

Free Software without a Free Lunch or Free Beer

Shane Greenstein
Harvard Business School

Economists like to say that there are no free lunches. How does that attitude apply to free software and services? It is no secret that many prominent platforms give away services, and so do many widely used open-source projects.

The answer should help us understand our world.

While it costs next to nothing to replicate an existing piece of software, someone had to design and debug it in the first place. That takes resources. Therefore, giving away software is not just about making it—to use the lingo of open source—“free as in freedom.” Giving away software really is the same as giving away free beer.

It will sound odd, but free goods and services create challenges for gross domestic product (GDP). In case you forgot what you learned in Econ 101, GDP is the total flow of final goods and services in an economy over a specific period of time (without double counting). Prices play an essential role in adding up the total flow. Stated bluntly, if a service is free, the revenue is zero, and the service contributes nothing to GDP.

That is problematic. Free software leads GDP accountants, as well as many corporate CFOs, to underestimate the contribution of free software to growth. Here is why.

NOT BLACK AND WHITE

Have you ever tried to explain to a child what it was like to experience color television after years of viewing in black and white? It is obvious that the quality of the user experience rose when color deployed. But imagine having the same conversation with a mathematically gifted child who only believes numerical evidence. That comes close to describing a conversation with an economic accountant about free software.

Stay with this metaphor. There is a big insight at the end.

What happened to GDP when color TV replaced black-and-white television? Here is how the conversation goes.

First of all, the price index for televisions primarily measured changes in prices for existing televisions. So, measured prices did not change. TV price indices underestimated the value of doing something that had been previously impossible. So far, says the child, there’s been no improvement at all.

But wait, you stammer, color improved shows. It also led to better ads because color made ads nicer to view and, hence, more effective. Overall, therefore, households watched more TV and bought more televisions, which increased ad revenue and revenue from televisions. Surely that increased GDP. Indeed, it did.

But there is an offsetting effect, says the child. Radio and newspaper ad revenue fell as advertisers switched to television. Creative destruction moved the allocation of ads from one market to another. As it turns out, the biggest effect comes from the increase in sales of TVs, because the amount of ad revenue in the economy tends to stay constant.

What about the increased effectiveness of ads? Surely that showed up in GDP in the form of increased sales for advertised products. Yes, but that came at the expense of sales for non-advertised products, so it was mostly a reallocation and, at most, a small gain.

Find that conversation frustrating?

Here is the promised insight: Similar economic reasoning covers the upgrade from dial-up to broadband, as well as subsequent improvements in bandwidth. The price index for Internet access underestimates the gains from doing something that was previously impossible. The improvement in speed helped providers of content and ads, who improved what they produced. Users spent more time online, and total online ad revenue did grow. The online ads also took away from ad revenue from old media, such as radio and newspapers (though, as yet, it has not yet taken a big chunk out of television), and that reallocation was mostly one for one. On net, these gains improved GDP, but not by much.

It cannot be by much because the sales of television sets and broadband lines are not large. To give a sense of scale, in the US, the former is less than \$30 billion a year (depending on whether you count monitors), and the latter is just north of \$50 billion for households. On a per-capita basis, that is less than \$300 per year per household. That is just not very much economic growth.

In other words, your numerically gifted child will insist that replacing black-and-white with color television did not make you rich. Neither did the improvement in broadband. If everybody sticks to the numbers, the child is right, even though the answer seems to defy common sense.

As an aside, the upgrade from cell phones to smart phones contains similar economics, albeit, with a twist. Smart phones both complement and substitute for other online devices. For example, your Facebook picture, taken and uploaded from your smart phone, also improves your parent's Facebook experience on a PC. Hence, smart phones both substitute for other devices, such as your landline phone and PC, and increase the time on them, as well as on tablets. We are still going through the smart phone transition, so it is not entirely clear how the creative destruction will evolve. Nonetheless, we can be assured of only one thing: the per-capita numbers will be small.

SITUATIONS

We can classify issues with free software by the three types of situations in which they arise: free output, free input, and a combination of both.

Free output is common today. The most prominent examples come from ad-supported web firms, such as Google and Facebook. A major part of their services is free, even though their operating expenses for electricity, datacenters, and internal development run in the tens of billions. Yet, only the revenue from ads shows up in GDP (which displaces other ads). Society also benefits from the main service, which is not a part of GDP.

Gazillions of less-prominent versions of the same phenomenon populate the web. From Weather.com and Reddit.com to Wikia.com, the vast majority of ad-support websites run up expenses on servers and programmers, as well as make revenue selling ads. Only the ad revenue counts in GDP.

Free input also arises frequently in the modern IT economy. That creates another type of distortion. For example, the Android phone makers get their software for free from Alphabet/Google, which does this for numerous reasons; among them, it wants to prevent the iPhone from dominating mobile search. The phone makers still charge for the phone, just not as much as they would have charged if the software cost money. As another example from the same firm, today, the software for machine-learning algorithms has become free. Management strategically decided—correctly, I believe—that somebody else would do this if it did not.

This situation is especially problematic for public policy. Many free software services descended from government-subsidized programs. Society benefits from the free inputs, but nobody knows how much.

By the way, many CFOs have the same problem in another form. They are happy to save the expense by using open-source software, but it also leads them to stop taking inventory (as they do for licensed software). Later on, they have a difficult time explaining to their board how much software exists at the firm and, moreover, why it is a source of productivity.

In the last situation, both input and output are free. Apache and Linux are prominent examples. Supported by foundations, which receive some minimal support from firms, Apache and Linux grow with suggestions from users. Another example is Wikipedia, which is also supported by a foundation that solicits donations. Content comes from volunteers, and the site charges nothing to billions of readers.

Apache, Linux, and Wikipedia create enormous value. Tens of millions of people use the software, and Wikipedia gets billions of views a month. The creative destruction is also high. The software displaces activity that could generate billions in revenue. And, as with smart phones or color TVs, it also raises the value of other parts of the economy where Linux, Apache, and Wikipedia get used intensively. Good luck trying to figure out the net contribution to GDP.

This topic remains complicated because a number of hybrids have grown off the basic models, and these keep evolving. For example, Github provides a substantial set of services at no charge, relying primarily on user contributions. It has attempted to generate revenue with complementary activity, such as talent acquisition. As another example, Nginx is a competitor to Apache for providers of websites with a huge scale of simultaneous transactions. Like many other providers of free software, Nginx maintains a free version with basic capabilities and an “enterprise-quality” version for which it charges. The additional list of hybrids is long and includes YouTube, Yelp, and OpenTable. In some of these platforms, the output came from the users, who provided it for free while expressing themselves on the website. Again, good luck trying to figure out the net contribution to GDP.

CONCLUSION

There *is* some merit to worrying about the underestimation in GDP. That is because free software—as in free beer—has become common. More to the point, try explaining this topic to a CFO or to someone in the executive branch of the US government. I have tried numerous times, and it was a lot like explaining something to a numerically gifted child when the numbers do not come out the right way.

ABOUT THE AUTHOR

Shane Greenstein is a professor at the Harvard Business School. Contact him at sgreenstein@hbs.edu.