



The 15-billion-dollar broadband bonus

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..... In September 2001, approximately 45 million US households accessed the Internet through a dial-up connection, while 10 million used a broadband connection. In March, 2006, a survey by the Pew Internet and American Life Project found a sharply contrasting picture: Approximately 42 percent (and growing) had broadband, while dial-up use was dropping rapidly (see http://www.pewinternet.org/PPF/r/184/report_display.asp).

That contrast motivates a seemingly straightforward question: What is the economic value created by the increasing use of broadband? As it turns out, popular discussion often gets the answer wrong.

The confusion is understandable. There are two alternative economic concepts for understanding the value created by a new good, one pertaining to gross domestic product (GDP) and another pertaining to users. Neither is better than the other. Each measures something different.

In today's column, I aspire to use each concept to estimate the economic value created by broadband. I will aspire to be as transparent as possible, so at the outset I must admit that it is impossible to be absolutely precise in this exercise. Rather, I am going to perform a bit of "ballpark" economics. That is, I will aspire to get the numbers "in the right ballpark"—that is, within an acceptable margin of error.

To whet your appetite, let me foreshadow the answer: Broadband created at least an additional 15 billion dollars of economic value in 2006, but less than half of that shows up in GDP.

Net revenue

Because the average price of residential broadband access is somewhere between \$36 and \$40 a month, residential broadband generates annual revenue of at least \$20.3 billion ($\$36/\text{month} \times 12 \text{ months} \times 42 \text{ percent} \times 112 \text{ million households}$). That is not the same as the GDP created, however. Broadband replaced dial-up in many households, so the additional value created should compare new broadband revenue to cannibalized dial-up revenue.

The first step is to figure out how many broadband users formerly used dial-up. Of those (roughly) 47 million broadband users in 2006, 10 million were there in 2001. Of the remaining 37 million broadband adopters, what fraction were former dial-up users?

The author of Pew's report, John Horrigan, does not give an estimate. He does highlight two sides of the same coin, however: Most broadband adopters first used dial-up, and until very recently few adopters of broadband went straight to broadband without first using dial-up. Horrigan also states that 4 (out of 8) million broadband adopters were new users of the Internet between

2005 and 2006, and never before had Pew's surveys found a percentage anywhere near that high.

On that basis, I will assume that approximately 30 (out of 37) million broadband adopters between 2001 and 2006 were converts from dial-up. I also will count all the 10 million broadband users in 2001 as converts, equivalent to assuming they switched from dial-up prior to 2001. That probably overstates converts, which, for various reasons (more coming), probably will underestimate the contribution from broadband.

Those assumptions imply that the new adopters generate at least \$3 billion of revenue annually ($\$36/\text{month} \times 12 \text{ months} \times 7 \text{ million households}$), while converts generate \$17.3 billion (20.3 less 3). So, how much did the \$17.3 billion cannibalize when households converted from dial-up?

If the average price of dial-up Internet access was \$20 a month, then that accounts for \$9.5 billion ($\$20/\text{month} \times 12 \text{ months} \times 40 \text{ million}$) of cannibalized revenue. That is not quite everything, however. Some households supported their Internet with a second telephone line. According to statistics at the Federal Communications Commission, a second telephone line cost as little as \$16 a month in some cities and as much as \$24, averaging around \$20. According to a different set of statistics, 11.4 percent of households had a second line

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in 1994, 26 percent at its peak in 2001, declining to 12 percent by 2005, the latest available data. That growth and decline coincides well with the growth of dial-up and its decline, strongly suggesting that broadband is responsible for the latter decline.

Based on those data, I will assume 14 percent of households retired their second lines between 2001 and 2005, so converting to broadband cannibalized revenue for second lines by \$3.7 billion ($\$20/\text{month} \times 12 \text{ months} \times 14 \text{ percent} \times 112 \text{ million households}$). Thus, the total conversion cost is \$13.2 billion (9.5 plus 3.7). That leads to a bottom line: Comparing 2006 broadband revenue to the beginning of the dial-up market, broadband created \$7.1 billion of additional revenue above and beyond what dial-up would have contributed. That comes from two sources: \$3 billion from the new adopters and \$4.1 billion from the converts (17.3 less 13.2).

Although these calculations tell us nothing about the cost to deploy and support broadband or, for that matter, its profitability, these numbers do say something about the suppliers who won and lost. Pew's survey finds that local telephone companies have a slightly higher market share than cable companies, but a slightly lower price as well. Hence, each type of firm had a similar level of broadband revenue in 2006. That means cable and telephone companies each gained from the additional revenue from broadband, but cable gained more because it did not cannibalize revenue for second telephone lines. The only big revenue losers were dial-up ISPs, which is no surprise.

Consumer surplus

Another definition for the value created by a new good is its additional contribution to user satisfaction. That is the difference between what a user was willing to pay for a new good and what they did pay, what economists call *consumer surplus*. Some users get more surplus than others because they

value broadband more. The open question is how much more?

A few years ago, Scott Savage and Don Waldman of the University of Colorado, Boulder, conducted an enormous survey of dial-up and broadband users and nonusers ("United States Demand for Internet Access," *Review of Network Economics*, vol. 3, no. 3, Sept., 2004, pp. 228-247).

They made estimates for "willingness to pay" among the "likeliest broadband adopters." For example, Savage and Waldman's lowest estimate of the average willingness to pay for broadband's speed is around \$11 per month. Their highest is around \$22 for the most experienced and educated user. They also find that users pay more for broadband because it is more reliable and always on, between \$1 and \$18 more, depending on how much more reliability the user perceives. Savage and Waldman guess that dial-up has half the reliability of broadband, yielding an additional value of \$9. The bottom line: among the "likeliest broadband adopters," the additional benefit of broadband lies between \$20 (11 + 9) and \$31 (22 + 9). Call it \$26 on average.

Where did the label "likeliest broadband adopter" come from? Savage and Waldman's estimates net out the benefits users already receive from dial-up, so users adopt broadband if the additional benefit exceeds the additional cost of converting. The conversion cost sums two things, the increase in subscription fees and the net savings in expense for a second line. I will put the average increase in subscription fee at \$16 (\$36 less \$20), recognizing it can go lower or higher for some people. I put the savings on second lines at \$6.5 a month on average, because two-thirds of converters did not have a second line (31 million out of 47 million), and \$6.5 is one third of \$20. The average conversion cost, therefore, was \$9.5 (16 less 6.5).

If the subscription fees for broadband are \$40 a month, and someone converts from a \$20 a month dial-up account, then the conversion cost is \$20. I will call that

the maximum conversion cost. That explains why "likely adopters" is truncated at \$20 willingness to pay. For those who paid the maximum conversion cost, the low end of the estimates of willingness-to-pay is just enough to cover the additional cost. If willingness to pay got any lower than this model predicts, that household did not adopt broadband.

More to the point, here is the bottom line: In 2006, converters to broadband received an average of \$16.5 per month in additional benefits in consumer surplus (\$26 less \$9.5). Let's put that in perspective. Against a \$36 price for broadband, this benefit is equivalent to a 46 percent decline in price for converts. Moreover, the 40 million households who converted to broadband since the beginning of the dial-up market received at least an additional \$7.9 billion in benefit in 2006 from their conversion ($\$16.5/\text{month} \times 12 \text{ months} \times 40 \text{ million}$).

These are conservative estimates. First, other researchers found the earliest adopters of broadband were willing to pay far above the market price. The Savage/Waldman estimate also measures some of this "inelastic demand," but truncates the level of that valuation among the biggest fanatics. Second, survey research always finds a larger willingness to pay from users who are (a) paying not to have something taken away after they have experienced it, rather than (b) paying for something they have yet to experience. Savage and Waldman corrected for this effect by surveying both users and nonusers. However, the survey is a few years old, before widespread broadband adoption. The answers about value could be higher if the survey were conducted today among actual users.

The bottom line

The increasing use of residential broadband created at least \$7.1 billion in additional revenue in the GDP for 2006. At the same time, it created at least \$7.9 billion in consumer surplus. That is a \$15-billion-dollar bonus in total, although less than half of it appears in official GDP statistics. Any way you look at it, that looks like a home run.