Market Empiricism

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Our Common Enemy

> *"All suffering is caused by ignorance."*
> *- Buddha*

What if you had access to the combined intellectual powers of all mankind? It would be easier for you to make decisions. You'd know what school to attend (if any), where to live, where to work, what to buy, and how to save/invest. You'd more quickly become aware of new medical treatments, unethical behavior within business/government, terrorist threats, societal problems, and of the consequences of a given law, scientific endeavor, or industrial achievement.

The economic-technology that makes this possible 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 **a place to buy and sell predictions**. Valid predictions entitle their owner to $1[1], whereas false predictions are worth nothing. The current market price of these tradable predictions can then be interpreted as the likelihood of the prediction coming true.

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.

When anyone can trade, no source of information is overlooked, and market forces balance info-sources in a way that is consistently and unanimously acceptable. A PM quickly integrates all available human subject-knowledge into a simple and useful representation of reality: a single number.

While it may sound far-fetched, the core idea is endorsed by some of the 'best of the best', multiple Nobel Prize winners, and superstar executives of the world's leading organizations.

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

I still don't get it.

Television has a gift for simplifying and communicating ideas:

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

For more examples see PM_Applications.pdf and LogMSR_Demo.xlsx.

The Failure of Conventional Information Sources

Compared to PMs, current info-sources do not inform and are therefore unacceptable.

Formal scientific publications are:

1. Unavailable (one would think that taxpayer-funded work would be freely available to the public, but in fact access to published research has become prohibitively expensive even to Harvard).
2. Incomprehensible (even among insiders).
3. Written/Published slowly (typically one publication is a multi-year process).
4. Ultimately, not even accurate! For university-grade research, from 60% to as high as 90% of published claims later turn out to be false.

Informal sources (TV/Internet):

1. Place no serious emphasis on objectivity, accuracy, or accountability.
2. Reward content that is flattering, amusing, frightening, or otherwise emotionally-distracting.
3. Manufacture/manipulate content to hold the audience's attention through the next advertisement, even when nothing attention-worthy is happening.

Fortunately, individuals are generally unaware of science and media reporting[3], and instead draw conclusions using their own experience and the comments offered by their friends/family/peers.[4]

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[2] Note that a] Maher himself seems more interested in allying the more-popular guest than in learning the science (a psychological/social barrier to truth which PMs aim to overcome), b] the formation of the bet ('the experiment') represents a clear/measureable outcome on which individuals have literally agreed to disagree (they are not open to persuasion), and c] the micro-debate terminates with mutual respect.

[3] Although the average American watches several hours of television per day, even the most popular cable news show never achieved a weekly viewership of even 1% of the US population. Although a large percentage of people claim (in surveys) to watch C-SPAN, these claims are not supported by (for example) Alexis rankings (foxnews.com, cnn.com, and c-span.org, rank 39th, 15th, and 8120th respectively). Of hundreds of acquaintances, I know of only one regular C-SPAN viewer (who is, regrettably, too old to change his mind about anything).

[4] Perhaps this is partially because the average citizen is unable to persuade info-sources (mainstream media or research universities) to investigate anything that actually affects their lives.

A Natural Fit for the Information Age

Can PMs help to make knowledge-sharing activities useful, instead of useless?

The key problem of our Information Age is not info-availability, but information-aggregation: combining millions of information-sources into one representative assessment.

Imagine a traffic light which has been disabled – each of its three lights is off. Now ask: is it an improvement to have all three lights *simultaneously on*? Of course there is no improvement – the traffic light as broken as before. All interesting statements, on all topics, are either True or False, and False is the opposite of True. Information can, therefore, be "destroyed by addition", leading us to conclude that the vast information-transfer capabilities of the modern internet are, in the absence of structure, perfectly useless.

Of course, the internet has many "structures" which do, in fact, make it very useful. These include: search engines, social media, databases, and mailing lists. The internet also extends the broadcasting capabilities of our pre-internet info-providers (CNN.com, library.yale.edu, blogs run by experts, …). While each of these is useful, none is a match for the raw aggregation power of a financial market.

Financial trades (ie, wagers[5]) allow *anyone* to challenge *any piece of information* they want. If this trading activity is anonymous, ideas can be proposed, and challenged, without risk to anyone's feelings or career. However, unlike anonymous talk, this "troll-proof" communication platform filters out all insincere actors, and thus resists all forms of vandalism and manipulation[6].

PMs aggregate information by providing *those with special knowledge* (ie, knowledge differing from the current forecast (the market price)) with an incentive to reveal that information (by making a trade). A PM doesn't need to find the most-informed people in a crowd; these people will come to the PM (and enjoy doing it). Similarly, the PM doesn't need to check people for motive, error, or bias; market traders check each other with each and every trade.

Their greatest benefit lies in their unlimited ability to scale – while a bet (or worse, a conversation) can only take place between two people at a time, and a bet's revealed-information can't be "re-used" (this information including: the precise nature of the disagreement, the specific conditions of the bet, the bet-offers which were accepted/refused…this info is unable to travel reliably), **prediction markets always fully involve everyone**. They can aggregate, and broadcast, theoretically-unlimited quantities of information. Because anyone who disagrees with the market price has an incentive to change it, the price only would only stop changing when *no one* disagrees with it. Online communities typically collapse when their growth crosses a certain threshold; markets, however, only become *more* liquid.

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[5] PM-trades *are* "bets", where the "odds" of each bet are set (and reset) continuously by market forces (instead of by individual bookkeepers). Unlike socially-useless gambling, this variation in odds

[6] In fact, it is optimally incentive-compatible, as it pays individual agents based on how important *they believed* their contribution to the discussion would be.

On the Use of Prediction Markets

Problems with Existing PMs

One might rightly ask, "If PMs are so great, why don't we already use them everywhere?"

Perhaps they *aren't* a great idea? Yet, these 'event derivatives' are nearly identical to existing financial derivatives[7] (which are very popular), and a major PM-website (InTrade.com) was popular-and-growing before it was forced to close (for being unable to comply with US Banking regulations). PMs have network-effects; the bigger the group, the better. If PMs are going to face institutional opposition, they'll never get big. What's the problem?

Perhaps, PMs are just new, and take some getting used to. Life insurance was once considered gravely immoral, and the stock market was once considered base gambling. Today, it is considered *responsible* to purchase life insurance, and *sophisticated* to "put money to work" in "the market".

Unfortunately, **Prediction Markets have features which inherently attract censorship**.

1. Prediction Markets Make Leaders Less-Powerful

"The main barrier to wider-scale adoption of prediction markets is that most organizations are reluctant to use them. It is unclear why this is the case. **Those currently in power** within firms may resist prediction markets because the markets would spread previously privileged information across the company** and change perceptions of what is knowable and who knows what." (emphasis added)

- [Dr. Robin Hanson](#), Prediction Market Thought-Leader

Groups usually have leaders, and these leaders make the decisions. With their veto-power, these authorities [1] "own" all the ideas generated by anyone, and [2] any success that follows. In fact, non-authorities [must bring their best ideas](#) to the authorities, for free (in order for them to be merely rubber-stamped). It's a pretty good deal for "the decider".

Prediction markets break that deal, and allow ideas to stand uniquely on their merit, without any certification or endorsement from anyone. This obsoletes the process of leadership entirely.

To see why, ignore for the moment that PMs allow anyone to **edit** a forecast (which is part of the "wisdom of crowds" which makes them so accurate), and instead pay attention to the fact that PMs allow anyone to **view** "*the" forecast*. No one has any more information than anyone else. **No one** has *any* more information than anyone else.

Because everyone is on the same page, and everyone *knows* that everyone is on the same page, there is no need for a leader or coordinator at all.

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[7] Compare "pays $1 if Hillary Clinton is elected in 2016" to "pays $1 if the price of Bond X is above Price Q".

2. Markets Are Inherently Unpopular (Especially Among Intellectuals)

"As consumers, we consume a million and one things, and seldom have a concentrated interest in any one. As producers, our interests tend to be concentrated; we get most of our livelihood from one activity or occupation."

"The role of the intellectual is much more limited in a free society than it is in a controlled society."

-"Why Does the Free Market Have Such a Bad Press?", by Milton Friedman, 2 July 1966

The first quote is damning enough (putting the consumer of information at a tremendous disadvantage), yet the second should be most concerning to us.

Prediction markets produce information for society. This puts them in direct conflict with other info-producers, namely **intellectuals**. PMs settle debates, instantly and permanently; yet debating is precisely what intellectuals are *best at*. To the intellectual, a difficult problem allows them to take center stage. They are to be flown around the world to conferences (at someone else's expense), and introduced as visionaries and geniuses. They are the heroes, the respected guardians of sacred truth, conquerors of ignorance!

We all want to win the respect of our peers, it is human nature. But what if there were a better way of settling complex issues, one which didn't involve "the intellectuals" (as people)?

The PM, thus, slaps intellectuals in the face in two simultaneous ways: [1] it steals their job, and [2] it points out that they weren't doing it right to begin with. The modus operandi of the PM *should* threaten all experts, because it outright rejects expertise altogether[8].

I think we can expect these (influential) individuals, to react poorly to the introduction of PMs.

3. A Bad First Impression

A further disadvantage, of course, is that PMs compete not merely with intellectuals, but with *all* info-sources. Most dishearteningly, this includes [1] the media and [2] social conversations.

For the former, it is foolish to expect Encyclopedia Britannica to include a flattering entry concerning Wikipedia. Similarly, pundits and bloggers tend to be disproportionately PM-skeptical.

For the latter, most human conversations – whether in the school playground, or the CEO's boardroom – are gossip. This is not to diminish the importance of gossip (the question of "Whom can I trust?" is a timeless one), but it is to lament that nothing substantial seems to rise above the posturing. Needless to say, the concept of a bet, implies that one cares more about "making money" than about

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[8] Instead, PMs emphasize openness and filtration – everyone is included in the process, but those who lack self-confidence are then filtered. To the extent that 'expertise' is involved, it is assessed on a per-trade basis, not a personal basis; with each new trade, anyone can compete with an Ivy Leaguer, at no disadvantage.

"speaking for the listener's benefit"...in addition to turning one into some weirdo who cares way-too-much if things are true or not, in addition to [a whole host of other social problems](#).

Hence, the public is unlikely to hear about PMs in school, or in the news, or from their friends. If they do hear about PMs at all, it is usually something uninformed or incorrect. The net effect is a kind of unending negative propaganda campaign.

4. PMs are Stubborn

Prediction Markets say exactly what they really think, regardless of who asks.

This is an extreme social aberration, and quite dangerous.

In our real world, there are alliances to maintain; we all expect that our friends, and even our acquaintances or neighbors, will treat us with kindness and respect. If we screw up, we expect some forgiveness, purely because we've been "a peaceful, law-abiding member of The Community for X years". **There is a fundamental tradeoff between truth and loyalty**; mastery of this tradeoff lies at the heart of mankind's oldest and deadliest weapon: politics.

PMs would shackle you (in this case, all the way on "truth side") and prevent you from maneuvering along this tradeoff! What if an ally were being humiliated by the markets? Worse, what if an enemy were being vindicated by the markets? There would be no recourse, no pleading, no negotiating. No opportunity for *you* to use *your* special popularity, your favors or resources. It would mean that you are no longer uniquely important to the permanent decision-making process. The horror!

In contrast, the smartest people in the room know "how to play the game", Lesson #1 is "Make Friends", and Lesson #2 is "*Never* say exactly what's on your mind". The best and brightest will be keeping their mouths shut about "the benefits of PMs", because they (correctly) realize that the more important conversation-topic is "what my boss thinks about PMs".

Because it refuses to compromise, there is only one way to influence a PM: destroy it altogether.

5. Censorship is Power

Finally, and most practically, there will always be those who, for whatever reason(s), want to prevent information from spreading. Such activities are common in all places and times.[9]

The Cost of Blockchain Immortality

Blockchains are among the slowest and most-convoluted database structures in the history of technology. While most databases sync in seconds (and some in nanoseconds), Bitcoin syncs in (highly irregular) 10 minute intervals. Because each member of the network is treated as an equal "peer", the network throughput is, generally, constrained by the network's weakest and slowest members.

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[9] The Edward Snowden revelations would one modern/USA example of selectively withheld information.

Blockchains are interesting for only reason: they cannot be destroyed. The blockchain structure supports the so-called "heaviest chain rule", where each blockchain inherently contains a kind of "score" – a single number (usually called the "cumulative difficulty" or "weight"). This number can be calculated from the database contents *alone*; Bitcoin simply displays the database with the highest score it could find. Users can connect, disconnect, start from scratch. It doesn't even matter who they connect to, or what these connections actually say – eventually all users will find "the" correct database. Each user contains a full backup copy of the database, which can be used to regenerate the entire system.

For Bitcoin, the merit of the tradeoff was clear: any "database of financial assets" carries with it a dangerous property: money can be made by anyone who can tamper with it! Indeed, the inspiring concept of "cash on the internet" had, empirically, failed many times[10] for this precise reason.

Bitcoin's Escrow Deficiency

Bitcoin's immortality can protect *consumer* markets (where goods are purchased), but can it protect *capital* markets (where assets are traded)? If so, competing "Bitcoin InTrades" and "Bitcoin Stock Exchanges" would appear to fulfill market demand. Such a service could use Bitcoin only as a medium of exchange, and do all of its accounting in (more stable) fiat.

Unfortunately, a capital exchange requires 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. Use of supra-national Bitcoin would prevent the use of any legal guarantee (to justify this trust).[11]

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 (for example, 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. This problem worsens with scale (as there is a bigger pot of money for hackers or insiders to steal), leaving us back where we started. **Capital markets *thrive* on scale, yet "Bitcoin 1.0" seems unable to provide a scalable solution.**

Can A Second Blockchain Solve This Problem?

To solve the problem of scalable capital markets, **I designed a [sidechain](#) which creates and manages prediction markets**. Although Bitcoin does not solve our PM problems, it demonstrates that a blockchain can provide **scalable, censorship-resistant, and trustless** solutions. As software, blockchain solutions also generate **efficiency** by cutting out middlemen and avoiding overhead costs (no brick-and-mortar, compliance, administration, etc.). They are **egalitarian and immortal.**

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[10] Notable (privacy stubborn) failures included Liberty Dollar, e-Gold, Liberty Reserve, as well as early PayPal.
[11] Even if laws were passed concerning the management of "Bitcoin hedge funds" or "Bitcoin re-insurance portfolios", these laws *literally* cannot be enforced. As a result, large scale financial operations are unmanageable.

My design was able to solve a few other PM-problems as well. **Any user can create a market about anything**, removing the dual-requirement that a PM-administrator must not only be trustworthy, but also share your prediction-interests[12]. Market scoring rule technology ensures that **trading volume is irrelevant**, 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_Whitepaper.pdf.
2. For trading, 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.
3. 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.
4. 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 .
5. 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!
6. 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.
7. Some are concerned that PMs will encourage (or make it easier to finance) crimes such as assassinations. I respond to this concern in 6_Crime_Markets.pdf

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[12] After all, it is something of a contradiction to expect PMs to aggregate society's information, and yet expect any centralized PM administrator to *know* which PMs to create. Thus, decentralization creates a kind of permanent affiliate program, allowing users to monetize their *knowledge of disputes*.

Conclusion: The Second Revolution

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, and 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 these 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-or-was-not "verified by personal experience". 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 expectations can't both be true; what to do?

Another problem is that we often take our own "word" for things, when we shouldn't. Modern social psychology reveals that man can [be](#) [very](#) [hypocritical](#). Evolution produced [a creature designed](#) to [survive-first, think-later](#), and to behave and talk accordingly. Optical illusions, for example, help our eyes quickly process information that is nonetheless incorrect.
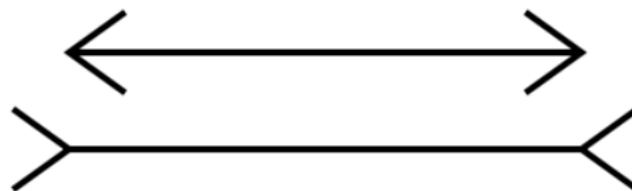

Figure 2. A classic optical illusion. Surprisingly, both horizontals are the same length. More importantly, **even after you verify this equality, you will continue to perceive the figure "wrongly".** Self-awareness, if achieved, must be constantly maintained…we must always be skeptical of our beliefs.

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 the informed people leave the conversation in frustration, while the oblivious brashly take center stage. Politicians do not need to obscure the truth, if citizens lose the original among a thousand imperfect copies.

PMs allow any individual to examine the relationship between truth and experience as easily as checking the day's stock prices. Is global warming real, and will it ever 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? More importantly, we can compare and contrast different potential-futures: Which political party is most likely to get us out of this war? Which FED policy is most likely to decrease future unemployment? Is our CEO really worth all of this money (what would happen to our stock price if we fired him)?

The printing press helped set the stage for first Scientific Revolution, but it took a new (and heretical) way of looking at information – Empiricism – 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 Multiple Sources into One Truth. We need a new (and taboo) way of looking at information today! Viva la revolución!

Appendix 1 – The PM Graveyard (vs BlockChain Immortality)

PM Operators – Unambitious and Short-Lived	
Name / Link	**Status**
economicderivatives.com	**CLOSED**. Even the likes of Goldman Sachs could not keep this one open.
intrade.com/v4/home/	CLOSED following problems with US regulatory compliance in early 2013.
tradesports.com	**Sports only**, Closed Nov 2008, re-opened Jan 2013 Closed again, Now back./Finally closed.
inklingmarkets.com	**Irrelevant: Private only**. Scope/pricing unknown.
thewsx.com	**CLOSED**.
bizpredict.com	**CLOSED**.
tippie.uiowa.edu/iem	**Irrelevant:** Limits of $500, not anonymous, only 3 markets total.
betfair.com	**Sports only**, Europe Only.
newsfutures.com	**CLOSED**. Remnant absorbed into private consulting group.
nadex.com	**CLOSED** by the CFTC "[political futures are] contrary to the public interest"
lumenogic.com	**Irrelevant: Private only**. Scope/pricing unknown.
ideosphere.com	**Irrelevant:** Play-Money only (not "markets").
policyanalysismarket.com	**CLOSED** in a single day by ignorance.
sandhill.exchange	**CLOSED** by the SEC while in testing phase.

Bitcoin Betting "Solutions" – A Point of Failure (that Worsens with Scale)	
Name / Link	**Status**
BitBet	Alive and well, for now. Hosts <50 bets at a time, (imperfectly-dynamic) pari-mutuel, volume typically <$5,000 per bet, BTC accounting, 1% fee.
BTC Sports Bet	Very old, yet apparently untrustworthy.
BetsOfBitcoin	Also old, yet closed after mysterious involvement with a BFL scam. Funds stolen or missing.
Predictious	Volume: 130 shares (* 10/1 * 1/1000 * 500/1 = $650, or pitifully low). Users do not trust.
bitcointalk Gambling Summary	Post about Bitcoin gambling insolvency (over 24 websites closed).

Roughly half of Bitcoin exchanges fail. Small exchanges close and large exchanges are hacked, as I argued above. This research was pre-MtGox-failure, a failure that itself resulted in the loss of 6% of the circulating Bitcoin money supply.

Other Notes:
History of US Election Wagering
History of UK Insurance and Gambling Law

History of US Life Insurance
      Banned by most churches (as "immoral")
      Steadily (and safely) deregulating itself.
List of Official US State-Sponsored Lotteries