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Beyond GDP: How Our Current Metrics Mismeasure the Digital Economy¹

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This paper was prepared for the Markle Economic Future Initiative.

“The Gross National Product does not include the beauty of our poetry or the intelligence of our public debate. It measures neither our wit nor our courage, neither our wisdom nor our learning, neither our compassion nor our devotion. It measures everything, in short, except that which makes life worthwhile.” —Robert F. Kennedy

When President Hoover was trying to understand what was happening during the Great Depression and design a program to fight it, a comprehensive system of national accounts did not exist. He had to rely on scattered data like freight car loadings, commodity prices, and stock price indexes that gave only an incomplete and often unreliable view of economic activity. The first set of national accounts was presented to Congress in 1937 based on the pioneering work of Nobel Prize winner Simon Kuznets, who worked with researchers at the National Bureau of Economic Research and a team at the US Department of Commerce. The resulting set of metrics has served as beacons that helped illuminate many of the dramatic changes that transformed the economy throughout the twentieth century.

But as the economy has changed so, too, must our metrics. More and more what we care about in the second machine age are ideas, not things—mind, not matter; bits, not atoms; and interactions, not transactions. The great irony of this information age is that, in many ways, we actually know less about the sources of value in the economy than we did fifty years ago. In fact, much of the change has been invisible for a long time simply because we did not know what to look for. There’s a huge layer of the economy unseen in the official data and, for that matter, unaccounted for on the income statements and balance sheets of most companies. Free digital goods, the sharing economy, intangibles and changes in our relationships have already had big effects on our wellbeing. They also call for new organizational structures, new skills, new institutions, and perhaps even a reassessment of some of our values.

What GDP Leaves Out

Despite all the attention it gets from economists, pundits, journalist, and politicians, GDP, even if were perfectly measured, does not quantify our welfare. While it would be unrealistic to put a dollar value on stirring oratory like RFK’s, we can do a better job of understanding our basic economic progress by considering some of the changes in the goods and services that we are able to consume. It soon becomes clear that the trends in the official statistics not only underestimate our wellbeing, but in the second machine age they have also become increasingly misleading. In addition to their vast library of music, children with smartphones today have access to more information in real time via the mobile web than the president of the United States had twenty

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years ago. Wikipedia alone claims to have over fifty times as much information as Encyclopaedia Britannica, the premier compilation of knowledge for most of the twentieth century. Like Wikipedia but unlike Britannica, much of the information and entertainment available today is free, as are over one million apps on smartphones. Because they have zero price, these services are virtually invisible in the official statistics. They add value to the economy, but not dollars to GDP. And because our productivity data are, in turn, based on GDP metrics, the burgeoning availability of free goods does not move the productivity dial. There's little doubt, however, that they have real value. When a girl clicks on a YouTube video instead of going to the movies, she's saying that she gets more net value from YouTube than traditional cinema. When her brother downloads a free gaming app on his iPad instead of buying a new video game, he's making a similar statement.

Free: Good for Wellbeing, Bad for GDP

In some ways, the proliferation of free products even pushes GDP downward. If the cost of creating and delivering an encyclopedia to your desktop is a few pennies instead of thousands of dollars, then you're certainly better off. But this decrease in costs lowers GDP even as our personal wellbeing increases, leaving GDP to travel in the opposite direction of our true wellbeing. A simple switch to using a free texting service like Apple's iChat instead of SMS, free classifieds like Craigslist instead of newspaper ads, or free calls like Skype instead of a traditional telephone service, can make billions of dollars disappear from companies' revenues and the GDP statistics.

As these examples show, our economic welfare is only loosely related to GDP. Unfortunately many economists, journalists, and much of the general public still use "GDP growth" as a synonym for "economic growth." For much of the twentieth century, this was a fair comparison. If one assumes that each additional unit of production created a similar increment in wellbeing, then counting up how many units were produced, as GDP does, would be a fine approximation of welfare. A nation that sells more cars, more bushels of wheat, and more tons of steel probably corresponds to a nation whose people are better off.

The U.S. Bureau of Economic Analysis defines the information sector's contribution to the economy as the sum of the sales of software, publishing, motion pictures, sound recording, broadcasting, telecommunications, and information and data processing services. According to the official measures, these account for just 4 percent of our GDP today, almost precisely the same share of GDP as in the late 1980s, before the World Wide Web was even invented. But clearly this isn't right. The official statistics are missing a growing share of the real value created in our economy.

New Goods and Services

In the early days of the 1990s Internet boom, venture capitalists used to joke that there were only two numbers in the new economy: infinity and zero. Certainly, a big part of the value in the new economy has come from the reduction in the price of many goods to zero. But what about the other end of that spectrum, price drops from infinity down to some finite number? Suppose Warner Bros. makes a new movie and you can watch it for nine dollars. Has your welfare increased? Before the movie was conceived, cast, filmed, and distributed, you couldn't buy it at any price, even infinity. In a sense, paying just nine bucks is a pretty large price reduction from infinity, or whatever the maximum price was that you would have been willing to pay. Similarly,

we now have access to all sorts of new services that never existed before. Much of the increase in our welfare over the past century comes not just from making existing goods more cheaply but from expanding the range of goods and services available.

Seventy-seven percent of software companies report the introduction of new products each year, and Internet retailing has vastly expanded the set of goods available to most consumers. With a few clicks, over two million books can be found and purchased at Amazon.com. By contrast, the typical physical bookstore has about 40,000 titles and even the largest Barnes & Noble store in New York City stocks only 250,000 titles. As documented in a research paper that Erik wrote with Michael Smith and Jeffrey Hu, there have been similar increases in the online selection for other categories such as videos, music, electronics, and collectibles. Every time a new product is made available, it increases consumer surplus.

One way to think of the value created is to imagine that the new product always existed, but only at such a high price that no one could buy it. Making it available is like lowering the price to a more reasonable level. There have even been substantial increases in the number of stock keeping units (SKUs) in most physical stores as computerized inventory management systems, supply chains, and manufacturing have become more efficient and flexible. For the overall economy, the official GDP numbers miss the value of new goods and services added to the tune of about 0.4 percent of additional growth each year, according to economist Robert Gordon. Remember that productivity growth has been in the neighborhood of 2% per year for most of the past century, so contribution of new goods is not a trivial portion.

Intangible Assets

Just as free goods rather than physical products are an increasingly important share of consumption, intangibles also make up a growing share of the economy's capital assets. Production in the second machine age depends less on physical equipment and structures and more on the four categories of intangible assets: intellectual property, organizational capital, user generated content, and human capital.

Intellectual property includes patents and copyrights. In addition, a lot of research and development (R&D) is never formalized as in intellectual property but is still very valuable. The rate of patenting by American inventors has been increasing rapidly since the 1980s, and other types of intellectual assets have also grown.

The second—and even larger—category of intangibles is organizational capital like new business processes, techniques of production, organizational forms, and business models.

Effective uses of the new technologies of the second machine age almost invariably require changes in the organization of work. For instance, when companies spend millions of dollars on computer hardware and software for a new enterprise resource planning system, they typically also include process changes that are three to five times as costly as the original investments in hardware and software. Yet, while the hardware and software spending generally shows up as additions to the nation's capital stock, the new business processes, which often outlast the hardware, are generally not counted as capital. Our research suggests that a correct accounting for computer-related intangible assets would add over \$2 trillion to the official estimates of the capital assets in the United States economy.

User-generated content is a smaller but rapidly growing third category of intangible assets. Users of Facebook, YouTube, Twitter, Instagram, Pinterest, and other types of online content not only consume this free content and gain the consumer surplus discussed above but also produce most of the content. There are 43,200 hours of new YouTube videos created each day, as well as 250 million new photos uploaded each day on Facebook. Users also contribute valuable but unmeasured content in the form of reviews on sites like Amazon, TripAdvisor, and Yelp. This content has value to other users and can be thought of as yet another type of intangible capital asset that is being added to our collective wealth.

The fourth and biggest category is the value of human capital. The years that we all spend in schools learning skills like reading, writing, and arithmetic—as well as the additional learning that happens on the job and on our own—makes us more productive and, in some cases, is intrinsically rewarding. It is also a contribution to the nation’s capital stock. According to Dale Jorgensen and Barbara Fraumeni, the value of human capital in the United States is five to ten times larger than the value of all the physical capital in the United States. Human capital has not always been this important to the economy. The great economist Adam Smith understood that one of the drawbacks of the first machine age was the way it forced workers to do repetitive tasks. In 1776, he noted “The man whose whole life is spent in performing a few simple operations, of which the effects are perhaps always the same, or very nearly the same, has no occasion to exert his understanding.”

Important as these intangible assets are, the official GDP ignores them. User-generated content, for example, involves unmeasured labor creating an unmeasured asset that is consumed in unmeasured ways to create unmeasured consumer surplus. In recent years, however, there have been some efforts to create experimental ‘satellite accounts.’ They track some of these categories of intangible assets in the U.S. economy. For instance, the new satellite accounts created by the Bureau of Economic Analysis estimate that investment in R&D capital accounted for about 2.9 percent of GDP and has increased economic growth by about 0.2 percent per year between 1995 and 2004. It’s hard to say exactly how large the bias is from miscounting all the types of intangible assets, but we are reasonably confident the official data underestimate their contribution.

New Metrics Are Needed for the Second Machine Age

It’s a fundamental principle of management: what gets measured gets done. Modern GDP accounting was certainly a huge step forward for economic progress. As Paul Samuelson and Bill Nordhaus put it, “While the GDP and the rest of the national income accounts may seem to be arcane concepts, they are truly among the great inventions of the twentieth century.” But the rise in digital business innovation means we need innovation in our economic metrics. If we are looking at the wrong gauges, we will make the wrong decisions and get the wrong outputs. If we measure only tangibles, then we won’t catch the intangibles that will make us better off. If we don’t measure pollution and innovation, then we will get too much pollution and not enough innovation. Not everything that counts can be counted, and not everything that can be counted, counts.

As Nobel Prize winner Joe Stiglitz put it: “The fact that GDP may be a poor measure of well-being, or even of market activity, has, of course, long been recognized. But changes in society

and the economy may have heightened the problems, at the same time that advances in economics and statistical techniques may have provided opportunities to improve our metrics.” The new metrics will differ both in conception and execution. We can build on some of the existing surveys and techniques researchers have been using. For instance, the human development index uses health and education statistics to fill in some of the gaps in official GDP statistics; the multidimensional poverty index uses ten different indicators—such as nutrition, sanitation, and access to water—to assess wellbeing in developing countries.

These are all important improvements when we heartily support them. But the biggest opportunity is in using the tools of the second machine age itself: the extraordinary volume, variety, and timeliness of data available digitally. The Internet, mobile phones, embedded sensors in equipment, and a plethora of other sources are delivering data continuously. For instance, Roberto Rigobon and Alberto Cavallo measure online prices from around the world on a daily basis to create an inflation index that is far timelier and, in many cases, more reliable, than official data gathered via monthly surveys with much smaller samples. Other economists are using satellite mapping of nighttime artificial light sources to estimate economic growth in different parts of the world, and assessing the frequency of Google searches to understand changes in unemployment and housing. Harnessing this information will produce a quantum leap in our understanding of the economy, just as it has already changed marketing, manufacturing, finance, retailing, and virtually every other aspect of business decision-making.

As more data become available and as the economy continues to change, the ability to ask the right questions will become even more vital. We must think hard about what it is we really value, what we want more of, and what we want less of. GDP and productivity growth are important, but they are means to an end, not ends in and of themselves. Do we want to increase consumer surplus? Then lower prices or more leisure might be signs of progress, even if they result in a lower GDP. And, of course, many of our goals are nonmonetary. We shouldn't ignore the economic metrics, but nor should we let them crowd out our other values simply because they are more measurable.

In the meantime, we need to bear in mind that the GDP and productivity statistics overlook much of what we value, even when using a narrow economic lens. What's more, the gap between what we measure and what we value grows every time we gain access to a new good or service that never existed before, or when existing goods become free as they so often do when they are digitized.