A HOOVER INSTITUTION ESSAY

Beyond GDP

LOOKING DEEPER AT PROSPERITY, PROGRESS, AND THE NATURE OF VALUE

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EXECUTIVE SUMMARY

- **A new contingent-valuation method for measuring quality of life** is presented. The mainstream GDP approach fails to account for technological progress over time and—as the Stiglitz Commission found—ignores liberty, national security, and health.

- Traditional economic measures are based on *value-in-exchange*. The new method measures *value-in-utility* by asking individuals to assess **how much cash the average person would be willing to accept** to give up various goods and services for a year.

- **Fifty-one "super" evaluators participated**, selected from a pool of the most accurate evaluators from an earlier contingent-valuation study.

- **One hundred and one items were evaluated**, including seventy that match data in GDP personal consumption expenditures.

- Utility value of goods and services are nine times higher than expenditures per capita. Because many items are only partial components of GDP categories, that means **gross utility value is likely twenty times higher than GDP**.

- Running water and electricity each had a one-year value of $50,000. Use of a personal computer and internet service were valued at $25,000 apiece.

- **Older and poorer respondents** had much higher utility value estimates than the norm, by 50 to 100 percent.

Introduction

Human society is much richer today than can be measured by traditional economics. Despite the critiques of capitalism that focus on the excesses of the wealthy, the hidden value produced by modern economies has widespread benefits that have been ignored for too long. The best historical data indicates that more than nine out of ten humans lived in extreme poverty in 1820—meaning less than one dollar per day in inflation-adjusted dollars—whereas nine out of ten people live *above* that threshold worldwide as of 2015.

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Yet even that income-based analysis neglects unmeasured progress from innovations, from environmental quality, and from the improved protection of human rights.

Hundreds of innovations—refrigeration, air-conditioning, international travel, and color televisions, to name just a few—that did not exist during the dawn of the Industrial Revolution have gone from being rare luxuries to mass commodities. Thus the paradox: rising *quality* of living standards achieved by falling *quantity* of prices, a commodification process that evaporates the measure of its own impact.

The paradox of unmeasured value is much bigger than you might think. Most students of economics understand that gross domestic product (GDP) is essentially prices multiplied by quantities at the intersection of supply and demand. They understand that there is a "consumer surplus" in the demand-curve triangle above the price line. My claim is that consumer surplus is just a fraction of unmeasured quality of life, or what Adam Smith described as *utility* value. There's the rub: utility value, not exchange value.

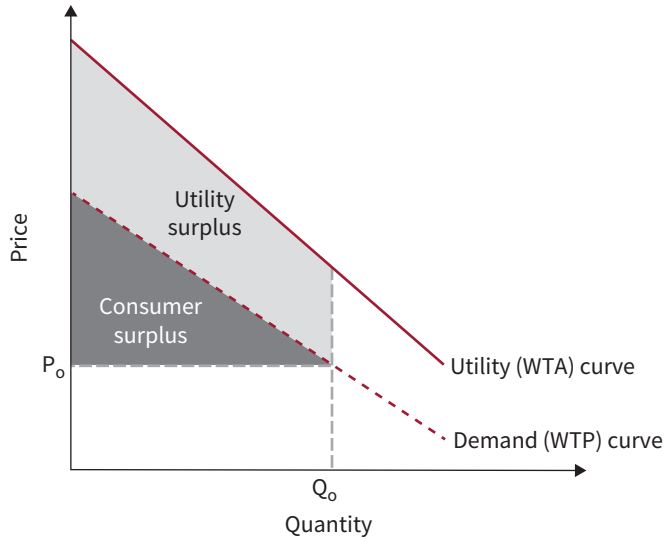
The 2009 Commission on the Measurement of Economic Performance and Social Progress (Stiglitz Commission) explored the weaknesses of GDP as a measure of well-being and concluded with five wide-ranging recommendations. GDP neglects such factors as health and environmental quality, for example. However, the Stiglitz team offered *no clear alternative*. Without an alternative, critics are allowed to eat their cake and have it too, complaining that GDP doesn't measure important things while also complaining its underlying incomes are distributed unfairly.

This project introduces a novel quantitative measure of quality of life—beyond GDP. In the simplest terms, I asked a diverse group of Americans to place dollar values on giving up tangible and intangible things (known as "willingness to accept" values, or WTAs). WTAs are stated preferences, different from the easily measurable prices paid in markets. The idea is somewhat controversial among academics who debate whether this approach—known as contingent valuation (CV) in the economics literature—is reliable.

In order to confirm the validity of the CV method, I conducted an earlier study to assess and refine it. Before that, I developed a series of lab experiments with a colleague to affirm the validity of different "willingness to pay" values (WTPs) and WTAs. Once the method was set, I assembled a list of 101 items that are used widely in the United States. Some of these items are included in GDP, but some are intangible. Many of the items are goods and services that are timeless (fresh fruit, prayer, education), but most can be understood as technological innovations that were introduced at some point in history. Most of these were invented in the past century, such as television, air-conditioning, and the internet.

Based on this research, there is a vast amount of hidden value in American society that is more than *twenty times larger* than measured GDP.

Figure 1. Utility is more than consumer surplus. WTA versus WTP curve.



WTP, WTA, and Utility

Scholars have long puzzled over how to measure changes in living standards. Basic indicators such as per capita GDP, median incomes, and median wages are essential starting points but can paint a distorted picture of well-being. Most aspects of modern living—such as internet apps, improved human health, and civil rights—are worth far more than they cost. Steven Pinker summarized the puzzle in his 2018 book, *Enlightenment Now*: "The combination of better products and new products makes it almost impossible to track material well-being across decades and centuries."[1]

This is nothing less than a fatal flaw in our ability to think coherently about economic progress, and it leads to profoundly flawed critiques of capitalism, particularly the debate about wealth inequality. Economists have long known this but have not been able to overcome the challenges of measuring qualitative living standards. They have instead generally fallen back on more easily quantifiable income measures, despite their flaws.

This evaluation project presents a resolution of the paradox: a newly developed analytical tool to assess hidden value in things currently measured poorly or not measured at all. My approach is rooted in the diamond-water paradox, which was famously described by Adam Smith in his 1776 book, *The Wealth of Nations*. Smith recognized that there was one type of value in *utility* and another type of value signaled by prices in *exchange*. He noted that commodities that were plentiful, such as water, had high utility but low exchange value, whereas luxuries, such as diamonds, had high prices in the market but essentially zero utility. Smith's lack of sentimentality is rather harsh (he was dismissive of the utility of sentimental goods), but his distinction is our launching point.

Economics is dominated by measures based on value in exchange, primarily the demand curve that accounts for the WTP for a good. The existence of a higher utility value is often misunderstood as the consumer surplus enjoyed by some whose WTP exceeds the market price. It is more accurate to think of utility value as existing *above the demand curve*. This value can be drawn as a higher curve that represents WTA payments to give up something (figure 1).

A gap between WTA and WTP values has been documented in lab experiments and public surveys. Many believe it can be explained by the *endowment effect*, an explanation offered by Richard H. Thaler, a pioneer in behavioral economics who was awarded a Nobel Prize. However, the endowment effect has been overinterpreted, and further research has shown that it often disappears for commodities and appears elsewhere when people are not even endowed. The lay public has been led to believe that the WTA–WTP gap represents a flaw in classical economics because humans, unlike textbook models, have irrational behaviors. This is a massive claim, and it is wrong.

Consider an alternative explanation to why the gap might exist. A budget-constrained homeless man cannot afford an icy cold Coca-Cola on a hot summer day. His measured WTP is zero. Does that mean his desire for the good is irrational? Of course not. The WTA perspective suggests his utility value of the cold drink and other things will *always be higher*—sometimes much higher—than the WTP perspective revealed by expenditures. Indeed, there is a rich literature on contingent valuation (that is, stated preferences) that recognizes that the WTA of some things can even approach infinity.

The Super Evaluators

In the first stage of this research, I conducted a national survey contest that asked participants to state their WTA preferences for a handful of goods. They were asked the valuation questions in three stages: first, how much they personally valued the items; second, how much they estimated the typical person valued the items; and third, a repeat of the second-stage question with a prize offered to the one hundred respondents whose guesses were closest to the median response. The study was approved by Stanford University's Institutional Review Board for research involving human subjects. More than one thousand Americans participated in the contest.

That study confirmed that an open-ended elicitation technique can be improved with median guessing. Use of open-ended elicitation has become rare in the CV literature because of concerns about extreme responses ("protest zeros"), but the study showed that extreme responses occur far less when the question is framed as median guessing. For example, the first-stage study found that the frequency of zero responses to WTA questions dropped by two-thirds when median guessing was the framework. Likewise, large extreme outliers dropped by two-thirds. Furthermore, the results found consistently higher and more

variable WTA valuations relative to the flatter WTP values, indicating that "high" WTAs cannot be dismissed as irrational. The gap is plainly not driven by confusion or protests from a few outlier respondents; rather it represents a consistent pattern in how people think about *utility* over exchange value.

I invited the most accurate evaluators to participate in this more in-depth survey, and fifty-one people agreed. The second stage of this project was designed to cover a wide range of goods in the modern economy. These goods included many intangible services, rights, and other things that are part of life in a modern society but that are not for sale—things that are of capitalism but not in the market, per se, such as voting rights, lower mortality, security, privacy, and environmental quality.

The Question

> *What is the minimum cash the average person would be willing to accept to give up and not use the following things for one year? Please consider each item in isolation, as if it alone is being given up.*

How valuable is fresh water delivered via indoor plumbing? The "cost" of clean tap water across the United States is roughly half a penny per gallon, which is surely far less than the actual value consumers get from it. You might accept no less than $10,000 to give up indoor plumbing for a year.

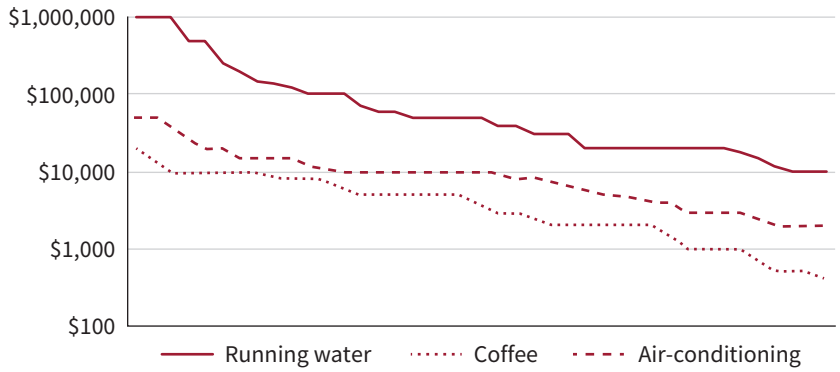
How much money would you accept to give up modern public goods such as highways, police, or parks? How much is air-conditioning worth to you? What about antibiotics and other prescription drugs? Recorded music, movies, and cable television? How much would you have to be paid to surrender the internet for a year?

The project used the WTA question (above) to quantify utility value, which I anticipated would be above market prices. For example, the annual expenditure on televisions was $105 per person in 2019, according to detailed GDP data. Yet the median WTA stated by the super evaluators was $12,000. That's a ratio of expenditure to value of 1 percent, meaning the hidden value is one hundred times higher than what is reported in GDP.

Given the large gap, one can see how assessing utility values will inevitably be controversial. Market prices are easy to see, because every buyer pays the same amount. In contrast, the WTA cash to give something up will (and should) vary widely. When we ask for individual WTAs for numerous goods, services, and intangible items such as improved health, leisure, and civil rights, the results will have large average values and large standard deviations.

When I first looked into this line of research, I began with lunch conversations with my Stanford colleagues and dinner conversations with friends and family. It's a great conversation starter: How much is plumbing really worth to you? Would you be willing

Figure 2. Super valuation for running water, coffee, and air-conditioning (trimmed)



to give up electricity in your home for $1 million? I asked my mother during a long phone call the question about giving up air-conditioning for a full year. She thought for a moment and very matter-of-factly said, "$9 million." I laughed out loud: "Mom! Are you saying $8 million wouldn't do?" Then she reminded me that she lives in central Florida.

Even though the super evaluators that were identified and selected for this survey excel at understanding the typical American's WTAs, they still reported a wide range of responses. Removing the most extreme responses—a statistical process known as trimming the data by 5 percent on each tail—allowed me to calculate average WTAs that are comparable to median responses. Figure 2 shows the middle 90 percent of super evaluation WTAs for three different goods. The value of running water inside the home ranged from a high of $1 million to a low of $10,000.

If the devil offered my mother a bargain of $11,446 to give up air-conditioning, she has every right to turn him down. But the average American would take the deal. For coffee, just under $5,000. A year without showers, toilets, and all the modern wonders of indoor plumbing? That would cost the devil quite a bit more.

101 Things: What to Evaluate?

This study included 101 items to be evaluated. Choosing which things to evaluate was an interesting challenge because I wanted to identify things that are widely utilized so that they could be appreciated by everyone, even if their utilization is not universal. Automobiles and televisions are well-known goods, for example, while banking and garbage collection are well-known services. But I also wanted to consider non-GDP things such as free speech and leisure time.

Since the motivating issue here was mismeasurement of GDP, the bulk of items selected for inclusion were either listed verbatim or components in the consumption data that

are published by the US government. The final items selected include seventy that are consumption related and thirty-one that are beyond GDP, as shown in table 1.

Table 1. Categories of evaluated items

	No. of items
GDP durables	24
GDP nondurables	21
GDP services	25
Public goods	11
Rights	8
Senses and abilities	8
Status/other	4

United States GDP at the time of the study was $22.1 trillion.[2] This is measured by total expenditures, two-thirds being personal consumption expenditures (PCE). Investment accounted for another 18 percent of GDP, though that is largely business, not residential. Government (federal and local) made up another 18 percent of GDP (note: this does not include transfer payments such as Social Security and other redistribution programs, so as to avoid double counting). Finally, net exports were included, but these tend to be negative, meaning that the United States imports more than it exports to the tune of roughly $1 trillion. Table 2 highlights the main categories and a few subcategories.

Table 2. Overview of GDP (2021)

	$ billions	*% of total*
Gross domestic product (GDP)	**22,062**	**100**
Consumption	**15,070**	**68**
Durable goods	1,941	**9**
Motor vehicles and parts	663	**3**
Nondurable goods	3,278	**15**
Clothing and footwear	419	**2**
Services	9,851	**45**
Health care	2,465	**11**
Investment	**3,920**	**18**
Residential	1,051	**5**
Government	**3,947**	**18**
National defense	906	**4**

Source: US Bureau of Economic Analysis, GDP Report Q1 2021, Table 3.

Annual expenditures on specific goods and services are published by the US Bureau of Economic Analysis.[3] I used the reported expenditures for the fourth quarter of 2019, which predates the COVID-19 pandemic and its associated distortions in consumption patterns, in current dollars.

In order to compare how much is spent on items relative to their utility value, I made sure to ask the WTA in terms of giving items up for a whole year and contrasted that with annual expenditures per year. This study focused on identifying goods and services that are found in GDP categories of consumption and government. There are three subcategories of consumption: *durables* such as automobiles, *nondurables* such as clothing, and *services* such as health insurance. Two dozen products in each consumption subcategory were included in the survey list. I made sure to include items that were invented and became widespread throughout recent decades such as antibiotics (1928), microwaves (1945), personal computers (1977), the internet (1995), and streaming video (2007).

For government-related items, I listed things that are not detailed as expenditures in the data but are better understood as public goods for which government has a central role in securing, if not providing: education, peace, police, voting, clean air, highways, nature (parks), clean rivers and lakes, and streetlights. Some of these items can be considered in the context of government expenditures, although the government is only partly responsible, through regulations and enforcement, for their quality.

Lastly, I included intangible categories that cannot conceptually be included in GDP at all: *senses and abilities* such as hearing, *natural rights* such as privacy, and *status goods* such as personal body attractiveness.

The full list of 101 items is presented in the appendix to this report. The next few sections provide a summary and categorical review of the results.

Results

This study found that the utility value of many goods and services is one hundred times higher than what is being measured in terms of prices and government GDP data. The median WTA for using an automobile for one year is $20,000. That's about twelve times higher than the average annual expenditure on automobiles. Most durable goods had WTAs that were far higher relative to expenditures. Computers had the highest absolute WTA of all durable goods considered, with a median value of $25,000 (and an average of $60,341), which was more than one hundred times the expenditure per capita.

Table 3 shows some of the durable goods, ranked in order of average WTA. It includes a column showing the ratio of expenditures to median WTAs (E/WTA). More than half of the durable goods had what I call *extreme* value with an E/WTA ratio of 0.01 or lower.

Table 3. Utility value of durable goods

Item	*Average WTA ($)*	*Median WTA ($)*	*Expenditure per capita ($)*	*E/WTA*
Computer	60,341	25,000	173	0.01
Glasses and contact lenses*	40,573	12,000	117	0.01
Automobile*	31,537	20,000	1,591	0.08
Television*	23,720	12,000	105	0.01
Refrigerator	22,856	10,000	148	0.01
Light bulbs and lighting fixtures	20,317	10,000	136	0.01
Smart phone	17,673	10,000	173	0.02
Air-conditioning	11,446	10,000	148	0.01
Large, color television	9,678	5,000	105	0.02
Clocks and watches	8,324	5,000	42	0.01
Microwave	3,876	2,500	29	0.01
Jewelry*	1,780	1,000	190	0.19

** Indicates survey items with the verbatim description from personal consumption expenditures.*

Durables and nondurables had similar E/WTA ratios of 0.06, considering only verbatim items. Service items were relatively less valuable, with a ratio of 0.13. There weren't as many nondurable and service items with extremely high relative WTAs (defined by an expenditure ratio of 0.1 and lower). Shoes and coffee were the two extremely valuable nondurables. Running water, electricity, internet service, and trash collection were the extremely valuable services.

To make fair comparisons, I listed items in the survey using verbatim descriptions from US data on PCE, which in table 3 include "glasses and contact lenses" and "jewelry." Items without verbatim listings in the survey were matched as closely as possible, resulting in an E/WTA ratio that was potentially overestimated or underestimated to some degree, depending on whether the survey item was a *component* of the PCE category or *overlapped* multiple categories.

For an example of the component effect, PCE reports expenditures of $45 billion on "Clocks, lamps, lighting fixtures, and other household decorative items." The per capita expenditure on all these things was $136. However, the survey asked for the WTA for the use of individual items, and the median response was $10,000 for "light bulbs and lighting fixtures."

Measuring the value of time—clocks and watches—required the inclusion of a survey item that overlapped two categories in official consumption data. This overlap effect

Table 4. Average and median WTAs for selected non-GDP items

Category	*Item*	*Average WTA ($)*	*Median WTA ($)*
Senses and abilities	Sense of sight	492,439	200,000
Rights	Privacy	246,305	50,000
Public goods	Education for your children	215,976	40,000
Status/other	Body attractiveness	40,715	15,000
Rights	Free speech	64,885	10,000

would be easy to control if both categories were discrete, but in this case "watches" was a discrete category with $14 billion in annual expenditures, but "clocks" was a component associated with lighting fixtures. This overlap effect will inevitably cause an underestimate of the E/WTA ratio by not fully including all expenditures. There are even some cases of verbatim items (such as automobiles) that necessarily overlap with other things (e.g., gasoline, maintenance, parking, registration fees, and road tolls). For full details, the treatment of each item in the survey is shown in the data appendix.

The most fascinating discovery is the large WTA for things that are not fully or even conceptually included in GDP. There are no expenditures for most of these items, so there's no way to contrast their utility values. However, the absolute value of median WTAs was striking. Consider the following examples from table 4, where the average values are remarkably high multiples of the medians—far higher than was expressed for GDP items.

Public Goods

Public goods are a category that is partially measured in GDP in terms of things like highways, clean air, and nature (parks). Also included in this category are voting, police protection, and peace (the absence of weekly riots). The median WTAs of surveyed items ranged from $2,000 for overhead streetlights to $40,000 for education for children. These were higher values than most tangible goods.

Two of the public goods in the survey—national defense and national electricity—are uniquely national in the sense that they cannot be atomized to the individual. As expected, the WTAs of these two very public goods were so large that they dwarfed everything else. National defense had a median WTA of $150,000 and an average of $41 million. Electricity for the entire country had a median WTA of $1 million, which is twenty times larger than the median WTA for personal utility of electricity.

The wording of the two environmental goods helped get at the value in question. Asked alone, the value of "clean air" is ambiguous, and so the survey phrased its absence as "a mild smog is in the air outside." Since most people are unaware of details about various

particulates and chemical pollutants in the atmosphere and the scale of their health effects, describing air pollution as mild smog was a way to make the choice more understandable. The median WTA for clean air in this sense was $10,000, on par with having a furnace or having half the square footage of your home. Clean local rivers and lakes, phrased as "unswimmable mild pollution" was valued at $5,000, which was the same value assigned to high-speed internet service.

Government's role in providing public goods is complicated, since many public goods exist in the absence of government. Environmental quality, for example, occurs naturally but is *protected* in part through government regulation. And many public goods are provided in the marketplace. Education is a good that is offered in private as well as public schools. In a similar sense, highways are almost entirely engineered and built by private companies at public expense but can also be managed privately through usage fees. More to the point, none of these public goods can be equated to GDP expenditures by government. There are multiple reasons that such comparisons are complicated, but one of the most fundamental is that the amount of government expenditures is not as impactful as the quality and enforcement of rules. To take one small example, research indicates that the best way to reduce carbon-based energy is to tax it, not to provide government subsidies for alternatives.

The Five Senses

I found the highest values by far in the category of senses and abilities: $100,000 apiece for hearing, speaking, and the ability to walk, and $200,000 for sight. This is interesting because basic human abilities have been unchanged for centuries, and so it could be argued that technological progress via economic growth is not so important. However, the counterpoint is that medical and health advances that have flowed from economic progress are more important than ever. Regardless, the extraordinary utility value from top to bottom of this category is consistent, although it is interesting to see a ranking of the value of the five senses.

Interestingly, the sense of hearing had an *average* WTA that was nearly 20 percent more valuable than the sense of sight, though sight had a higher *median* WTA. Those two senses were considered the most valuable, followed by touch, then taste, and then smell. Notably, the combined WTAs of touch, taste, and smell were less than the WTA of either sight or hearing alone.

The ability to speak was considered as valuable as the top senses, with a median WTA of $100,000. The ability to walk had the same value of $100,000. These are remarkable in that each ability alone is considered worth twice as much as the most valuable item in GDP (running water). Sleeping comfortably was something valued very highly at $25,000, though this is difficult to categorize as a natural ability, given that a peaceful rest combines elements of health along with social stresses. The ability to read has a median WTA of $20,000, which by comparison is equal to the utility value of automobiles.

Rights

What Americans think of as their natural rights are explicitly stated in the US Constitution, and these were found to be held very dearly in the survey. But many implicit rights were even more valuable than the explicit ones. Legal autonomy, in the news lately with certain celebrity cases of coercive conservatorships, was considered as valuable as six other rights combined. The survey described this as the "right to make your own decisions/legal autonomy," and it had a median WTA of $100,000.

Privacy was valued at $50,000. Free speech was one-fifth as valuable, at $10,000. Interestingly, the "right to borrow money, including new loans or credit" was considered slightly more valuable than the "right to own a gun" as well as the right to "attend church or other religious services."

The survey also asked about leisure time, which has become an interesting dimension of study in economics literature in recent years. One hour of leisure or free time per day had a median WTA of $6,570 in this study.

The valuation of rights stands in stark contrast to private and public goods because rights can be had at no cost. The recognition of rights depends entirely on the laws and civic behavior of citizens, not on wealth. A materially impoverished nation can be richer in rights than an opulent one.

Status and Social Goods

Although America is known as a classless society, in America *status* is an intangible state of being that defines an individual's worth only within a social environment. Class is a part of status, less important perhaps than a person's integrity, wisdom, and virtue, but certainly it has a material aspect. The idiom "keeping up with the Joneses" refers to a neighborhood benchmark for material success. Somewhat ironically, it originated as the title of a comic strip that was popular a century ago.

To be sure, status is intertwined with material goods and services, so it has been included in the study. Economists have understood status goods—Rolex watches, Gucci handbags—as the defining elements of conspicuous consumption. And we don't travel to France just for the experience, but also for the bragging rights. However, I wanted to isolate that aspect of immaterial status that matters so much to people, even if its definition can be elusive. The survey asked two questions about social status and two more about social goods in a more personal sense.

Taking the issue head-on, the first item asked for the WTA of giving up "status (significantly less respect for you in your community)." The median response was $10,000. A second type

of status—body attractiveness—was even more valuable; it commanded a WTA of $15,000. That's higher than the value of television.

People valued social goods that were more personal even more than those that were conspicuous. No contact with a best friend was valued at $15,000. Even more valuable was human touch. The median WTA to give up physical human contact was $20,000. This final item, if you can imagine not hugging loved ones for a year, had one of the highest response variances, with an average WTA nearly five times higher than the median. The average person would rather do without electrical power than without hugs.

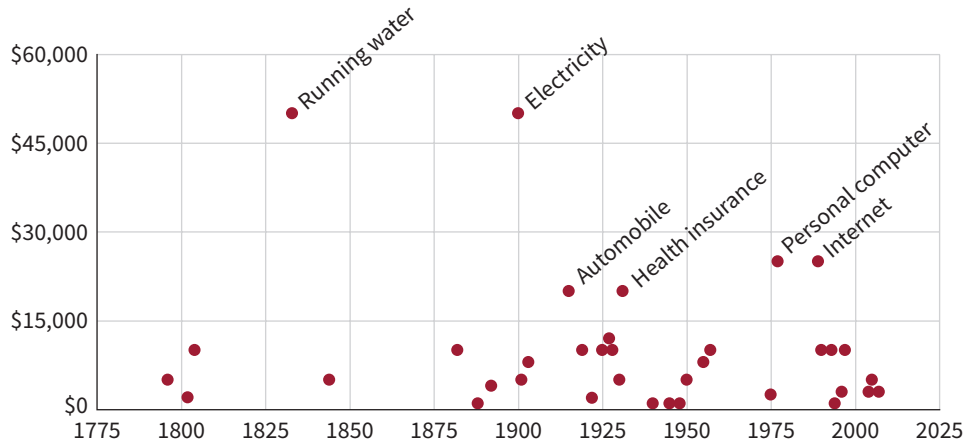
Evidence of Progress?

While many of the most valuable things in modern life are actually quite ancient in origin, the lay public can probably be described as technology optimists in that they share an undercurrent of confidence that tech inventions are making life better. Indeed, Americans in particular like to reinforce the narrative of entrepreneurs such as Thomas Edison and Steve Jobs—plucky young misfits who grew up to become successful industrialists. Light bulbs, assembly lines, and smart phones are the symbols of progress. This study made a point of identifying dozens of items that were invented and became widely used.

I defined the innovation year of an item as the year it was adopted by 10 percent of American households. This tabulation is possible only with good household survey data. As this was more common in the twentieth century than before, it could be difficult to pinpoint when the threshold was passed for something like electric light bulbs and plumbing, particularly because refinements to crude early versions were as gradual as the diffusion was irregular. In the case of plumbing, the White House Historical Association reports that Thomas Jefferson installed a cistern with wooden pipes, but it wasn't until Andrew Jackson added iron pipes and a bathroom in 1833 that we could say proper plumbing arrived. And although Edison's discovery of a functional light bulb filament occurred in 1879, the extension of the electrical grid into over half of US homes took another half century, so I mark the invention at the midpoint in the year 1900.

Figure 3 shows a utility value time line. I assigned a year of innovation for as many items as possible, and thirty-four goods and services could be fairly dated to a specific year in the United States between 1776 and the present. This amounted to roughly half of the GDP items and a couple of public goods. The majority of these innovations happened in the past century, and the vast majority earned median WTA valuations of $15,000 and below. However, the two most highly valued innovations, valued twice as high as everything else, were older. Household running water (1833) and household electricity (1900) both have a median WTA of $50,000, and perhaps it should be noted that the *average* WTA of running water, at $147,000, was the highest by far.

Figure 3. Utility valuations of household innovations in the United States



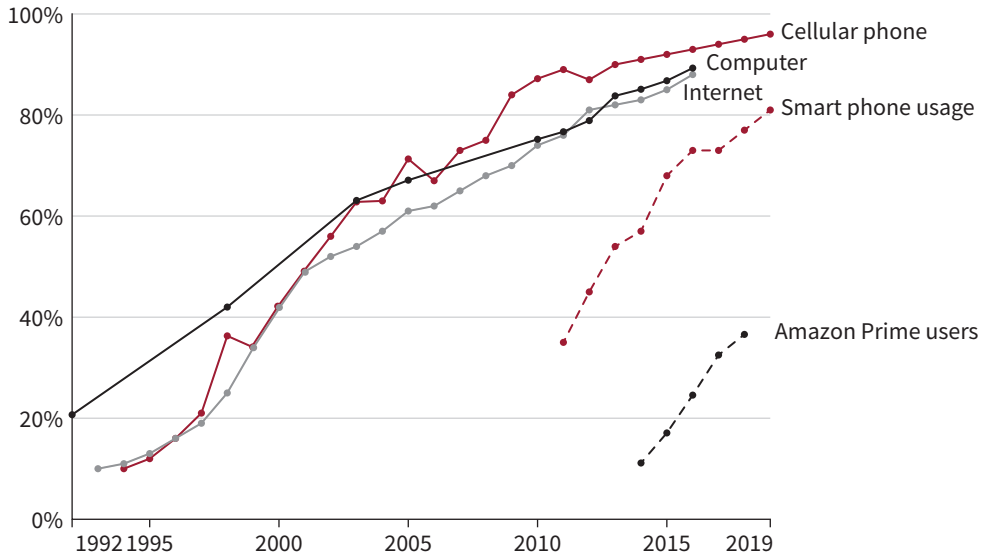
Information technology has grown in importance in modern life, taking up a bigger proportion of household expenditures as well as time in our days. The rapid diffusion of all of information technologies across all income classes has been intense, as figure 4 shows.[4] I selected ten tech items, which were predominantly services along with a couple of vital durable goods—the personal computer and smart phone. And as you might expect, to pay people to do without any of them would require very large sums relative to what is actually spent in the marketplace. Consider a summary of each in chronological order:

- *Personal computer.* When Steve Wozniak introduced the Apple II in 1977, he launched the modern tech revolution in the American household. Currently, the median estimate of the amount of cash it would take to pay people to give up using the personal computers in their home is $25,000 (and the average WTA estimate is $60,341).

- *The internet.* Invented by American academics along with support from the Defense Advanced Research Projects Agency, the internet was first commercialized in 1989 when British computer scientist Tim Berners-Lee developed the hypertext protocol, allowing for what came to be known as the World Wide Web. In 1995, it went mainstream in the United States. It's median utility value today is an estimated $25,000 per person ($39,805).

- *Email.* Asynchronous electronic messaging evolved hand in hand with computer networking in the 1960s. Email has come to be in multiple formats: software (technically a durable good), webmail, and a ubiquitous free app. I decided to pinpoint its innovation in 1990, the year I first saw and purchased a CompuServe account. Although email accounts are now free, their WTA is $10,000 ($13,680).

Figure 4. Diffusion of information technologies. Share of US households using specific technologies, 1992–2019.



Sources: Data from Diego Comin and Bart Hobijn, "Cross-Country Technology Adoption: Making the Theories Face the Facts," *Journal of Monetary Economics* (January 2004): 39–83, and others. Chart from Our World in Data, https://ourworldindata.org/technology-adoption, used under CC BY 4.0.

- *Cellular telephone services*. Cellphones evolved very rapidly in the 1980s and 1990s, but digital (so-called 2G) cellular service emerged in 1993. Today it is valued at $10,000 per person ($20,227).

- *Amazon.com*. Founded in 1994, the e-commerce company started as an online bookseller and has grown to become a transformational global marketplace that dwarfs most national economies. My survey tended to ask about general categories of tech goods (e.g., social networking, not just Facebook), but treating Amazon specifically here assesses its utility even in the context of alternative e-commerce venues. The median utility value for being able to access Amazon.com for one year is $1,000, and the average WTA is nearly triple that amount ($2,775).

- *Global Positioning System (GPS) and mapping apps*. MapQuest launched in 1996, and a handful of competitors soon proved to be an essential—arguably *the* essential—application for mobile smart phones. Today, mapping apps are integrated into giant technology company application suites, include Apple and Google. The WTA for GPS and mapping apps is $3,000 ($4,184).

- *Smart phone*. There were other smart phones before it, but Steve Jobs's iPhone was introduced in 2007 and changed everything. People could still go back to pagers and

voice/SMS flip phones, but the integration of computing power and applications in a handheld device has a current median WTA of $10,000 ($17,673).

- *Social networking.* Facebook was started in 2004 and became the leading company in a rapidly shifting new platform technology. Giving up all social networks would require a payment of $3,000 per year, according to our median estimate ($6,404).

- *Internet access at high speed.* In 2005, a decade after the internet was commercialized, service providers started offering much faster and larger data plans that enabled video and music services. These allowed downloads at first, then expanded to allow streaming. The value of higher speeds is an estimated $5,000 ($13,148).

- *Streaming video.* I was tempted to ask about Netflix alone, which supplemented its digital video disc (DVD) mailings with an online streaming capability in 2007. In recent years, there has been a proliferation of streaming services—Hulu, Apple TV+, Paramount+, and dozens more. The whole category is valued at $3,000 ($5,211).

Rich Values, Poor Values

Older evaluators tended to have much higher utility values than middle-aged and younger evaluators. One-third of the study participants were age 60 and over, and their WTAs were 70 percent higher than the norm. Making such comparisons could easily be clouded by taking averages, even trimmed averages, given the relatively small sample size of demographic subgroups with a total study size of fifty-one. Therefore, the demographic differences were calculated not by taking averages but rather by taking the median value of each subgroup for each item. Furthermore, those medians were normalized relative to the overall median for each item. For example, the personal computer had an overall median WTA of $25,000, which was the same median expressed by the participants age 18–39, so that group's normalized value was 1. The participants age 40–60 gave computers a median value of $45,000, and the seventeen participants older than 60 gave a median response of $50,000, for normalized values of 1.8 and 2.0, respectively.

Normalized values were calculated for all 101 items, with the surprising result that the oldest cohort expressed WTAs that were 1.70 on average, or 70 percent higher than the norm (see table 5). By contrast, the middle-aged cohort had WTAs that were 23 percent higher than the norm, and the youngest cohort was 21 percent lower. This does not mean that older Americans value things more, at least not necessarily. Rather, it means that older people have a higher estimate than younger people of the typical person's WTA valuation of things in general. This could of course be explained by biased perceptions related to health, on the theory that less healthy people value things in life more, or relatedly to a sense of mortality. Alternatively, the WTA age gap could derive from an appreciation effect—that is, appreciating the experiences of material progress firsthand. Older Americans

Table 5. Relative median WTAs by demographic cohort

	Age			*Income*		*Childhood income*		
	18–39	*40–60*	*60+*	*High*	*Middle and low*	*High*	*Middle*	*Low*
All items	**–21%**	**23%**	**70%**	**–20%**	**83%**	**–12%**	**4%**	**133%**
Durables	–23%	15%	79%	–17%	81%	–19%	6%	87%
Nondurables	–20%	21%	38%	–19%	67%	–8%	8%	82%
Services	–19%	45%	99%	–17%	90%	–3%	12%	119%
Public goods	–14%	1%	101%	–15%	111%	–22%	–5%	351%
Rights	–38%	1%	79%	–26%	125%	–26%	–10%	186%
Senses and abilities	–19%	27%	35%	–22%	55%	–25%	–8%	197%
Status	–19%	13%	30%	–25%	52%	–16%	–6%	102%

lived through the invention and domestication of many goods considered, whereas younger Americans may take microwaves, refrigerators, and big-screen TVs for granted.

This elder effect on WTAs was consistent across categories, including items beyond GDP. There were 79 percent higher valuations for durables, 38 percent for nondurables, and 99 percent for services. Public goods saw an even larger effect at 101 percent. There was a consistently lower WTA valuation across categories by the younger cohort, especially for rights, at 38 percent below the norm. The effect was consistent within categories but far from universal across all items. Above-average valuations by older participants were observed for sixty-three items.

An even sharper contrast in valuations was observed between income cohorts, and it should be noted that the survey employed two different income demographic questions. The first income set divided participants into three income classes based on their responses to a question about whether their household's current income was "above, near, or below" the national average. A second question asked respondents about their childhood household's income with the same three options. There were very few (three) participants who have below-average incomes currently, but a sizeable proportion with below-average childhood incomes (ten).

The surprise revealed by looking at income cohorts is that wealthier people tended to report lower utility valuations, middle-income people tended to report valuations very near the norm, and poorer individuals reported valuations that more than double the norm. This income effect on utility valuations is highly consistent across items and is especially large for non-GDP items. For example, poorer respondents valued public goods 351 percent higher than the norm.

Background and Pitfalls

Economists have always known that GDP is an imperfect measure of an economy, just as income is an imperfect measure of welfare. Simply put, a poor man can be far happier than a rich man due to many noneconomic factors, notably health, friendship, and quality of life.

The progressive French economist Thomas Piketty argues that GDP is distributed less equally in free-market economies than socialist economies, even if the proverbial pie is larger. A separate progressive critique by Cambridge professor Diane Coyle holds that the obsession with economic growth neglects the health of the planet and human happiness, making it "the primary symbol of what's gone wrong with the capitalist market economy."[5]

In 2008, French president Nicolas Sarkozy asked a trio of economists, including Joseph Stiglitz, to lead a commission of experts that would reevaluate GDP and recommend alternative measures of social progress. The final report of the Stiglitz Commission was published in September 2009; it included five wide-ranging recommendations *but no specific alternative*. It was more of a list of GDP's problems than a solution to those problems. Thus, the public policy debates remain unchanged. Progressives maintain something of a moral high ground with emotional appeals to inequality of income while unironically debasing arguments that point to improving incomes among the poor because of what income doesn't measure.

Meanwhile, a separate field of economics emerged that I believe can resolve the inequality paradox: behavioral economics. The promise of studying actual behavior and incorporating human psychology into simple economic models was pioneered by Richard H. Thaler, Daniel Kahneman, and Amos Tversky. Behavioral economics was meant to enrich the standard assumptions but is today usually used as a punchline to ridicule the economic assumption of human rationality. Sadly, this is often an excuse for policy wonks to suggest limiting consumer choice and giving a central planning "nudge" to citizens. But the field's central critique of crude rationality is itself based on a crude caricature.

Starting with a seminal paper in 1990 by Kahneman and coauthors, new concepts such as "loss aversion" are now incorporated in what is known as "prospect theory." At its core, this theory suggests that the rational agent at the heart of "standard economics" has perfect knowledge of a good (e.g., a coffee mug or pen in the seminal paper) so that someone would buy the good for the exact same price that they would sell it. When numerous experiments revealed a gap between the prices of an individual's willingness to pay (WTP) and willingness to sell (WTS) an identical item, the myth of the great flaw in economics began flying around the world. Although plenty of economists pointed out that the gap is entirely rational for a variety of reasons (Michael Hanemann wrote a definitive theoretical response in a 1991 *American Economic Review* article), the rich literature about the valuation

gap has yet to be applied to a better understanding of quality of life.[6] The fundamental reason that WTS is larger than WTP is that market prices do not capture all of the value a person gets by consuming a good, only the cost of getting it.

Pitfalls

There will be objections to the WTA approach, and only partly because the lay public has been led to believe that any WTA–WTP gap is a sign of irrationality. Among economists, the use of contingent valuation is a niche field. It has been the topic of high-profile debates about validity precisely because WTA valuations can seem unbelievably higher than observable prices in the market. The only remedy for those objections is to expand the scope of studies such as this so that the results are shown to be robust and statistically significant.

A more technical objection is that the entire economy can never be measured in terms of WTA. Not only is the sheer number of goods impossible to survey, but also the conceptual structure of WTA is different from WTP in this way: goods and services are *nested*. For example, you might have four or five goods that are all necessary to make the final product usable. Driving a car requires more than the car, it requires gasoline too. And roads. The utility of an automobile can only be optimized with myriad other small goods and services. It is easy to see the prices of those myriad goods but difficult to disentangle their WTA values if each is essential. In this example, if driving a car for a year has $1 million of utility value, then each essential component can show up as being worth $1 million. This means that WTA values are not additive, rather they are nested. This is why there can be no comprehensive WTA account that is parallel to GDP.

Electricity is the ultimate nest. Most goods and services in the modern economy rely on electricity, and as a result we should find that it has a WTA for it that encompasses all the nested goods that rely on it. The median WTA estimate for electricity in this study was $50,000, whereas nested goods such as microwaves ($2,500) and air-conditioning ($10,000) were lower. Here the thinking gets tricky, because the human brain cannot help but instinctively think of substitutes. In the study, many questions were framed as giving up goods for use *in the home* that inherently suggests people can consume these goods at work or even next door. I made sure to ask an extra question about the WTA of "electricity in the entire country" and got a median WTA that affirmed its ultimate nested value of $1 million.

One of the affirmations of the validity of WTA research is to find evidence of nested value in descending order. This is why a handful of our items were duplicates. There were four different "television" questions and a half dozen questions at the intersection of internet and cellular technology. The broadest television question was phrased in the survey as "television or any video technology" and received a median utility of $12,000. A "large, color television" was valued at less than half that ($5,000) and "cable channels" was even less ($1,000). "Streaming video services" was valued at $3,000 and "family videos" at $1,000.

The way to think about the total scale of utility value in the entire society is to compare the ratio of WTA to WTP for end goods that are as discrete and non-nesting as possible. Jewelry, fresh fruit, and dentistry services are three good examples—a durable, a nondurable, and a service that are also verbatim subcategories of GDP expenditure data in the United States. Their ratios of expenditure to median WTA were 0.19, 0.04, and 0.21, respectively. And as mentioned earlier, the typical E/WTA ratio for GDP goods was 0.06. This is why it is fair to say that GDP accounts are missing at least 90 percent of utility value *of GDP goods alone*. When we expand the scope of concern to things that are not measured by GDP whatsoever—such as rights, senses, abilities, and public goods—and find that their utility values are even higher than for tangible goods, then it is clear that the GDP undercount of social value is profound.

Conclusions

This project's development of an initial measure of *utility value* answers the challenge of the Stiglitz Commission—an alternative to GDP that can quantify the value of health, civil rights, and environmental quality of life. By establishing firmly and with some precision that WTA values are higher than income-price measures for a wide range of goods, this metric offers a credible initial estimate of hidden value beyond GDP.

This study's fifty-one super evaluators—selected from a pool of over a thousand participants in an initial contingent-valuation study—assessed the utility value of 101 items, i.e., the cash that the average person would be willing to accept to not use each item for a full year. The median WTAs for many goods and services in GDP were shown to be a hundred times larger than the per capita annual expenditure, and the typical WTA multiple was around twenty. Values expressed for non-GDP items were found to be much higher than GDP items, with physical abilities and senses being the most valuable of all.

This study exposes the weakness of GDP and income as the basis of discussions of social inequality. The new method presented should help economists and policy makers understand with some precision how measured GDP does not capture the full impact of many modern goods. The emergence of a wide array of digital technologies in this new century was shown to be extremely valuable, with the personal computer, internet access, and the smart phone valued at a combined $50,000 per year. But when it comes to economic inequality, income alone does not measure utility, and vast improvements in quality of life for all income classes are inherent in electrification, health, and new leisure technologies that are widely consumed.

The surprising finding is that utility values are perceived differently by people of different income levels. In this study, poorer respondents consistently valued GDP goods 50 to 100 percent more than the norm, and wealthier respondents consistently valued them 10 to 20 percent less. A similar valuation gap was found by age, with older respondents valuing goods more than younger respondents. Ironically, poorer and older individuals had the highest valuation differential for things that money cannot buy.

NOTES

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1 Steven Pinker, *Enlightenment Now: The Case for Reason, Science, Humanism, and Progress* (New York: Penguin Books, 2018).

2 "Gross Domestic Product (Third Estimate), Corporate Profits (Revised Estimate), and GDP by Industry, First Quarter 2021," US Bureau of Economic Analysis, posted June 24, 2021, https://www.bea.gov/sites/default/files/2021-06/gdp1q21_3rd_1.pdf.

3 See "Table 2.4.5. Personal Consumption Expenditures by Type of Product," Section 2—Personal Income and Outlays, National Income and Product Accounts, National Data, US Bureau of Economic Analysis, last revised September 30, 2021, https://apps.bea.gov/iTable/iTable.cfm?ReqID=19&step=2#.

4 See Hannah Ritchie and Max Roser, "Technology Adoption," Our World in Data, 2017, retrieved on June 15, 2021, from https://ourworldindata.org/technology-adoption.

5 See Diane Coyle, *GDP: A Brief but Affectionate History* (Princeton, NJ: Princeton University Press, 2014).

6 For Michael Hanemann's article, see "Willingness to Pay and Willingness to Accept: How Much Can They Differ?," *American Economic Review* 81, no. 3 (June 1991): 635–47, https://EconPapers.repec.org/RePEc:aea:aecrev:v:81:y:1991:i:3:p:635-47.

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APPENDIX

This appendix includes data on the median WTA of 101 items given by participants in a comprehensive contingent value survey. For the three categories of items that are included in GDP calculations, there is a number for the expenditure per capita in the United States in 2019. The ratio of the expenditure per capita to the median WTA is also presented. Finally, there is a column for the year an item was first adopted.

The full dataset can be accessed online at www.hoover.org/beyond-gdp-looking-deeper-prosperity-progress-and-nature-value/data.

Item	*Median WTA ($)*	*Exp. per capita ($)*	*E/WTA*	*Year*	*Category*
Computer	25,000	173	0.01	1977	GDP durables
Glasses and contact lenses*	12,000	117	0.01	1285	GDP durables
Automobile*	20,000	1,591	0.08	1885	GDP durables
Television*	12,000	105	0.01	1927	GDP durables
Refrigerator	10,000	148	0.01	1913	GDP durables
Telephone	8,000	92	0.01	1876	GDP durables
Light bulbs and lighting	10,000	136	0.01	1879	GDP durables
Smart phone	10,000	173	0.02	1997	GDP durables
Email	10,000	308	0.03	1971	GDP durables
Washing machine	5,000	148	0.03	1935	GDP durables
Air-conditioning	10,000	148	0.01	1902	GDP durables
Music, recorded and streaming	5,000	6	0.00	1877	GDP durables
Large, color television	5,000	105	0.02	1950	GDP durables
Clocks and watches*	5,000	42	0.01		GDP durables
Clothes dryer	4,000	148	0.04	1892	GDP durables
Tools*	2,500	98	0.04		GDP durables
New photos and videos	2,500	52	0.02		GDP durables
Microwave	2,500	29	0.01	1975	GDP durables
Books	1,000	102	0.10		GDP durables
Vacuum cleaner	1,990	29	0.01	1901	GDP durables
Family photos	1,000	52	0.05	1872	GDP durables
Family videos	1,000	41	0.04	1960	GDP durables
Jewelry*	1,000	190	0.19		GDP durables
Wedding rings	1,000	190	0.19		GDP durables

Continued

(*Continued*)

Item	*Median WTA ($)*	*Exp. per capita ($)*	*E/WTA*	*Year*	*Category*
Prescription drugs*	10,000	1,442	0.14	1804	GDP nondurables
Antibiotics	10,000	1,442	0.14	1928	GDP nondurables
Shoes*	30,000	262	0.01		GDP nondurables
Immunizations/vaccines	5,000	1,442	0.29	1796	GDP nondurables
Soap, perfume, and deodorant	8,000	169	0.02		GDP nondurables
Meat*	5,500	531	0.10		GDP nondurables
Birth control	5,000	229	0.05	1844	GDP nondurables
Pets*	5,000	212	0.04		GDP nondurables
Toothbrush	5,000	233	0.05	1498	GDP nondurables
Allergy medicine	5,000	229	0.05		GDP nondurables
Alcohol*	3,600	448	0.12		GDP nondurables
Sugar and sweets	5,000	147	0.03	1069	GDP nondurables
Cosmetics*	2,500	169	0.07		GDP nondurables
News*	4,000	247	0.06		GDP nondurables
Fresh fruit*	3,000	125	0.04		GDP nondurables
Coffee	3,600	50	0.01	1450	GDP nondurables
Brands	1,000	943	0.94	1858	GDP nondurables
Pizza	1,000	280	0.28	1945	GDP nondurables
Vitamin supplements	600	20	0.03		GDP nondurables
Art and craft supplies	500	221	0.44	1851	GDP nondurables
Toys, dolls, and stuffed animals	500	221	0.44		GDP nondurables
Running water	50,000	328	0.01		GDP services
Hospital*	20,000	3,549	0.18	300	GDP services
Electricity*	50,000	570	0.01	1900	GDP services
Internet*	25,000	226	0.01	1995	GDP services
Current residence	20,000	7,134	0.36		GDP services
Banks*	7,600	497	0.07		GDP services
Health insurance*	20,000	753	0.04	1850	GDP services
Furnace	10,000	153	0.02	1919	GDP services
Half of square footage in home	10,000	7,134	0.71		GDP services
Cellular telephone services*	10,000	405	0.04	1946	GDP services

Continued

(*Continued*)

Item	*Median WTA ($)*	*Exp. per capita ($)*	*E/WTA*	*Year*	*Category*
Highest academic degree	5,000	586	0.12	1100	GDP services
Access to doctor	5,000	1,763	0.35		GDP services
Foreign travel*	10,000	556	0.06		GDP services
Trash collection*	10,000	86	0.01	200	GDP services
Internet access at high speed	5,000	226	0.05	2005	GDP services
Restaurants*	4,800	2,149	0.45	1100	GDP services
Social networking	3,000	226	0.08	1997	GDP services
Streaming video*	3,000	102	0.03	2007	GDP services
GPS and mapping apps	3,000	226	0.08	1993	GDP services
Dentist*	2,000	413	0.21	1723	GDP services
Favorite sports team	1,000	92	0.09		GDP services
Amazon.com	1,000	226	0.23	1994	GDP services
Attend movies and live shows*	1,000	161	0.16	400	GDP services
Cable TV*	1,000	287	0.29	1948	GDP services
Museums and libraries*	750	32	0.04		GDP services
Electricity in the entire country	1,000,000			1925	National goods
National defense	150,000				National goods
Education for your children	40,000				Public goods
Peace	30,000				Public goods
Police	10,000				Public goods
Voting	1,000				Public goods
Clean air	10,000				Public goods
Highways	8,000			1955	Public goods
Nature	5,000				Public goods
Clean rivers and lakes	5,000				Public goods
Streetlights	2,000			1802	Public goods
Legal autonomy	100,000			1190	Rights
Privacy	50,000				Rights
Free speech	10,000			1776	Rights
Gun rights	5,000			1364	Rights
Church	4,000				Rights

Continued

(*Continued*)

Item	*Median WTA ($)*	*Exp. per capita ($)*	*E/WTA*	*Year*	*Category*
Credit (right to borrow)	6,000				Rights
One hour of leisure per day	6,570				Rights
Sense of hearing	100,000				Senses and abilities
Ability to speak	100,000				Senses and abilities
Sense of sight	200,000				Senses and abilities
Ability to walk	100,000				Senses and abilities
Sense of touch	50,000				Senses and abilities
Sense of taste	30,000				Senses and abilities
Ability to sleep comfortably	25,000				Senses and abilities
Ability to read	20,000				Senses and abilities
Sense of smell	10,000				Senses and abilities
Physical human contact	20,000				Status/other
Body attractiveness	15,000				Status/other
Status	10,000				Status/other
Contact with best friend	15,000				Status/other

** Indicates survey items with the verbatim description from personal consumption expenditures.*

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27 26 25 24 23 22 21 7 6 5 4 3 2 1

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Synopsis

This essay presents a new contingent valuation method for measuring quality of life. Individuals were asked the willingness-to-accept (WTA) value of giving up various things for a year. Participants report utility values ten times or higher than expenditures, implying that GDP undervalues the fruits of modern society. It finds that technological progress is undervalued, intangible things are worth more than material goods, and richer respondents have relatively lower utility values.

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