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# On Value, Outcomes, and Data: Why aren't traditional economic approaches easily solving the "Big Problems"?

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**Abstract**

**Background**
Current economic "languages" center on instruments such as financial currencies to represent value and meaning in exchange. Existing financial instruments frequently appear to be insufficient in expressing the value of complex outcomes that nonetheless have significant value to society as a whole, such as positive outcomes in public health and environmental sustainability.

**Approach**
We examine how the application of current technologies, specifically those enabled by digital data, might shift perspectives described in historical economic frameworks by enabling highly detailed, and yet highly contextual, measurement, description, and tracking of complex and numerous inputs and outcomes within economic activities.

**Discussion**
The technological capabilities of digital data in the 21st century allow us to expand upon our existing economic languages and potentially use data as a means to agree upon and to communicate value, in part because of the ability to use digital data and data systems to express complex outcomes and the inputs that contribute to such outcomes. We further hypothesize that as digital data becomes a means of economic measurement and expression, digital data in and of itself may take on additional intrinsic value because of its utility as such a means of value expression.

Those of us who work on the "Big Problems"—searching for solutions to bring health, stability, liberty, and prosperity to people and societies—often feel that our current economic language fails to properly capture the value of solving such problems. This language, and the means we have to express value and incentives, frequently falls horribly short of giving us the tools we need to achieve the "Big Solutions" that "Big Problems" call for.

For example, in health care, we all know that longer lives and improved well-being should be the shared end objectives, but almost no one within the health care sector is directly financially rewarded for achieving such meaningful outcomes. Similarly, with regards to the health of our planet, generating the collective action to reduce negative or irreversible impact to the environment seems at times insurmountable. In 2020, as a raging global pandemic stares us in the face, we see again how poor we are at making economic tradeoff decisions together, and as a result, we're experiencing crippling economic and health effects that are likely to ripple through generations to come.

Our traditional approaches to economics aren't solving these challenges for us. Arguably, our existing frameworks are not fully equipping us to tackle such problems. The limited economic language we employ for measuring, describing, and expressing value has evolved incrementally from the past and centers around converting all types of value into a form of money. Although the currencies and mechanisms of exchange that we have today look quite different than the first "coinage" of 600 B.C., the concepts around exchange haven't evolved as much as one might think. We've certainly developed more sophisticated ways to measure value and determine the worth of the new products and services that have been invented across the centuries. Yet, even with today's advances, we have many areas where the current "languages" of value seem counterintuitive, overly subjective, lacking in universality, or even so opaque that they fail to provide the ground rules for a shared understanding.

*Is our economic vocabulary too limited for the modern world?*

The result of traditional approaches is that in the 21st century, even if our imaginations can produce concepts of value and economic meaning that go beyond the status quo, we lack the language to express them, or to even establish a baseline for building the arguments. As abstract as that sounds, we run into it all the time, and have devised all manner of academic and esoteric means to try to overcome such limitations.

In health care, for example, we argue endlessly over methods to best determine "fair" or "optimal" drug prices, but we rarely discuss how drugs are merely intermediate goods, and sometimes poor ones, for the outcomes—longer lives, better health—that we truly value as individuals and society. Our methods to define, measure, and then express the value of health outcomes remain severely limited by traditional economic approaches and structures.

In education, we likewise have a difficult time explaining why a university degree can vary in price a hundred-fold between various institutions, and, at the other end of the spectrum, children in some parts of the world can grow up without an assumption that they will become literate, despite the nearly innumerable return on investment of learning to read. Even in describing this problem, use of the word innumerable only highlights the problem: Our means of describing the value of reading are imperfect, even though we know that literacy is strongly correlated with both health outcomes and economic markers of financial independence anywhere in the world. In climate science and environmental impact tracking, our economic toolkit is similarly insufficient to quantify impact, express trade-offs, and reward economic behaviors for climate actors from individuals to companies to nation states. When faced with large, meaningful, but difficult-to-describe outcomes, and labyrinthine inputs and processes, our methods and language of value start to break down.

Even at the edges of the "Big Problems", we see places where our tools to describe and express value seem too limited: the productivity of artists, the preservation of historical artifacts, the maintenance of biodiversity. We see these limitations in our language of economics and value in more mundane examples as well. How do we understand the value of so-called "intangibles" such as brand equity, goodwill, or, to pick a hot topic, data? Is data, as The Economist famously asked, the "new oil"? Is data a mere commodity, the "exhaust" of our interactions with each other, mediated by phones and computers? Or is it something fundamentally different?

*How can we better understand and talk about meaningful outcomes?*

Across all of these domains, our approach to value measurement and expression tends to focus on the intermediate inputs rather than the desired outcomes. In health care, we have arguments about what goods and services should cost, but we don't have a fundamental problem with putting prices on medicines or an hour of a doctor's time; we agree that these things have value. In parallel, while nearly no one would argue that an extra year of life is valueless, the methods we've tried to employ to equate that value to money, or to describe it as merely a function of various intermediate goods, are sloppy at best and unjust at worst.

As global commerce has evolved over the past five centuries, we've built upon the existing language of value to include tools that enable exchange such as standards for goods and products and standards of international exchange of currencies. Such standards enable shared understanding. To put it more concretely, we can change US Dollars into Euros when we have a shared understanding and agreement of Forex exchange rates—a shared language to express value. We can have confidence that we're paying the right amount for a car when we can reference the Kelley Blue Book value—an agreed-upon means of measuring and defining the value of a vehicle at any given time in terms of US Dollars.

When it comes to complex outcomes, even those we know to be immensely valuable and important—longer lives, better-educated people, more sustainable environmental practices—we have well-developed language to describe and measure many of the inputs, but lack the means to share or express the value of the true "end products".

*What do past frameworks tell us about complex outputs and numerous inputs?*

This issue with how to account for, value, or describe complex outcomes with numerous economic inputs isn't

exactly a new question in economics. We can see it lurking behind the surface of the first chapter of Adam Smith's A Wealth of Nations, where he discusses the "Division of Labour." Smith illustrates that even for relatively simply defined, tangible products, such as a workman's woolen coat, trying to understand and account for all of the inputs to that single garment, whether physical items or in terms of laborers' time and effort, is a vast undertaking. He goes so far as to mention not only those who provide the raw materials, from the shepherd to the weaver, but also the merchants who run the ships transporting these goods, the ship-builders and sail-makers who built the ships, and the parties who developed the technologies of the ship, the loom, and the "simple machine" of the shepherd's shears.

> *"In those great manufactures[1]… every different branch of the work employs so great a number of workmen that it is impossible to collect them all into the same workhouse. We can seldom see more, at one time, than those employed in one single branch…. The work may really be divided into a much greater number of parts… the division is not near so obvious, and has accordingly been much less observed"*

If we consider a complex outcome of the modern age, such as a health outcome, what parallel thinking can we employ? Who "manufactures" such an outcome? The physicians and nurses might first come to mind, but do we also include but the patient who follows advice or chooses to not? Are the drugs themselves actors, or are they merely agents of the scientists who discovered and developed them, the clinical trialists who demonstrated their utility, the bold patients who received such drugs in a Phase 1 trial, the biotech investors who provided the seed funding for the research, or, further back, the NIH grant that allowed the lead scientist to complete her PhD studies twenty years in the past? How much of the outcome is a function of more complex factors: hospital location, the expertise of the treating team, the socioeconomic status of the patient, the health insurance plan of the patient, and the patient's employer's sick-leave policy? We intuitively understand the division of labor, but we start to falter when we try to describe how each of the "inputs" (whether the work of individuals, systems, or tools) contributes to the end product. How much "credit" should each of these inputs and the people responsible for creating each of them receive, and how might we possibly account for that?

If we now conduct a dialogue with Adam Smith's paragraph in the 21st century, it might go like this:

> *"In those great manufactures… every different branch of the work employs so great a number of workmen that it is impossible to collect them all into the same workhouse.*
>
> «But it is possible, and infinitely more feasible than it was in the 1700s, to collect all of the information about these laborers and their roles in a dataset that can be seen, edited, and shared by each of these participants...»
>
> *We can seldom see more, at one time, than those employed in one single branch….*
>
> «Primarily because of the limitations of data technologies in the 1700s, and the lack of digital means of recording and transmitting data with nearly no added cost...»
>
> *The work may really be divided into a much greater number of parts… the division is not near so obvious, and has accordingly been much less observed"*
>
> «We now have much clearer ideas of division of labor, of tracing packages from origin to destination, but we still have not tackled with great granularity or certainty the concept of value throughout the "supply chain" of physical goods, let alone "intangible" outcomes, although this now is becoming more possible...»

We've come a long way since Smith published the first edition of his work in 1775 and 1776, and technology now

allows us to peel back at least a few of the layers of understanding on the production of his workman's coat. Whether bought from H&M or Bally, networked technologies would help us know what box it arrived to the store (or our home) in, what truck it was on, what lot it was part of, the ship it traveled on to our shores, and the factories that produced the woolen cloth, the thread, and the buttons. We might even be able to figure out what design software was used to develop the pattern or what company manufactured the sewing machines. But we don't necessarily have a good framework to describe how or why all of those inputs contribute value to the output of a coat, and why one sells for $59.99 and the other sells for $1500.

*Proposing to evolve the language of value using a misunderstood tool: Digital Data*

The idea that our economic and societal perspectives on "value" might need to evolve has been kicking around since at least the 1960s, as the "futurists" of the day recognized that computers were enabling new types of digital, data, and information "products" that bore little resemblance to the outputs of a manufacturing economy. How could these be accounted for, and what value were they contributing to the economy, and to society? Perhaps the fundamental qualities that differentiated these so-called "intangible" assets from physical products weren't that well understood, or perhaps it's just difficult to create a new taxonomy for things when society is in the middle of inventing them. Whatever the reason, in many ways our categorization of value hasn't changed from the 1950s—clear distinctions are still drawn between "tangible" and "intangible" assets, with all of the wonders of the digitized world falling into that second bucket.[2]

One possible conclusion to draw is that our economic taxonomies haven't kept up with the technological capabilities we've developed in the past six decades. Considering that innovation grows at an exponential pace, it was likely difficult in the 1960s—or even in the 1990s—to see what value exists in what we now call "digital data" (or often, just "data"). Only now are we starting to grasp what data truly means.

What we've perhaps failed to realize is that, through the persistent digitization of our world—of our actions, our tasks, and our desire to increasingly digitize our measurements, records, and activities—we've potentially equipped ourselves to address some of the fundamental problems of economics. We haven't noticed because our perspective still has us locked in the frameworks of the pre-digital world. Somehow we've failed to notice that this problem of accounting for, measuring, defining, and valuing important outcomes that were difficult to capture, share, or verify can potentially be solved by all of the digital data accumulating right under our noses. Going back to our coat example: The tracking data for the delivery box isn't simply information generated by the box being delivered, but is a digital representation of real world work and actions as the coat made its way to its final location. That final delivery scan is an outcome, and it mirrors the very real-world outcome of the coat reaching your front door.

Buying (or even measuring) a complex outcome that depends on complex inputs, processes, and associated variables has never been as straightforward as buying or measuring the inputs themselves. We now have additional tools, however, unlocked by an array of new technologies. These technologies make it more feasible than ever before to evaluate the most complex outcomes we encounter.

Our pervasive digitization is not just generating some sort of commoditizable digital "exhaust", as some would argue. Instead, what has been created is a digitized overlay of our actions, activities, and results, allowing us to measure the outcomes of our actions as digital products—and to trace back the inputs contributing to these outcomes—with a degree of precision and resolution that was never before possible or practical. Digitally recorded results are a representation of results in the real world; much of the data we create is not a mere side-effect of actions, but is seemingly "manufactured" by our activities and labor in the real world. Such data is the way that we demonstrate what has been achieved. Further, due to the ability of digital data to be efficiently combined and replicated with minimal energy expenditures and thus minimal costs, outcomes represented by digital data can be inexpensively combined to form new, complex outcomes in ways that we couldn't previously imagine or implement.

*Digital data isn't merely the language; it's something akin to the unit of measurement*

To vastly oversimplify, let's assume that the "standard" way of accounting for value is to assign a monetary value to something. Typically, this something is an object. In the digital world, specifically with data, we still cling to the idea that dollars correspond to the value of objects. We purchase a dataset, or subscribe to a data feed. Even though the true value of what we're purchasing lies in the insights derived from the data, or in the results confirmed by the data, we still cling to the idea that we're somehow purchasing a commoditized pile of ones and zeroes.

In a world where uniquely identifiable pieces of digital data can represent meaningful outcomes, and where those pieces of data can be combined, computed, and transformed to represent ever more interesting and complex outcomes, "the value of data" is fundamentally altered. What follows is that we can abstract away from our discussions around the value of datasets and instead start to talk about "the value of the varied outcomes represented by an underlying set of digital data" to business, society, or ourselves as individuals. Given the technology landscape of the early 21st century, we now have the means to trace and measure results via digital data in a way that enables improved valuation of outcomes, not only more easy-to-measure inputs. From a business perspective, this could be transformational. From the individual perspective, we can better understand how our actions and activities contribute to the whole, and we can take some level of control and "ownership" over the digital data that is generated by our individual activities. As a result, we might gain a greater sense of ownership and control over the value of the outcomes we help generate. From the enterprise perspective, we can go beyond "cost-of-goods" and "cost-of-labor" approaches to more sophisticated measures of contribution, including how business results contribute to larger-scale collective metrics (such as GDP, for example, or climate impact). Whether from the individual or enterprise view, such transparency might allow us to better align incentives throughout and among economic participants.

If digital data is as rich of a substance as we theorize, it not only creates a language and means for granular and highly contextual measurement of nearly infinite inputs and complex outcomes, but also has inherent value as the tool enabling such economic expression in and of itself.

*What happens to the value of digital data when it becomes the standard for measuring and transacting value?*

The idea of attaching value to a specific digital product isn't as new as we might think; we pay for a copy of a software program. Gaming enthusiasts have bought and traded digital characters or objects with each other for at least several decades, sometimes for huge sums of "real-world" money. The past decade's experiments with cryptocurrencies have further solidified the idea that we're happy as a society to attach very real value to digital things we'd previously have categorized as "intangibles"—particularly when those digital products are uniquely identifiable, trackable, and somehow "ownable." (All of these words and concepts, particularly those around "ownership", replicability, identifiability, and transferability, and perhaps even the concept of "manufacturing" take on some different connotations in the domain of digital data, but for the observer, we're clearly starting to evolve in our thinking past the frameworks we used to discuss these concepts in the 1960s.)

If digital data is presented as the unit of defining, measuring, and transacting value based on outcomes, it becomes not only a form of language, but also a "raw material" for the outcomes it measures and describes. Digital data, therefore, has inherent value, not merely as a commodity nor as an externality of other transactions. The value of any specific quantum of digital data arguably increases as it is utilized as an input to achieve outcomes, and even more if those outcomes are deemed to be increasing in value. The greater the *potential utilities* of any uniquely identifiable quantum of data—the more outcomes it can be used to describe, measure, or transact—the greater the value of that quantum. We all generate digital data on a near-constant basis, whether as individuals or as organizations. What does this mean for the value of our data today and in the years and decades to come? Data Economics seeks not only to define a framework for packaging digital data to measure and transact the value of outcomes, but also to

define a framework for defining the value of digital data itself based on the outcomes it measures and utilities it enables.

*Where do we go from here? The discipline of Data Economics.*

Economics gives us ways to interact with the material world and understand how to create, exchange, and sustain value. We now have the capability to treat digital data as an interface to such economic activities. Digital data can provide context and richness to the world of economics that mere money has never been able to provide. While currencies are highly scalable, they provide relatively little context. In contrast, highly contextual exchanges within communities are imbued with rich levels of information and communication, but lack the ability to scale. Digital data, as both a language for more detailed and contextual descriptions of value, as well as potentially the marker of value itself, can essentially do both.

The science of Data Economics posits that while currency instruments facilitate exchange and solve for the problem of lack of local coincidental need among participants, the traditional and present form of money in most economies serves merely as a representation or approximation of value. Whether a US Dollar has been used to purchase a hamburger at a fast-food restaurant or a Rembrandt masterpiece from auction at Sotheby's, once that dollar circulates past that transaction, it has no memory of its prior use and has no context except that of its next transaction. Similarly, the generation, or minting, of such money is controlled by governing entities, whether in the US or elsewhere, but money is not generated by economic participants (although it can be earned), and is not generated with a predefined purpose.

In an economy based on the value represented by digital data, or what we'll term a Data Economy, we have the opportunity to have the participants of such an economy define the shared outcomes they deem to be meaningful and valuable if manifested in the material world within a Data Economic Frame of Reference. The participants can further define the parameters, values, and tasks (essentially, the intermediate goods and processes and their utility), as well as the specific inputs of participants that will be evaluated as contributing to the desired outcomes within this Frame of Reference. Further, the participants can define the rules and parameters governing the interaction between their Data Economic Frame of Reference and other Data Economies generating outcomes considered valuable by these participants, potentially creating new, shared Data Economies (or shared Data Economic Frames of Reference).

Given the technological advances in distributed computing technology, participants (regardless of geographic location) can view and verify a common record of tasks performed and outcomes achieved as defined by the values of their Data Economy.

We theorize that Data Economies constructed in this new paradigm may serve to mitigate many of the barriers to solving the "Big Problems"—barriers such as information asymmetries, "tragedy of the commons," and other flavors of market failure or near-failure.

Data Economies built in this mold could be infinite in number, not only enabling economic activities within each economy, but also enabling the exchange of information and value between and among economies built according to these parameters. Participants are not restricted to a single economy; they can participate in as many economies as represent their shared desired outcomes. Communication among these economies has a shared language with two foundational elements. First, the defined outcomes and tasks are based on tangible and measurable events in the real world, represented as digital data. Second, a set of rules (or digital "machines") serve as translators to help these economies interpret the value of tasks and outcomes achieved by other economies, regardless of whether the economies share the same values or interact in the real world, facilitating trade or exchange. These machines can also help solve asymmetric information problems by helping one economy understand the activity of a second economy through the lens of what the first economy defines as meaningful or important.

If such an economy existed, what would it look like, and how could it be implemented using technology available in the present day?

Data Economics has captured our imagination because of its potential to address problems we have been working on for decades. With the ability to treat digital data as a new means of value expression as well as a carrier of value itself, and to operate accordingly within a shared, consensus-governed framework enabled by technology, we have a new toolkit for addressing the Big Problems.

**Endnotes**

1. By "manufactures," Smith means the manufacture of complex products, quite parallel here to our use of the term "outcomes."
2. For a much more in-depth history and analysis on this phenomenon and the current "problem" of accounting for intangibles and data, we recommend as further reading the book *Capitalism Without Capital* by Jonathan Haskel and Stian Westlake, Princeton University Press, 2018.

**Works Referenced**

Smith, Adam. *An Inquiry into the Nature and Causes of the Wealth of Nation*s. Oxford World's Classics. London, England: Oxford University Press. 2008 edition.