, having paid less for access, are willing to pay more for content. Consequently, the content providers raise their prices even as access gets cheaper. Further, the global reach and the distance and content-independent nature of Internet pricing also favor the content provider. The content provider's profits increase while the profits of access providers decrease as more of them enter the market. A recent *Fortune* article [5] states:

"Internet access by itself is a lousy business. Price competition is intense, and as more people spend more time online—good news you'd think—costs soar."

Given these trends, it is not surprising that the Internet access business is being taken over by telecommunication firms—firms that have a comparative advantage at managing large networks.

The customers and users of proprietary content benefit too. They use the Internet to access a variety of proprietary data using common hardware and software. Their connectivity costs decrease as more access providers provide local points of presence and lower their fees. These factors increase the net benefit that consumers get from the Internet as the numbers of access providers increases. These trends have resulted in a vertical disintegration of the industry with global telecommunication companies such as WorldCom specializing in access, while others such as AOL specialize in content.

Taxation and subsidy seem to have limited roles in managing the Internet. The benefits of access subsidies in a competitive access market flow primarily to the content provider and somewhat less to the consumers. The monopoly content providers will take advantage of any access subsidy provided to the public. Our research shows that if a complete subsidy were provided, the proprietary content provider would raise its price so that only a fraction of the customers would gain access to proprietary data. Universal access to the Internet, therefore, does not imply

universal access to proprietary content.

Taxes, even on a single component in our simplified model, have an impact on the whole Internet economy. The first impact of taxes on access is to reduce the number of access providers. This, in turn, makes it less convenient for consumers as some local POPs disappear. This reduces consumer welfare. Those consumers who could barely afford to get onto the Internet and access proprietary content will no longer be able to afford to do so. The content provider is also affected adversely. Taxing access reduces its profits as discussed previously, and consequently it may not find it worthwhile to collect, process, and make proprietary content available to the consumers. Taxation, even on access alone, will reduce the quality and quantity of content available on the Internet. ■

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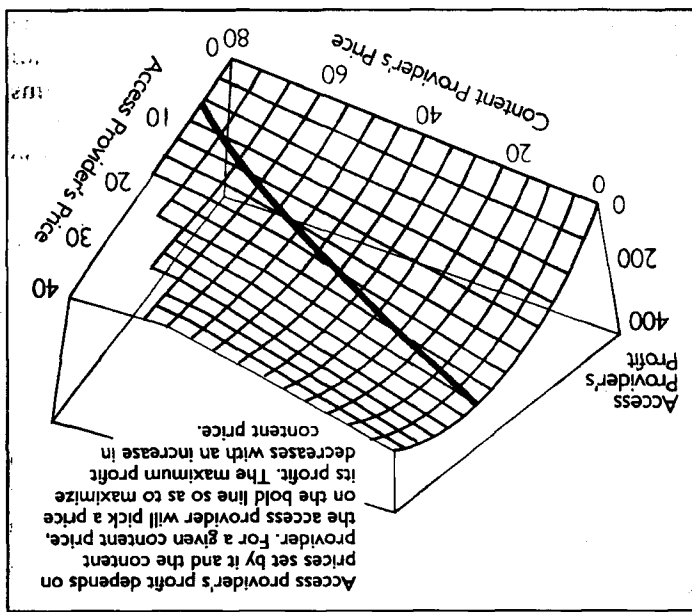


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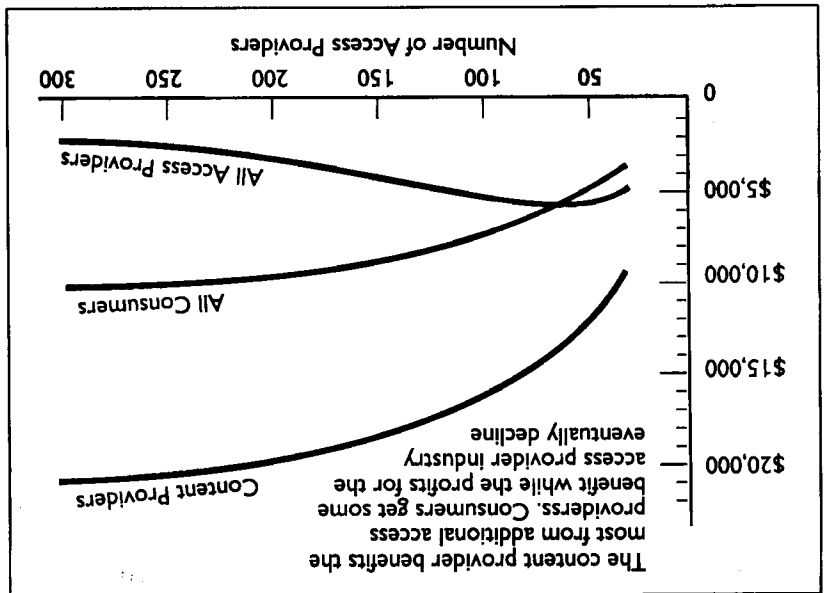


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Figure 5. Impact of tax content provision

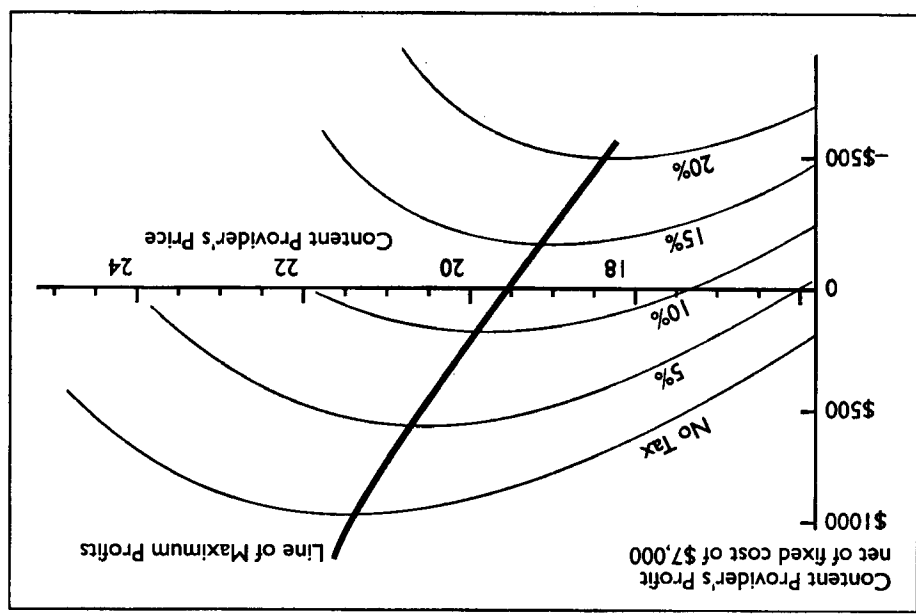
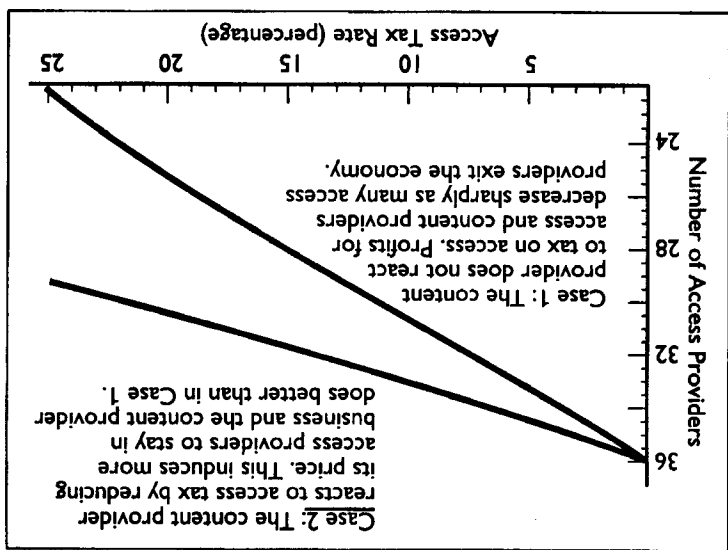


Figure 4. Impact of tax on number of access providers



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