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Testimonial Injustice and Prediction Markets

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ABSTRACT

This essay argues that prediction markets, as one approach for aggregating dispersed private information, may not only be praised for their epistemic accuracy. They also feature characteristics that are morally desirable from the point of view of epistemic justice. Notably, they are a promising approach when we are trying to address testimonial injustice. The impersonality of market transactions effectively tackles the issue of identity prejudice, which underlies many forms of testimonial injustice. This is not to say that prediction markets do not pose challenges for epistemic justice of their own like the risk of excluding knowers based on ability to pay. Or, in light of identity prejudice's systematicity, the risk of discouraging some knowers because of differences in education or social background that lead to a certain unease when faced with prediction markets. The essay discusses these challenges, concedes limitations but also offers countermeasures to certain worries – e.g. hosting prediction markets on a play-money basis. Throughout, the essay addresses the question of the potential scope of using prediction markets for epistemic purposes, notably by means of the practical example of a prediction market for monetary policy.

KEYWORDS

Testimonial injustice; prediction markets; identity prejudice; impersonal exchange

Introduction

According to Fricker (2007, 28), testimonial injustice (TI) is a kind of epistemic injustice that occurs when a hearer discounts (or adds to) the credibility of someone's testimony, because of some kind of prejudice as regards their social identity. The purpose of this essay is to argue that, of all things, markets may come to the rescue where identity prejudice leads to injustice. More precisely, *prediction markets* may.

Like group deliberation or voting, prediction markets (PMs) are a mechanism able to combine individual people's attitudes into a collective attitude (List 2014). While PMs normally are praised for their epistemic characteristics – notably their predictive accuracy (Sunstein 2006; Bragues 2009; Hanson 2013) – I shall argue that they also feature characteristics that are morally desirable from the point of view of epistemic justice.

I shall first briefly explain what PMs are, also introducing the example of a PM for monetary policy as a promising epistemic institution (section 1). I then argue how PMs structurally address TI (section 2). My main argument is that the impersonality of market transactions effectively tackles the issue of identity prejudice, which underlies many forms of TI. On markets, every trade is registered, irrespective of the identity of the trader. And every trade contributes in the exact same way to the aggregation mechanism that lets the market price emerge.

With the main argument established, in [section 3](#) I turn to other kinds of TI, like *pre-emptive TI* (Fricker 2007, 130), *testimonial quieting* or *smothering* (Dotson 2011; McKinnon 2016), or *testimonial void* (Carmona 2021). PMs also do a good job addressing these, as they provide explicit incentives for everybody to acquire and share knowledge. However, the discussion also reveals limitations. Taking into account differences in education or social background of potential participants, we may worry that PMs are unable to overcome or at least mitigate existing systemic inequalities.

In [section 4](#), I discuss the most salient risk PMs pose with respect to they themselves excluding knowers; namely, exclusion based on a lack of ability to pay. I argue that this risk can be more easily addressed than other kinds of structural epistemic injustice. This is true even though the fact that identity prejudice tracks the subject ‘through different dimensions of social activity’ (Fricker 2007, 27) – i.e. TI’s *systematicity* – resurfaces in this context. For instance, we may equalize the financial situation of participants by limiting bet size or conduct the PM on a play-money basis. On empirical grounds, I argue that the latter option is preferable.

The paper concludes with some general considerations about the appropriate scope of using PMs for epistemic purposes ([section 5](#)).

1. Prediction Markets

Generally speaking, a PM is a market on which bets about future events can be traded. PMs are unlike traditional betting on, say, football games, in that the counterparty of the bettor is not a bookmaker, but another bettor. Therefore, the prices for bets are not centrally determined but emerge from the free interplay of supply and demand.

The most well-known example of a PM is the *Iowa Electronic Markets*, a group of PMs on which bets about the results of elections can be traded. For instance, recently one could have participated in the ‘2020 U.S. Presidential Election Markets’ (Iowa Electronic Markets 2020a). One could have bought either a bet that the democratic candidate is going to win, which pays \$1 if the democratic candidate wins and \$0 otherwise. Or a bet that the republican candidate is going to win, which pays \$1 if the republican candidate wins and \$0 otherwise.

For example, one month before the 2020 elections, a bet for the win of the democratic candidate traded for \$0.794 (Iowa Electronic Markets 2020b). A bet for the win of the republican candidate traded for \$0.208.¹ The way to interpret these numbers is the following. The ‘2020 U.S. Presidential Election Market’ on average predicted at that point in time that the probability of a win of the democratic candidate is 79.4% and that the probability of a win of the republican candidate is 20.8%.

PMs come in different shapes and sizes. What all of them have in common is that they are a straightforward example of attitude aggregation via *behavioral aggregation* (List 2014). In instances of behavioral aggregation, aggregates ‘are determined as emergent property of the individuals’ patterns of behavior’ (List 2014, 1605). What this means is that privately held information gets aggregated *by trading*. The actual empirical process of trading goods on markets is what does the aggregation. Notably, this involves a lot of feedback loops. If I see the price of something rising due to increased demand, I might choose to buy less of that thing which reduces demand, which might in turn lead to a reduction in supply, which drives the price back up, and so on.²

PMs notably are renowned for their predictive accuracy. There is a wealth of evidence about them outperforming other approaches for making predictions (e.g. Pennock, Steve Lawrence, and Arup Nielsen 2001; Gjerstad 2005; Lionel and Clemen 2013). The most widely studied case is that of comparing PMs to polls on the outcomes of US presidential elections. They beat them in 709 out of 964 comparisons (Berg, Nelson, and Rietz 2008). This also means that PMs are not always right. But the consensus is that their accuracy typically is higher ‘relative to alternative institutions dealing with the same situation’ (Hanson 2013, 156).

PMs are no multi-purpose tool. Most importantly, 'it is not easy to see how PMs could be used on normative questions' (Sunstein 2006, 208). We may have a vote on whether we should push the fat man off the bridge to stop the trolley. And we may have a PM on whether people will vote that they should push that fat man off the bridge. But we cannot have a PM on whether we should push the fat man off the bridge.

This is because PMs function best when the object of betting is a future event that is exogenous to the betting on the market and that can be empirically assessed with absolute certainty once it occurs (Sunstein 2006). However, empirically assessing normative facts is notoriously hard to do. This is why Sunstein holds that '[a]t most, such markets could be used on the factual questions that are sometimes part of ... [normative] questions' (2006, 208).

To give a concrete example of a PM that is both feasible and promising from the perspective of epistemic justice, think of a PM on monetary policy. Enacting monetary policy to achieve a given goal is an immense epistemic challenge. Many unforeseen and hard to measure factors may influence success. If predicting a country's future economic performance is notoriously difficult, deciding on measures to achieve particular economic goals, like a target inflation rate, is even more so.

Currently, it typically is high-ranking members of central banks who decide in non-public meetings which monetary policy would be good to enact to achieve a predetermined inflation rate. The success in achieving this goal relying on this epistemic mechanism has been limited at least since the financial crisis of 2007–2008. Based on Sunstein's (2006) arguments, we may reasonably hope that relying on a PM instead would improve this track record. Hanson (2013, 161) mentions some ideas how such a PM could look and function in practice.

Importantly, establishing such a PM would not help us in addressing the normative question of which monetary policy is just, e.g. whether the entire idea of a target inflation rate is somehow wrong. A PM also would not be suitable to address the question of whether we should aim for an inflation rate of 2% or 5%.

Instead, what speaks for a PM on monetary policy is that it would more reliably tell us which policy, if enacted, will prove successful in achieving a given target inflation rate. It would do so by ending the practice of only some groups' voices being heard and taken seriously. This makes sense given that whether monetary policy achieves its goals crucially depends on how all those affected by the policy behave once it is enacted. One of the unforeseen and hard to measure factors of monetary policy is people's actual behavior in reaction to the policy. Since it is everybody's behavior that affects macroeconomic measures like the inflation rate, it is not only more epistemically just but also reasonable to listen to everybody and equally so in trying to come up with policies reaching their goals.

Furthermore, relying on a PM might help to alleviate the widespread impression that monetary policy is partial. Consider that most central banks have a wide array of tools at their disposal to achieve a target inflation rate. Quantitative easing, with the central bank buying government bonds or other financial assets, has been in vogue in recent years; as has the more traditional tool of lowering interest rates. But there also are tools like credit guidance (i.e. influencing the lending practices in certain sectors) or directly influencing exchange rates. All these tools are not only effective but also partial, in the sense that each also tends to particularly further some groups' interests. Being a favorite tool for one group also makes it likely that that group will have studied it in more detail, knows more about its intended ways of working, indicators to look out for, and so on, and thus be inclined towards predominantly using that tool. A PM counteracts the tendency that the same tool is employed over and over again, albeit with limited success, simply because those in charge are experts for it.

2. Identity Prejudice and Impersonal Exchange

With the example of a PM on monetary policy in mind, let us turn to how exactly PMs address epistemic injustice. Note that what follows applies to our example as well as to PMs in general.

Fricke (2007, 22) argues that we can trace back all kinds of cases of TI to *identity prejudice*. With Anderson (2012, 166) we might want to ask ‘why credibility discounting and epistemic marginalization must ultimately be traced to prejudice in order for it to be unjust’. After all, this means to assign the fact that people’s testimony receives less (or more) credibility because of their social identity a fundamental place in the theory. But also with Anderson, we may answer that we need to distinguish epistemic errors that are not intrinsically justice-related from epistemic injustice as such. ‘[I]nnocent epistemic error, or even mere epistemic negligence, does not do an injustice to the speaker . . . It is simply a mistake. Prejudice is wrongful, and so transmits its injustice to harmful errors that it causes’ (2012, 166).³

Because identity prejudice and similar epistemic vices occupy such a fundamental place in theories of TI, we may argue that PMs are highly suitable for counteracting TI. This is because, like all modern markets, they rely on *impersonal* transactions.

Following North, personal exchange can be defined as exchange that ‘relies on reciprocity, repeat dealings, and the kind of informal norms that tend to evolve from strong reciprocity relationships’ (2005, 117). Personal exchange is predominant in traditional societies, in which family groups and tribes exchange on an everyday basis with the same small group of people over and over again. By contrast, impersonal exchange is effected without a look to the person who is buying or selling. It does not rely on the informal rules and emotional bonds of closely knit social groups to enforce exchange contracts. Instead, it requires the development of formal economic and political institutions to ensure smooth exchange (a monetary system, a reliable legal system, etc.).

In modern markets, we typically do not need to know anything about the person with whom we want to exchange. To buy a candy bar in a supermarket (or a bet on a PM on monetary policy), I need not know who the person sitting at the cash desk is – whether she is trustworthy, for example. In order to perform a successful market exchange basically all we need to know about is the good exchanged and its price.

Modern markets are characteristically impersonal. This also means that the credibility of every anonymous market participant on the PM on monetary policy is exactly the same. You do not ‘testify’ (in the form of, say, betting on a rising inflation) and remain unheard – or heard less than others. Every trade is registered. And every trade contributes in the exact same way to the behavioral aggregation that lets the aggregate market price emerge. Identity prejudice and the TI that builds on it are severely constrained by this.⁴

A different way to make this point is in relation to Kenyon’s (2013) argument that testimonial contexts usually are *informationally rich*. According to Kenyon, testimonial contexts provide a wealth of information about the speaker on which we base our credibility judgments (albeit often unconsciously). This is problematic if identity prejudice leads to the rich information being used against the speaker, i.e. undermining her credibility.

On PMs, the testimonial context is *informationally poor*. This is not because PMs – like the suggested PM on monetary policy – typically are computer-mediated online markets where participants do not see each other. We could set up forms of group deliberation or voting that work in similar ways, so that PMs would lose this typical advantage. Rather, their being informationally poor is a general feature of all impersonal exchange.

Consider that it does make an informational difference whether – in an over-the-counter transaction – the buyer pays using coins, or an infamously expensive credit card, or her cell phone. Notably, one may be inclined to assess the buyer’s overall wealth and/or technophilia based on this. But the only piece of information that matters for the behavioral aggregation of the market is whether the terms of exchange have been respected; most importantly, that the agreed on amount of money has been paid. If this condition is fulfilled, the information that a trade has been effected will be aggregated by the market. And that information will have the exact same credibility attached to it, irrespective of whether the buyer paid by coins, card, or cell phone.

A PM on monetary policy would also be informationally poor in such a way. This would lead, among other things, to all market participants looking at price movements (that suggest policy changes) in the same way, irrespective of who ‘sponsors’ them. Abstracting from personal reputation and theoretical background – i.e. information that is all too present when high-ranking officials hold committee meetings – would lead to more neutral critical evaluations of the situation at hand and suggested policies.

Another facet of markets’ impersonality is revealed when we think about *credibility excesses* and *interactive credibility* (Medina 2011, 2013). Medina points out that credibility excesses of some overly trusted speakers might be similarly problematic as credibility deficits. This is because some less trusted speakers are trusted less precisely because there are more trusted speakers around. Thus, even if ‘credibility has no distributive nature, there is nonetheless an intimate relation between credibility excesses and credibility deficits’ (2013, 62).

As regards PMs, we have to distinguish between people moving the PM, i.e. affecting prices, by *what they say* or by *their trades*. For these are not identical, even though some people seem to be in a position to disproportionately affect markets in both ways.

With respect to the former way, one might reasonably doubt that PMs are immune to credibility excesses. On financial markets, which are similar to PMs in that people make guesses about future developments and take positions accordingly, the voice of people like Elon Musk seems to be heard more widely than that of others. For instance, Musk seems to be able to move the market for cryptocurrencies by his words alone. There is no obvious reason for why similar things should not be possible on PMs, or why credibility on PMs should be assessed in a less comparative or contrastive manner than elsewhere.

However, credibility on markets is not interactive with respect to participants’ trades. While Elon Musk has extra power in the market with his words, he has no more power than anyone else with his trades. More generally speaking, a person ostracized because of his social identity moves the market in the exact same way by his trades than some ‘average’ trader (with the same amount of money at her disposal). It is true that Elon Musk has more disposable capital than others. But the effect his trades have is of the exact same size as the effect a group of anonymous traders would have if they joined forces, together putting forth the same amount. The market does not care *who* buys a certain asset, but only *how much* of a certain asset is bought. There is no continuously declining function of how credence is accorded in a market – with the likes of Musk on top (excess credibility), an average trader in the middle (neither excess nor deficit), and an ostracized trader at the bottom (credibility deficit). In contrast to Medina’s (2013, 60–64) argument, the market giving a particular degree of credibility to some trade does not affect all its other attributions of credibility to other trades.

Thus, as a countermeasure to credibility excesses on PMs, it might be worthwhile to try to limit ‘cheap talk’, i.e. people talking about PMs without being invested themselves and their positions being publicly visible. To the extent that we manage to reduce it, we also reduce credibility excesses being a problem for PMs. Note that for the suggested PM on monetary policy, cheap talk is naturally limited, since, say, a rise in the inflation rate affects everybody – albeit to a different extent.

3. Prediction Markets and Other Kinds of Testimonial Injustice

Anderson (2012) argues that we should address the issue of TI on the level of social institutions, as it is hard to perform the corrective virtue of testimonial justice purely on an individual level (cf. also Medina 2011; Alfano 2015; Sherman 2016). In this sense, it is a good thing that PMs *structurally* address TI.

PMs also address *structural* TI. Consider Fricker’s concept of *pre-emptive TI*. It occurs

when hearer prejudice does its work in advance of a potential informational exchange: it pre-empts any such exchange. . . . The credibility of such a person on a given subject matter is already sufficiently in prejudicial deficit that their potential testimony is never solicited; so the speaker is silenced by the identity prejudice that undermines her credibility in advance (Fricker 2007, 130).

PMs feature incentives that powerfully counteract pre-emptive TI. This is, quite simply, because it pays to be a knower in PMs. If somebody possesses private knowledge relevant to the issue the PM is about, she will regularly be able to cash in on that knowledge. For instance, she might buy bets cheap when everyone else is selling, only to sell them later at a higher price once her private knowledge has become public. And with her trades she herself contributes to making that knowledge public.

If it pays to be a knower, this also means there are incentives to amass more valuable private knowledge. From the point of view of epistemic justice, the important point about this incentive is that it exists for every market participant in the exact same way. If other mechanisms for information aggregation are used, it might be a bad idea to invest in acquiring more knowledge. For the costs of acquiring new knowledge have to be weighed against the risk of not being heard or being heard less than others. Because of the impersonality of a PM, however, one can always share one's knowledge independent of one's credibility among market participants.

The importance of this indirect incentive to become a knower should not be underestimated, especially for members of groups who often are not heard. In PMs, they cannot only share their private knowledge. It even pays to acquire more private knowledge, for they will be heard. If, as McKinnon (2016, 439) holds, being harmed as a knower is a moral harm, then this indirect incentive is fit to raise the knower's feeling of moral worth.

What remains, as long as there are not PMs on literally everything, is the worry that there will be some kinds of knowledge that one can profit from and others that one cannot. This will privilege some knowers while demoting others. Unfortunately, odds are that knowledge marginalized groups exclusively possess (e.g. about experiences of oppression) will not typically be the subject of a PM.

This does not seem to be a straightforward case of *hermeneutical injustice* in Fricker's terms. There not being PMs on experiences of oppression or on the future of social movements is not the same as 'having some significant area of one's social experiences obscured from collective understanding', because certain hermeneutical resources – and notably concepts shared in the social imagination – are lacking (Fricker 2007, 155). Rather, part of the problem is that some issues do not lend themselves easily to being formalized in the context of a PM. Future inflation is easier to quantify than the future of social movements – with quantifiability helping with PM's need for empirical assessment. It is well documented that this bias towards the quantifiable is a limitation of PMs (e.g. Bragues 2009). But certain issues or experiences not lending themselves to being treated on PMs in particular is not the same as them being non-expressible, even outside of PMs, in general.

Be that as it may, there is no easy solution to this worry. Hanson (2013, 174) rightly highlights that we may become more creative with respect to measuring things that are hard to measure and should not be put off if the most common existing measure is rather noisy. Especially if we succeeded in giving people from marginalized groups the epistemic materials needed to understand how PMs work and feel at ease with them, this would seem like a viable strategy. For if they are given these epistemic materials, they are in a privileged position to come up with design solutions for fitting their knowledge to the form of a PM.

If we follow this strategy, however, one might object that we are not cautious enough in our endeavor not to perpetuate epistemic oppression. Notably, we might be accused of abetting a particular kind of hermeneutical injustice that Dotson (2012) calls *contributory injustice*. Contributory injustice occurs when 'there are different hermeneutical resources that the perceiver could utilize besides structurally prejudiced hermeneutical resources' (2012, 32), but the perceiver willfully refuses to acknowledge and use these alternative resources. It is a kind of 'willful hermeneutical ignorance' (2012, 32), where the epistemic agent ignores an entire way of understanding the world.

Contributory injustice is most likely to occur in situations in which hermeneutically marginalized groups have managed to develop alternative epistemologies and protect them against outside pressure, so that they exist and persist among themselves. If these alternative epistemologies then are willfully ignored, we are dealing with a phenomenon in the 'gray area between agential and structural perpetuation of epistemic injustice' (2012, 31).

Unfortunately, the fact that certain issues do not easily lend themselves to being treated on PMs thus might raise worries of contributory injustice precisely when we are trying to make these issues treatable for PMs. If we give people from marginalized groups the epistemic materials needed to understand how PMs work, they might choose to willfully ignore existing alternative epistemologies and instead go for the PM.

As Dotson notes, 'those who experience contributory injustice find that they can readily articulate their experiences'. In our context, this might be because they were given the necessary epistemic materials to feel at ease when engaging with PMs. However, these articulations of knowledge on PMs might fail to gain appropriate uptake and might even be met with resistance. Dotson's worry is that choosing to contribute to a PM could thwart the contributor's ability 'to contribute to shared epistemic resources within a given epistemic community by compromising her epistemic agency' (2012, 32). The contributors to PMs and the marginalized community might develop the mutual feeling that the other side simply 'does not get' the knowledge they are producing.

Dotson (2012, 34–35) elaborates on just how difficult and time-consuming it might be to overcome this kind of third-order epistemic injustice. Even if we managed to, our original worry that there will be some kinds of knowledge that one can profit from and others that one cannot will remain. For part of the worry has nothing to do with PMs as such. While PMs affect how a society aggregates knowledge, they do not directly affect which knowledge is deemed valuable for aggregation in the first place. Yes, contemporary technology has made it comparably simple for everyone to set up a PM on the topic she always wanted (Augur 2021). And yes, knowledge on 'mainstream' social issues, e.g. inflation, that marginalized groups also possess might become the object of a PM. This might help some more knowers to profit from PMs. But the problem which knowledge (and which knowers) we privilege runs deeper. To at least not make the situation worse in absolute terms, we must not allow for PMs to become the only epistemic institution deemed to produce good results. Advocating PMs as a useful complement to a society's existing matrix of epistemic institutions should be accompanied by efforts to promote knowers with knowledge that does not lend itself to be treated on them.

To move on, how PMs address TI with the incentives they provide can also be seen with respect to Dotson's (2011) concepts of *testimonial quieting* and *testimonial smothering*. Testimonial quieting occurs when some speaker is heard – but her testimony is immediately disregarded in such a way that it would amount to the same thing had she not spoken at all. This is, as Dotson stresses, more problematic than to suffer one's testimony being somewhat discounted due to a credibility deficit. Testimonial smothering, on the other hand, is what Dotson coins the speaker's pre-emptive reaction to expected testimonial quieting. A speaker may choose not to speak at all, if she recognizes that she will be utterly ignored. Testimonial smothering is not an instance of the speaker excluding herself from knowledge production. Rather, the speaker deciding not to speak is 'due to a pre-existing injustice in practices of uptake and credibility assessments. Thus, ... testimonial smothering is ... [a] form of epistemic oppression' (McKinnon 2016, 443).

Testimonial quieting strictly does not occur on PMs. This is because a person's trading is never fully ignored. The effect of a single transaction in a large, well-functioning market might be minuscule. But there always is some small effect of trades being effected in markets. And this small effect never gets further diminished because of being discounted based on the identity of the trader.

Testimonial smothering is made less likely by PMs. First, if there is no testimonial quieting, one reason to practice testimonial smothering is eliminated. Second, PMs incentivize the sharing of information. And they do so most in those cases in which one's private knowledge contradicts the current market opinion.

It would be wrong to think that all we need to overcome a phenomenon like testimonial smothering is the right kind of incentive; as if it was the knowers who had voluntarily decided not to talk because there was not enough 'in it' for them. Incentives alone do not do away with the phenomenon of people following the majority, i.e. trading in line with the general market trend, because they do not trust their epistemic voice. It is hard to imagine that someone who is seriously epistemically marginalized is self-confident enough to behave in a PM as if they were not marginalized, just because the incentives are right. I shall have more to say on this in the next section, talking about TI's systematicity. Still, PMs *ceteris paribus* make testimonial smothering less likely.

Carmona's concept of *testimonial void* is closely related to testimonial smothering. It occurs 'when a speaker withholds epistemic materials on the basis of an epistemically and ethically faulty assumption that a hearer-to-be cannot do anything epistemically relevant with the materials' (Carmona 2021, 1). What is characteristic for testimonial void is that the speaker is the one doing the wronging. She withholds her testimony 'because she fails to recognize the hearer as an epistemic subject' (2021, 3), rather than being at the receiving end of epistemic oppression.

Testimonial void is unlikely to occur on PMs. This is because the kind of inner thoughts, which typically underlie testimonial void – thoughts like 'Why bother telling her? She won't know what to do with it' (2021, 1) – seem unlikely to come to mind when considering trading on a market. In a manner of speaking, the market always 'knows' what to do with a testimony in the form of a trade. If someone is buying, the price goes up. If someone is selling, the price goes down.

Put differently, the market is unlikely to trigger the epistemic vices typically underlying testimonial void: carelessness, arrogance, indifference, etc. It would be somewhat strange for a confident knower not bothering to trade because 'the market' is too dumb to understand. It is the market's impersonality – in the sense of the market not being a human person – that helps to counter these epistemic vices, which are similar to identity prejudice in that they track personal characteristics.

This does not mean that testimonial void could not affect PMs in more indirect ways; notably, as a kind of pre-emptive TI as regards the education of potential participants. For one does need a certain kind of knowledge in finance and mathematics to confidently participate in PMs and not all potential participants are equally trained in this respect.

It is often said that markets are a particularly open social arena in that they allow for participation from very different people. You can buy and sell things on a market – and thus participate in the behavioral aggregation taking place – even if you have the 'wrong' religion, if you belong to the 'wrong' class, if you have the 'wrong' political or scientific views, etc.

But in light of structural testimonial void, PMs might not effectively be as open as it might *prima facie* seem. There is exclusion of a more indirect kind, if marginalized groups are kept away from certain epistemic materials (cf. Carmona 2021, 5–9). Even if knowledge on finance and mathematics is not as such withheld from certain groups, the epistemic materials tied to thorough understanding or practical deliberation might be lacking. For instance, teachers might discuss probability calculations and financial tools in less detail with female learners, e.g. by giving less reasons, mentioning less doubts, not airing certain hypotheses – because supposedly it is not worth the effort (cf. Fricker 2015, 79). This bars a deeper understanding or familiarity with these topics and leads to a certain unease when faced with them. If PMs and other financial markets are often seen as environments in which the mathematically apt particularly thrive, then studies showing that women's math performance suffers because of stereotype threat (e.g. Spencer, Steele, and Quinn 1999) highlight the issue at hand. It is not a coincidence that investment banking is a male dominated industry. The kind of structural testimonial void at play here is bound to also negatively affect PMs; e.g. in the form of a biased pool of participants.

A final characteristic of PMs worth mentioning is that, if a PM is liquid enough, it allows for everybody testifying *at the same time*. PMs share this feature that counters certain cases of structural epistemic injustice with some voting mechanisms. That it might be morally desirable can be seen in contrast to aggregating attitudes via group deliberation.

In group deliberation, people state their attitudes one after the other. This may lead to undesirable effects from a purely epistemic point of view. Sunstein (2006), for one, has argued that deliberating groups ‘fail to achieve their minimal goal of aggregating the information actually held by the deliberators’ (2006, 193), e.g. because of the role *cascades* play. Sunstein cites widespread empirical evidence that group members tend to ignore, override, or doubt the information they hold privately because of the information conveyed earlier by others. If you are, say, the fourth person to speak, and the three people who spoke before you all stated they believe that p , odds are that you, even if you believe that p , will not actually voice the information you have in favor of p .

Cascades do not necessarily start because of some kind of testimonial injustice. They might simply start because those points that more people know about or can relate to are statistically speaking more likely to be voiced first and more often. In this case, we are dealing with epistemic error (not aggregating information well) rather than epistemic injustice. Still, cascades have the tendency to further marginalize the knowledge minorities possess and make it more likely for this knowledge never to be heard. As Sunstein stresses, cascades often are not purely informational but also have a reputational form. Group members ‘silence themselves so as to avoid the opprobrium of others’ (2006, 199), which would be problematic for reasons of epistemic injustice. To this effect, it does matter – epistemically and morally – that liquid PMs allow for everybody to testify at the same time.

This is not to say that PMs are immune to *speculative bubbles*, which may form for the exact same reasons for which other epistemic institutions often fail to appropriately aggregate information. For instance, they may form because of *hidden profiles* (Sunstein 2006, 197); e.g. when those who believe that prices in a certain market are too high stay out of the market (rather than actively going against the market by short-selling). Also, price bubbles seem like a good example of *group polarization* (Sunstein 2006, 206). As prices go up, more and more people who used to be skeptical also become ‘bullish’. Right before the bubble bursts, there typically is the highest concentration of investors with bullish sentiments (Thorp 2004).

Consequently, the very positive picture of PMs’ predictive accuracy as painted, for example, by Bragues (2009) or Hanson (2013) should be taken with a grain of salt. PMs are not immune to ‘group think’. For the purpose of this paper, however, it is crucial that these epistemic issues are not likewise issues of epistemic injustice for PMs. This is because PM-transactions are impersonal and behavioral aggregation is an anonymous process.⁵

4. Structural TI, the Rich, and TI’s Systematicity

PMs counteract pre-emptive TI grounded in identity prejudice. This is not to say that PMs might not suffer from variants of pre-emptive TI grounded in things other than identity prejudice.

As Anderson states, in cases of pre-emptive TI, ‘members of a group are excluded from opportunities to testify because they lack certain markers of trustworthiness’ (2012, 165). If you do not have the ‘right’ identity – which is the relevant marker of trustworthiness for many mechanisms – you might be excluded from testifying. Because markets are impersonal, identity is not the relevant marker of trustworthiness to them.

But they operate with a marker of trustworthiness that is able to exclude in a similarly powerful fashion: ability to pay. In PMs, if you lack the money to participate, your information does not get behaviorally aggregated. (Or your information might not get the attention it deserves, if you do not have sufficient funds to back it up.) In this sense, PMs may feature pre-emptive TI based on a lack of ability to pay.

Much can be said about the many ways in which market-based approaches might unduly favor the rich (e.g. Mildenerger 2020, chap. 7). For the purpose of this essay, suffice it to say that exclusion (or discounting) based on monetary grounds does not strike me as being clearly less problematic than exclusion (or discounting) based on identity. Both grounds for injustice are deeply rooted in contemporary Western societies and may wreak havoc if left unchecked.

However, there is one positive aspect about pre-emptive TI based on ability to pay. Namely, it is a kind of structural epistemic injustice that is comparably easy to overcome.

Identity prejudice is hard to separate from what we have in our heads. In the end, what we need to fight when trying to establish just social institutions are our prejudices, i.e. the many cognitive biases that might lead to unjustifiable credibility deficits (and excesses). Designing institutions to this effect is an incredibly hard task.

By contrast, ability to pay has comparably little to do with what we have in our heads, but with what we have in our hands.⁶ Either we have money, or we do not. And the amount of money we have, and how much others have relatively speaking, is comparably easily controlled.

I do not mean to say that it is easily controlled when we consider the economies of Western societies as a whole. Designing institutions to establish distributive justice on the grand scale seems as hard a task as designing identity-blind institutions. But we do not need to get distributive justice on the social level right to address pre-emptive TI based on ability to pay in PMs.

PMs are a niche phenomenon. They are a consciously designed mechanism used for the precise purpose of aggregating information. Because of this, they can be separated from the wider economic system. We can control for ability to pay on PMs (and thus for pre-emptive TI), without at the same time having to control for ability to pay on the social level (and thus for distributive injustice overall).

Two structural approaches for doing so come to mind. First, one might limit the maximum bet size. This would rid PMs of the most drastic effects of existing monetary inequality.

There are many drawbacks to this approach. First, even by setting the maximum bet size very low, we would still exclude the poorest. They have no spare money whatsoever to participate in PMs. Second, a comparatively low maximum bet might hinder people from giving their information the weight they deem fit. If I can only bet \$10 on the democratic candidate winning – although I would be willing to bet \$10 million (for I know, for some reason, with absolutely certainty, that he is going to win) – then the maximum bet size distorts the market price. Third, the same amount of money is not worth the same to a poor and to a rich person. This could lead to the rich self-excluding themselves, as the stakes are too low. Also, if some participants do not feel the risk of (repeatedly) losing all their stakes, this would distort market prices.

I do not think this list of drawbacks is conclusive. While maximum bet sizes would help to reduce the issue of pre-emptive TI based on ability to pay somewhat, all things considered this approach seems insufficient.

The second approach would be to create a new, independent currency exclusively for the PM. Given the technological advances of blockchain technology, creating a trusted currency *ex nihilo* and for a specific purpose is significantly easier than it once was.

This approach would have many advantages. Notably, the operator of the PM could distribute the new currency equally (or in whichever way she deems just). If the operator did not allow for ‘foreign exchange’, i.e. to trade the new currency for currencies like the dollar, we also would not import existing monetary inequality into the system.

Second, even if everybody starts with the same endowment, over time those who trade successfully would gain relative wealth. From an optimistic perspective, this means that those who have shown to be ‘in the know’ acquire a greater potential to influence the market. This arguably is as it should be (Hanson 2013). Note that in PMs, the trade of a participant with knowledge *ceteris paribus* receives the same credibility as that of a participant without knowledge. One might hold that it is not necessarily good that expertise and competence thus play a comparably small role; that the fact that PMs are as informationally poor as they are – being blind to everything but ability to pay – is not in itself good. From this

perspective, the effect of expert traders making more money over time might be welcomed. (Yet, success in a PM is not necessarily related to possessing superior knowledge, expertise, or competence. In a pessimistic scenario, participants who continuously get lucky could acquire 'undeserved' influence.)

Finally, prices would not be distorted by people not being able to bet as much as they can or by people who do not feel the risk of losing everything. With an independent currency for the PM, the value of each unit of that currency would be relative to the overall money supply in the PM. This is unlike the case in which the operator runs the market using dollars – with there being a huge amount of dollars used outside the PM, which influences the value of each dollar used in the PM (and in different ways for the rich and the poor).

The major drawback of this approach is the question of whether it would leave the incentives that drive PMs intact. Who would be loss averse on the PM? Who would invest time to acquire new knowledge to earn more of this 'play-money'? These are legitimate worries.

Yet, there is a fair amount of evidence that suggests that the incentives of PMs are not broken if we use play-money instead of, say, dollars. Emile et al. (2004), for instance, tested two PMs on the results of NFL football games against each other – one operating on a dollar basis, the other running on play-money. They conclude that

[a]s expected, both types of markets exhibited significant prediction powers, and remarkable performance compared to individual humans. But, perhaps surprisingly, the play-money market did not perform any worse than the real-money markets. We speculate that this result reflects two opposing forces: real-money markets may better motivate information discovery while play-money markets may yield more efficient information aggregation (Emile et al. 2004, 243).

This finding underscores the worry that people might be less incentivized by play-money. On the other hand, information aggregation seems to work more efficiently because nobody is excluded based on a lack of ability to pay and because even poor participants can take bigger risks corresponding to the level of credence they have in their own views. Put differently, play-money PMs seem to work better since they are more inclusive. This counteracts the weaker incentivization of play-money, yielding a comparable level of predictive accuracy (Emile et al. 2004, 243).

The main result of Emile et al. (2004), – namely, that play-money prediction markets perform 'surprisingly' well – has been replicated in other studies. Slamka, Soukhoroukova and Spann find 'robust and valid results with both incentive schemes' (2008, 53). Wolk and Peeters (2009) find that trading volume is a significant factor in raising PM accuracy; in the sense that the more people actively trade, the better for predictive accuracy. All the while, 'the information aggregation process . . . operates even when not introducing truthful belief revelation with [real] monetary incentives'. Again, this amounts to an argument for more inclusive play-money PMs. Slamka et al. (2008) find that 'the play-money PMs for the FIFA World Cup are about as accurate as betting markets'. Rosenbloom and Notz (2006) find that while dollar-based PMs outperform play-money ones with respect to predictive accuracy as regards sports events, results do not significantly differ for financial or political events.

To summarize, PMs feature their own variant of pre-emptive TI, if they operate on the basis of a currency like the dollar. We might lose some of their predictive accuracy, if we try to overcome this issue by creating a new, specialized currency for them. But there is considerable economic evidence that even play-money PMs do not fail to achieve their goal of accurately aggregating the information held by the market participants.

At this point, it becomes important to relativize the claim that pre-emptive TI based on ability to pay is comparably easy to address by relying on PMs that run on play-money. With a view to the systematicity of identity prejudice and TI one might argue, for instance, that play-money requires a level of abstraction that discriminates between knowers. Knowers that have been marginalized in other contexts, notably educational ones, might have failed to acquire the relevant capabilities, and thus would not do well in play-money PMs.⁷ Or one might stress that, although play-money PMs treat every trader equally and equally endow them, not all traders are equally trained. This might

keep some knowers from participating in the first place. Also, certain people might never participate because they cannot imagine themselves as bettors. It is no coincidence that people like Musk play the games they play, with other social classes not being associated with such activity.

To summarize, we should not expect knowers who are marginalized outside of PMs to behave as if they were not marginalized when trading on PMs (or when deciding whether to participate). PMs do not provide a direct solution to the systematicity of TI. They mostly leave the underlying structural problem as it is.

What speaks in favor of PMs is that they might have an indirect effect on this systematicity. As argued above, participation in PMs might have positive effects on the epistemic agency of marginalized knowers (and on their feeling of moral worth in relation to this). At least on PMs they are taken seriously. If one wants to be particularly optimistic about this, an analogy to an argument by Mill (1991) on the educative, character-building function of democracy comes to mind.

Mill argues that one can only become a good citizen if one actively participates in political decision-making. He thinks that one can most effectively do so on a lower level, where one's own vote has a higher likelihood to be decisive, in the sense that it leads to visible effects. Participation in PMs might play a similar role: not educating voters to become good citizens but educating traders to become good knowers. If participants learn that their knowledge is important, can have influence, and may be rewarded in the comparably small social arena of a PM, this might catalyze developments in larger social arenas ridden with the same structural inequalities.

Given just how stable epistemic power structures are, we should not be too optimistic. The easiest way to profitably trade on markets is to make the trend your friend, i.e. to follow the majority. And we should not forget that there are further limiting factors to break up the systematicity of TI. For example, all knowers would also need to be granted spare time, as participating in PMs requires time and energy, and becoming a good bettor even more so.

5. The Scope of PMs

Many examples for TI that are widely referred to in the literature involve informal discussions, courtroom cases, or personal conversations. In most of these cases, it is neither possible nor desirable to use PMs to counteract TI.

It is often not possible, because PMs need to be formally set up, require a certain number of participants, and a future event with a clear outcome as the object of betting. It is often not desirable, because I do not think that PMs teach us something about how our everyday epistemic interactions ought to be; in the sense that, quite generally speaking, they ought to be more impersonal. We must not confuse the finding that PMs are able to address many instances of TI because market interactions are impersonal with the finding that personality, in and of itself, is a bad thing to have in epistemic interactions.

So we might end up with the impression that the scope for solving issues of TI with PMs is rather limited; that there are no epistemic purposes for which PMs could be used, which are currently being served by other mechanisms that exhibit TI; that they are able to address TI only where it is least pressing. That impression would be wrong as the example of a PM on monetary policy given above reveals.

Informal conversations and small-scale interactions make for lively examples of different kinds of TI. But one might doubt that they are representative of the most pressing cases. The consequences of TI seem more drastic on the social level. Here, epistemic purposes often call for an aggregation of knowledge from a lot of people from a lot of different backgrounds and TI has the potential to significantly negatively affect many people at once. (Unsuccessful monetary policy surely has this potential as, for example, the Great Depression and the aftermath of the financial crisis of 2007–2008 show.) PMs excel in these kinds of situations. Consequently, PMs

most straightforward epistemic and moral use case is not with correcting transactional TI in informal conversations. It is to complement a society's matrix of epistemic institutions when large-scale epistemic purposes are at stake.

I do not want to go as far as Hanson (2013), arguing that PMs should form the basis for a new form of government – 'futarchy' – where we vote on values, but bet on beliefs. But PMs are a salient candidate for inclusion into the institutional matrix of forms of democracy that take the importance of good outcomes seriously, e.g. 'epistocracies' as proposed by Estlund (2008) or Brennan (2016). Anderson's conjecture that, testimonial justice 'is otherwise known as epistemic democracy: universal participation on terms of equality of all inquirers' (2012, 172) strikes the same chord.

Notes

1. These two numbers can be expected to be close to adding up to 1 but do not always have to. This is because the markets for a win of the democratic candidate and of the republican candidate are separate markets, even if they treat the same event. Whenever the two numbers come apart, arbitrage between these markets becomes possible. If the gains from arbitrage become too small to be worth the effort of arbitrageurs, small price differences might remain.
2. The behavioral aggregation of a market is unlike the evaluation of large amounts of data performed by trained algorithms in the context of artificial intelligence. Using such algorithms may lead to the replication of all sorts of implicit biases contained in the training data (e.g. Catherine and Klein 2020). Because of the kind of data markets aggregate (epistemically thin data about trades effected) market-based aggregation seems less prone to this kind of risk.
3. It has been contested that prejudice is the only epistemic vice relevant in this context. Steers-McCrum (2020) holds that TI can also be based on arrogance, carelessness, or habits (cf. also Li 2016). The discussion of other kinds of TI in section 3 will establish that PMs also counteract vices other than prejudice.
4. The idea that impersonality – or anonymity – might be a desirable feature for just social institutions is not a new one, of course. Hayek (1976) cherishes that markets are not only 'identity blind' but also 'ends-blind' (in the sense that you might be selling things to people, whose values and ends you do not share). They thus allow people to cooperate with each other in spite of their differing goals. One influential recent uptake of this idea comes from Estlund (2008) and his work on democratic practices. Analyzing the idea of 'fair proceduralism' in democratic theory, Estlund argues that, for a procedure to be intrinsically procedurally just, it has to be fully anonymous; i.e. 'its results would not be different if any features of the relevant people were changed' (2008, 80). However, proponents of deliberative democracy might highlight that impersonality is not necessarily desirable – and that PMs share some of the shortcomings of voting or polls. It is a fundamental problem with (direct or behavioral) aggregation that it does not include reasons, justifications, or explanations for individual (voting or trading) decisions. But these are, one might hold, needed for democratic legitimacy and epistemic quality.
5. In the same context (prediction) markets may suffer from moral problems other than epistemic injustice. Anderson is right to point out that '[a]sset markets can suffer from speculative booms and busts that throw millions of innocent people out of work and into poverty [and] ... [i]ndividuals may take reasonable risks that turn sour, plunging them into desperate straits' (2012, 164).
6. There is an empirical connection between identity prejudice and ability to pay, in the sense that those who usually lack ability to pay belong to certain social identities.
7. Zelizer's (2017) work may be seen as providing evidence against this worry. She shows that we all constantly use the same, seemingly homogenous thing – money – in different, abstract, and inventive ways.

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