From: "jeffrey E." <jeevacation@gmail.com>
To: Joichi Ito <██████████████>
Subject: Re: $1M rain contract
Date: Mon, 25 Apr 2016 15:17:05 +0000

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concerned about fire sale

On Mon, Apr 25, 2016 at 11:07 AM, Joichi Ito <██████████████> wrote:
> So maybe just say, "for the SEC who would be concerned about liquidity, it might be valued at zero even though it clearly isn't for other purposes"?
> - Joi
>
>
>> On Apr 25, 2016, at 11:05 AM, jeffrey E. <jeevacation@gmail.com> wrote:
>>
>> sec rules vs accounting rules vs gapp accounting vs tax accounting vs common sense.   . if i own all of manhattan,   it cant be sold right away, , ulikeley to one person, no real market for the whole thing . is it worht zero?
>>
>>> On Mon, Apr 25, 2016 at 11:01 AM, Joichi Ito <██████████████> wrote:
>>> OK. But for instance, when the SEC is talking to Goldman about the pricing of the subprime credit default swap contracts on their books when there was no longer a market for them, aren't they questioning the value of the instrument at that time? Aren't they suggesting that they should be marked down to zero if there is no market?
>>>
>>>
>>>> On Apr 25, 2016, at 10:37 AM, jeffrey E. <jeevacation@gmail.com> wrote:
>>>>
>>>> think of it like insurance values,   a life policy,
>>>>
>>>>> On Mon, Apr 25, 2016 at 10:18 AM, Joichi Ito <██████████████> wrote:
>>>>> Hmm… I was just trying to sketch that it was complex. Do you think the last sentence is wrong? If something is nonnegotiable would you have to report it as zero for book value? I guess you would probably make up some sort of pricing formula? Should I just omit the last sentence? I talk about non-negotiable stuff later actually. It's part of a longer thing. I'll paste it below in case you have time to read the current draft. Thinking of posting this today. Hopefully it's not stupid. ;-)
>>>>>
>>>>>
>>>>>> On Apr 25, 2016, at 10:12 AM, jeffrey E. <jeevacation@gmail.com> wrote:
>>>>>>
>>>>>> more complicated,   value for book purposes value to a buyer.   value to a buyer if cloudy weather day before.   etc
>>>>>>
>>>>>>> On Mon, Apr 25, 2016 at 10:09 AM, Joichi Ito <██████████████> wrote:
>>>>>>> Is the last sentence correct?
>>>>>>>
>>>>>>> ___
>>>>>>>
>>>>>>> When you take, for instance, a contract that pays out $1 million if it rains tomorrow, and put it into your accounts, you will be required to guess the chance of rain–maybe 50%– and value that asset at something like $500,000. The contract will actually never pay out $500,000; it will either be worth zero or $1 million in

the end. But if you were forced to trade it today, you'd probably sell it for something close to $500,000; so for tax and management purposes, you "value" the contract at $500,000. On the other hand, if you unable to sell it because there were no buyers, it might actually be valued at zero today by regulators, but then suddenly valued at $1 million tomorrow if it rains.

Reinventing Bookkeeping and Accounting (In Search of Certainty)

Joichi Ito

Current plan is to publish on Monday April 24, 2016

Original is on PubPub.

Double-entry bookkeeping was deployed in its modern form in the 1300s, and while minor innovations have occurred since then, the fundamental atomic unit of tracking and managing value–our accounting system–is still based on this 700-year-old invention. With modern computers, networks, and cryptography, we have the opportunity to fundamentally change one of the most important and empowering–but also limiting– tools of modern civilization.

Accounting underlies finance, business, and the management of the State's resources, and is the way that the world keeps track of almost everything of value. Accounting predates money and was originally used by communities to track and manage their limited resources. There are accounting records dating back more than 7,000 years ago in Mesopotamia listing the exchange of goods by the temples. Later, accounting became the language and information infrastructure for trade. Accounting and auditing also enabled the creation of vast empires, such as the Egyptian and the Roman empires, by enabling governments to levy taxes and manage resources at scale.

As accounting scaled, it made sense to go from counting sheep, bushels of grain, and cords of wood to calculating and managing resources using their exchange value in terms of an abstract unit of account–money. This money could be used for exchange and to record and manage obligations. These accounting systems were fundamentally more powerful than some of the earliest forms of bookkeeping that just kept records of promises and exchanges between individuals: Alice lent Bob a goat on this date. By pricing resources and trading in money rather than specific items or commodities, it dramatically simplified the management of accounts allowing markets, companies, and governments to scale. However this powerful simplification has a surprising downside in today's digitally connected world.

While companies today use enterprise resource planning (ERP) systems to keep track of widgets, contractual obligations, and employees, the accounting system, and the laws that support it, require us to convert just about everything into monetary value and enter it into a ledger system based on the [700 year old double-entry bookkeeping method](#) used by the Florentine merchants of the 13th century and described by Luca Pacioli, the "father of accounting" in book *Summa de Arithmetica, Geometria, Proportioni et Proportionalità* published 1494.

When you take, for instance, a contract that pays out $1 million if it rains tomorrow, and put it into your accounts, you will be required to guess the chance of rain–maybe 50%– and value that asset at something like $500,000. The contract will actually never pay out $500,000; it will either be worth zero or $1 million in the end. But if you were forced to trade it today, you'd probably sell it for something close to $500,000; so for tax and management purposes, you "value" the contract at $500,000. On the other hand, if you unable to sell it because there were no buyers, it might actually be valued at zero today by regulators, but then suddenly valued at $1 million tomorrow if it rains.

A company's accounts are an aggregate of cells in various ledgers with numbers that represent a numerical value denominated in some currency–yen, dollars, euros, etc.– and those numbers are added up and organized into a balance sheet and an income statement that show the health of the company to management and investors. They are also used to calculate profits and the amount of tax owed to governments.

Your balance sheet is a list of assets and liabilities. If you looked in the assets column, you'd have a number of items that you would be reporting as having value, including things like printing presses, lines of code, intellectual property, obligations from people who may or may not pay you in the future, cash in various countries' currencies, and bets on things like the prices of a commodity in the future or the value of another company in the future.

As an auditor, investor, or trading partner, you might want to drill down and try to test the assumptions that the company is making and see what would happen if those were incorrect at the time they were recorded, or turned out to be wrong some time in the future. You might also want to understand how buying the company would change your own company based on the way your obligations and bets interacted with theirs. Today you would rack up millions of dollars in auditor fees to "get to the bottom" of the set of assumptions most big companies. The process would involve manually reviewing the legal contracts and also the assumptions made in every cell of every spreadsheet. That's because accounting is a very "lossy" process, that reduces complex functions with probabilities and transforms/converts dependencies into static numbers at every step. The underlying information is stored somewhere, but most of it requires manually digging around.

The modern complex financial system is full of companies that have figured out ways to guess when investors and the companies themselves have made mistakes in their assumptions. These companies bet against the companies and financial assets with inaccurate pricing or are somehow able to take advantage of the gap in information and convert this into financial returns. Also, when these mistakes are duplicated across the system it can cause fluctuation amplification that also allows companies to make more money both as markets rise, as well as fall, if they can successfully predict those fluctuations. In fact, as long as the whole system doesn't collapse, smart traders make more money on fluctuation than on stability.
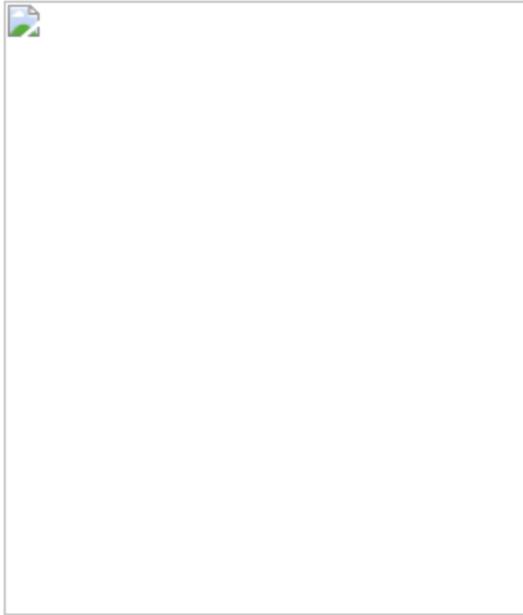
Houghton & Byrne, pest exterminators (9/7/1937)

Just like rodent exterminators aren't excited about the idea of rodents being completely eliminated because they would no longer have jobs, those financial institutions that make money by "making the system more efficient and eliminating waste" don't really want a system that isn't wasteful and is very stable.

Right now, the technology of the financial system is built on top of a way of thinking about money and value that was designed back when all we had were pen and paper and where reducing the complexity of the web of dependencies and obligations was the only way to make the system functionally efficient. The way to reduce to complexity was to add it up and simplify it. The current technology just builds on these 700-year-old building blocks trying to make the system "better" by doing very sophisticated analysis of the patterns and information without addressing the underlying problem of a lossy and over-simplified view of the world: a view that everything of "value" should be as quickly as possible reduced to some "value" where "value" is a price denominated in "money."
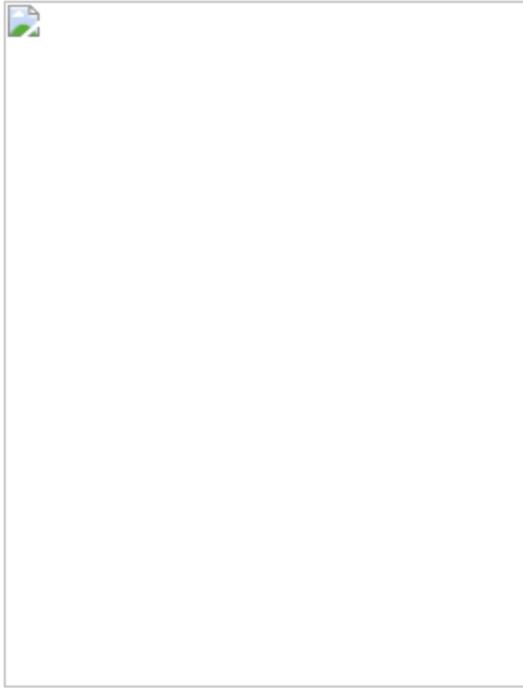
The standard idea of the "value" of things is a reductionist view of the world that is useful to scale the trade of commodities that are roughly of equal worth to a large set of people, but in fact most things have very different values to different people at different times, and I would argue that much–if not most–things of value can't and probably shouldn't be reduced to numbers on a spreadsheet.

Financial "value" has a very specific meaning. A home clearly has "value" because someone can live in it and it's useful. However, if no one wants to buy it and no one is buying similar homes on the market, you can't set a price for it; it is illiquid and it is impossible to determine its "fair market value." Some contracts and financial instruments are non-negotiable and may not have a "fair market value" and may have no value to you if you needed money (or an apple) RIGHT NOW, but may still be "valuable." Part of the problem and the confusion comes from the difficulty of describing legal and mathematical ideas in plain English, and the role of context and timing.

One example is exchange rates. My wife moved to Boston several years ago, but still looks at prices and converts them into yen. She sometimes comments on how expensive something has gotten because the value of the yen has diminished. Because most of our earnings and most of our spending are in dollars I always have to remind her, the "value" in yen is irrelevant to her now, although to her mother, who she talks to in Japan, cares about the "value" in yen.

An email from you to me about a feeling that you had about our last conversation is probably valuable to me at a particular time and probably not valuable to most people. An apple to a hungry person is worth a lot more than an apple to an apple orchard

owner. If you lived in Boston and all you ate were Big Macs, having part of your paycheck paid in time-limited, Boston-only, non-transferrable Big Mac certificates would probably be more valuable to you than yen since the exchange rate and the price of Big Macs might fluctuate. Context is everything.

We have become accustomed to the notion that things have a "price" and that "price" is equivalent to its "value," but as these examples clearly show, the "price" depends on the currency that is local to you and, even in the same locality, the home or the email or the Big Mac might have different "values" to different people. However, the prevalence of money and price as a measure of some kind of universal "value" have become so common that I often hear comments like, "How could he possibly be that smart? He's not rich."

Can't Buy Me Love

- The Beatles

The economics notion of consumers making financial decisions to maximize "utility" as a kind of proxy for happiness is another example of how the notion of a universal system of "value" oversimplifies its complexity—so much so that the models that assume that humans are "economically rational" actors in a marketplace simply don't work. The simplest version of this model would mean that the more money you had, the happier you would be, which Daniel Kahneman and Agnus Deaton argue is true up to about USD\$75,000 a year in annual income. (Social Sciences - Psychological and Cognitive Sciences: Daniel Kahneman and Angus Deaton)

Today, we have the technology and the computational power to create a system of accounts that isn't as lossy and in fact could retain and deal with a lot of the complexity that the current system was designed to avoid.

There is no reason that every entry in our books needs to be a number. Each cell could be an algorithmic representation of the obligations and dependencies that it represents. In fact, using machine learning, accounts could become sophisticated probabilistic models on what might happen depending on how things around them change. This would mean that the "value" of any system would change depending on who was asking, their location, and the time parameters.

Today, when the Financial Stability Board conducts a stress test, it gives a bank a scenario—changes in the credit markets or the prices of certain things. The bank is then required to return a report on whether it would crash or remain solvent. This requires a lot of human labor to go through the accounts and run simulations. What if the accounts were all algorithmic, and instead you could instantly run a program to provide the answer to the question? What if you had a learning model that could

answer a more important question: "What sets of changes to the market WOULD make it crash and why?" That's really what we want to know. We want to know this not just for one bank, but the whole system of banks, investors, and everything that interacts financially.
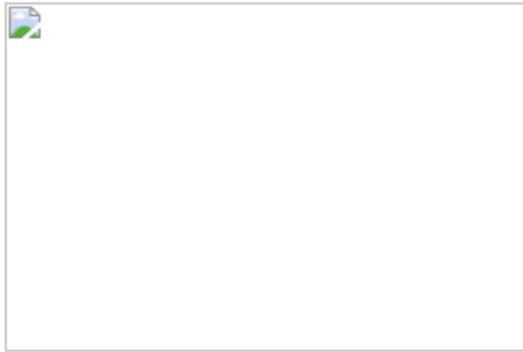
The Big Short (Paramount Pictures)

When ▇ buying something from a company—let's say a credit default swap from your company, AIG—what I want to know is whether, when the day comes to pay the obligation on the impossibly unlikely chance that the AA mortgage-backed bonds that I was betting against defaulted, would your company be able to pay? Right now, there is no easy way to do this. However, what if all of the obligations and contracts, instead of being written on paper and recorded as numbers, were actually computable and "visible"? You'd immediately be able to see that, in fact, in the scenario in which you'd have to pay me, you'd actually have no money since you'd written similar contracts to so many people that you'd be broke. Right now, even the banks themselves can't see this unless an internal investigator thinks to look for it ahead of time and finds it.

With cutting edge cryptography like zero-knowledge proofs and secure multiparty computation, there are ways that we might be able to keep these accounts open to each other without compromising business and personal privacy. While computing every contract as a cell in a huge set of accounts, every time anyone asked a question it would exceed even today's computing capacity. But with machine learning and the creation of models, we might be able to dampen, if not stabilize, the massive amplifications of fluctuations. These bubbles and collapses occur today, in part, because we are building our whole system on a house of oversimplified cards, with the handlers having an incentive to make them fragile and opaque in order to introduce inefficiencies that they can exploit later to make money.

I think that the current excitement about Bitcoin and distributed ledgers have created a great opportunity to take advantage of its flexible and reprogrammable nature and rethink the fundamental system of accounts. ▇ much more interested in this than apps for banks, or even new ideas in finance, which will address some of the symptoms without taking a shot at eliminating one of the root causes of the impossibly complex and outdated system that we've built on a clever trick invented by traders of the 1300s.

It feels like we are using integers when we should be using imaginary numbers and reinventing accounting is more like discovering a new number theory than tweaking the algorithms, which is what I feel like we've been doing for the last several hundred years.

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communication in error, please notify us immediately by
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