Market Empiricism

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How Life Improves

"All Suffering is caused by Ignorance."
-Siddhartha Gautama, founder of Buddhism

I believe in knowledge. Hard work is great, but knowledge has all the benefits (and more) with none of the 'work' part. Today, people often wish they knew more about their employment prospects, how to cure themselves of disease/injury, how to be better understood by friends and family, which diet to follow, and so forth. In the future, maybe every child will possess powerful knowledge about economics, medicine, and communication, the same way that the children of today know secrets of literacy, mathematics, and astronomy that escaped the brightest minds for hundreds of millennia.

It would be nice if the citizens of the future could help us out, by somehow putting useful information into a time machine and sending it to us in the present. (Haven't you ever wondered what advice you would give your younger self, if you could?) This project aims to do something similar: Individuals ask questions about future information, and those questions are answered quickly and accurately by a self-updating summary of <u>all currently available human knowledge</u>. We measure, today, the likelihood of our future selves learning one thing or the other.

This is done by considering the point of view of literally every available person, every employer and employee, every patient and doctor, every victim and criminal, and every mathematician, logician and statistician, and every psychologist, writer, and general. Every unemployed person, every child, the author of every research paper on anything, the author of every fan-fiction about anything, everyone skeptical of this line of reasoning. Everyone.

The internet gives each person the ability to communicate their point of view, but how to balance all of them? On any single issue, most folks will have nothing new to contribute, and some would like to contribute lies or misinformation. How do we know which people are 'the right people' to ask?

Well, we don't need to know. If the 'right people' can see the current answer, and disagree with it, then <u>they</u> know who they are. They will come to us.

The economic technology that provides this incentive is called a Prediction Market.

What is a Prediction Market?

Whereas a stock market is a place to buy and sell shares of a corporation's earnings, a Prediction Market (PM) is <u>a place to buy and sell predictions</u>. Valid predictions entitle their owner to \$1[1], whereas false predictions are worthless. The current market price of these tradable predictions can then be interpreted as a global consensus of the likelihood of the prediction coming true (the "summary of all human knowledge").

For example, a prediction might reward a dollar if Hillary Clinton is elected US President in 2016, such that any individual who thinks that she has at least a 70% chance of winning the election should be willing to buy that prediction for up to 70 cents. Predictions can be about anything: sports, politics, nominations and awards, scientific theories, the effect of a certain economic policy on the unemployment rate, the relationship between a war-declaration and casualties, etc.

I still don't get it.

Television has a gift for simplifying and communicating ideas:

1. <u>John Stossel gives an introduction,</u> The Stossel Show, (4:13).
2. <u>Neil deGrasse Tyson sketches out the general idea</u>[2], Real Time with Bill Maher, (1:22).
3. <u>InTrade and the 2008 Presidential Election</u>, CNBC, (2:22).
4. <u>CEO of InTrade on Elections and Recessions</u>, Kudlow Report, (4:06).
5. <u>News segment on PMs</u>, The Stossel Show, (8:31).

"Pay Up!" – The Counterparty Curse

One might rightly ask, "If prediction markets are so great, why don't we already use them everywhere?" The most central reason is that it has never before been possible to build true Commodity-Predictions, defined as "assets which will have a definite value based *solely* on their future accuracy". Previously, the value of the commodity predictions depended primarily on the <u>behavior of the counterparty</u> (ie, the guy holding the money). If you make a bet with someone, you have to hope that they'll pay. The value of a prediction depends on the behavior of the market administrator.

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[1] Or any amount…call this "the unit price".

[2] I have a number of comments to make about this excellent example. Notice a] that Maher seems more interested in allying himself with the more-popular guest than he does in learning any of the science (a psychological/social barrier to truth which PMs aim to overcome), b] that the formation of the bet ('the experiment') represents a very clear and measureable outcome on which individuals have literally agreed to disagree (they are not open to persuasion), and c] that this micro-debate terminates with mutual respect. Were an actual contract drawn up, both parties would happily agree to the clearly defined terms, both would have stated their case to an extent that they themselves believed it and no further.

In practice, the PM administrator has proven to be unambitious at best and unreliable at worst.

Name / Link	Status
www.economicderivatives.com	Once a multi-million dollar Goldman-Sachs run juggernaut, auctions were transferred to the CME in 2005. Still alive, but limited to economic variables such as CPI, GDP, nonfarm payrolls. Trading is expensive and not anonymous.
http://www.intrade.com/v4/home/	Dead. Mysteriously closed following problems with US regulatory compliance in early 2013.
http://tradesports.com/	Sports only, Died Nov 2008, Reborn with InTrade Jan 2013, Immediately died again. Now back with InTrade2.0.
http://inklingmarkets.com/	Healthy, for now.
http://www.thewsx.com/	Restricted to election outcomes. Long dead anyway.
http://bizpredict.com/	Dead.
http://tippie.uiowa.edu/iem/about/	Individual Account balance limits of $500, not anonymous, only 3 contracts are open to trading by non-academics.
http://www.betfair.com/	Sports only, Europe Only, but very much alive.
http://newsfutures.com/	Dead. Remnant absorbed into private consulting group.
http://www.lumenogic.com/	Private industry applications only, private operations. No publically available prices or data. Presumably expensive.
http://ideosphere.com/	Play-Money only.
http://www.policyanalysismarket.com	Killed within 24 hours[3] by ignorance[4].

Table of PM operators, roughly in order of peak significance.

The Image Problem

PMs have weak advocates and strong opponents. Firstly, PMs strongly resemble[5] betting, which can be taboo. For an excellent summary of the discomfort most people have with betting, see this blog post. Secondly, they often work too well, and as every member of a large organization knows, 'flattery' and 'loyalty' trump petty details like 'accuracy' every time. If you're smart, you tell people want they want to hear, and definitely not what you really know. Most organizations, governments especially, don't want accurate forecasts[6] and anyone who advocates for them is appearing to accuse the existing sources of lying (and putting their career on the line). In exchange for what?

Thus, because defenseless PMs so closely resemble gambling, monopolistic casinos can engage in anticompetitive lobbying behavior[7]. Look again, and they not gambling but instead (according to CFTC

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[3] http://www.newyorker.com/reporting/2013/12/16/131216fa_fact_lizza?currentPage=all
[4] http://hanson.gmu.edu/PAMpress.pdf
[5] PMs basically are betting, with the "odds" set my market forces instead of bookkeepers.
[6] http://www.cato-unbound.org/2011/07/13/robin-hanson/who-cares-about-forecast-accuracy
[7] http://youtu.be/6xkSPUj5ZgQ?t=5s

bureaucrats trying to advance their political careers[8]) an unregulated futures market[9]. Once, a PM triggered the psychological bias known as "taboo tradeoffs" (as, for some contracts, someone might benefit from an event which harms the group), creating an onslaught of uninformed[4][10], irrational[11] fake politician-outrage. None of it made any sense, but I'm sure it made someone's political opponents look bad.

The situation will never improve. Overwhelming academic and industry support[12] is not enough. Even overwhelming public support would not be enough (were it ever obtained for an idea which is taboo, new, and difficult to explain). Economist Bryan Caplan has remarked[13] that a bet is "a tax on hypocrisy"; would our political leaders really bring a tax upon themselves?

The Trust Problem

Bitcoin operates independently of a nation's legal framework, and might seemingly avoid the Image Problem. If so, competing "Bitcoin InTrades" would appear to fulfill market demand.

Unfortunately, PMs require a way to store up money and pay it out based on a real world outcome, which implies trusting a third-party with your money. The Image Problem prevent the creation of any brand, reputation, or legal guarantee that would justify this trust.

Bitcoin is P2P software. It was not ever designed for *other people* to store your money; it was designed for *you* to store your own money. The Bitcoin businesses that oppose this intent by holding customer funds (a clear example being the currency exchanges) lose those funds regularly. Although businesses can prove their solvency, proof of future-solvency is impossible, and even solvent Bitcoin PM businesses would be able to steal funds by trading on and then reporting incorrect prediction outcomes. The Trust Problem only worsens with scale, as there is a bigger pot of money for hackers or insiders to steal.

Blockchain Solutions

Although Bitcoin does not solve our PM problems, it demonstrates that a blockchain can provide scalable, censorship-resistant, and trustless solutions. Blockchain solutions also generate efficiency by cutting out middlemen and avoiding overhead costs (no brick-and-mortar, compliance, or administration). They are egalitarian and immortal.

For these reasons, I designed a blockchain which creates and manages prediction markets. My design was able to solve a few other PM-problems as well. Any user can create a market, removing the

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[8] http://dealbreaker.com/2012/11/now-you-cant-buy-your-crude-oil-futures-in-10-increments-on-intrade/
[9] http://www.cftc.gov/PressRoom/PressReleases/pr6423-12 (InTrade was an Irish, not US company)
[10] http://www.overcomingbias.com/2013/12/wyden-puff-piece-errors.html
[11] http://hanson.gmu.edu/innovations.pdf
[12] http://hanson.gmu.edu/promisepredmkt.pdf
[13] http://econlog.econlib.org/archives/2009/03/what_does_the_b.html

dual-requirement that a PM-administrator must not only be trustworthy, but also share your prediction-interests. Market scoring rule technology ensures that <u>trading volume is irrelevant</u>, and traders will always be able make a trade updating the price to their estimation (even if they are the only trader). Markets are not limited to two 'Yes'/'No' states, nor are they limited to one dimension. Finally, a custom algorithm, based on a game-theoretic application of weighted singular value decomposition, determines and sustains accurate reports about the market outcomes.

I hope you're interested in helping me make world-class knowledge freely available to everyone, and allowing individuals to profit by contributing their personal experiences. To learn more about what I have to say, you could consult the following:

1. If you'd like to dive into the technical details of the PM blockchain, read Truthcoin_1.1.pdf .
2. PMs are easiest to understand in their simplest "Yes" / "No" form, where the price of "Yes" represents the probability of the event happening. However, PMs can easily be combined into more interesting types. File 2_PM_Types.pdf discusses multi-state and multi-dimensional contracts in greater detail.
3. PMs can be used to build the optimal efficient forecast of the future. They aggregate all available information, prefer cheaper info sources to expensive ones, and discourage waste and redundancy. However, PMs can do *much* more than just predict the future. For a taste of some of these other possible applications, read 3_PM_Applications.pdf .
4. PMs can be difficult to understand. I have personally observed even professional forecasters making the same misinterpretations over and over again. Refer to 4_PM_Myths.pdf to avoid embarrassing yourself!
5. Market manipulation is a frequent subject of discussion in the PM world. If we are to trust PM-accuracy enough to use PM-estimates to inform our decisions, we have to consider how adversaries might strategically respond to such trust. In 5_PM_Manipulation.pdf I discuss the immunity all PMs have to naïve manipulations, and describe how the Blockchain PMs I designed have unique features which enable them to resist *all* manipulation attempts, and even profit from these attempts at the expense of the manipulator.
6. The PM Blockchain employs something called the Logarithmic Market Scoring Rule, which can be difficult to understand. I built an Excel spreadsheet demo of hypothetical trades in LogMSR_Demo.xlsx to help anyone interested.

Conclusion: A Brighter Future

For millennia, there was suffering and misery. Can you imagine a world without music, or eyeglasses, or DayQuil? Our ancestors wished they knew how to make those things. They wished they knew how to stay warm, prevent their teeth from falling out, or use the stars to navigate. They probably wondered what stars were. Despite having brains that were essentially the same as ours, no one in any occupation in any region of the world would see an answer to that question or countless others. They wouldn't even see progress, any hope that the questions even *had* answers, until a very special time.

If the utopian Scientific Revolution (1543-1687) had a motto, it was arguably that of the Royal Society of London: *"Nullius in Verba"*, which implored individuals to *"Take no one's word for it"*. Knowledge could not be received passively from an authority figure; it all had to be verified by personal experience. It was an idea that would literally change the world.

Sadly, the world has only partly-changed. Most people still "take someone's word" for their civic and scientific news, and most don't even know how tell if knowledge was "verified by personal experience" or not. Those who do try to verify even a few claims are quickly overwhelmed by the massive amount of work required. Political think-tanks, for example, often reach opposite conclusions with equal vigor. However, there is only one *reality* experienced, and so only one *truth* (in the sense of "a global consensus of honest expectations"). Opposite conclusions can't both be true.

Another unresolved problem is that we often take our own "word" for things. Modern social psychology reveals that man can be very hypocritical[14] [15] [16] [17]. Evolution produced a creature designed to survive-first, think-later, and to behave and talk accordingly. When everyone pretends to know more than they do (to seem impressive or valuable) it can be hard for a first-mover to admit ignorance honestly. Unfortunately, this means that smart people leave, and the most oblivious take center stage. Politicians do not need to bury the truth, if the public entomb it within a Library of Babel.

 PMs allow the layperson to examine the relationship between truth and experience as easily as checking the day's stock market. Is global warming going to affect my life? Check the markets on the likelihood of future temperatures, future sea levels, and future hurricane damages. Will a campaign promise be fulfilled? Will a new medical treatment really live up to its hype? Will a scientific theory still be accepted in 50 years? Which team is mostly likely to win the Super Bowl?

The printing press helped set the stage for first Scientific Revolution, but it took a new way of looking at information (a heretical, taboo way) to make *what was printed* have the impact that it did. Similarly, we today have the internet, drowning us in information-sources. *What is broadcast* is less useful than it would otherwise be if we could reliably combine this information into one Truth. We need a new (heretical, taboo) way of looking at information today! Viva la revolución!

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[14] http://en.wikipedia.org/wiki/Introspection_illusion
[15] http://www.overcomingbias.com/2010/03/homo-hipocritus.html
[16] ftp://ftp.gate.cnrs.fr/RePEc/2012/1216.pdf
[17] http://en.wikipedia.org/wiki/List_of_cognitive_biases