A REJOINDER TO CROVELLI'S "THE COURTIERS OF CONFUSION"*

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Resumen: Este artículo es una respuesta a la réplica de Crovelli a nuestra crítica original de su objeción a la adopción supuestamente equivocada del frecuentismo por parte de Ludwig von Mises. En primer lugar, demostramos la falta de importancia de la distinción favorecida por Crovelli entre la probabilidad y el método para generar probabilidades. Más adelante, mostramos que en alguna lectura del «subjetivismo» su afirmación de que el determinismo necesita abrazar la definición subjetiva de la probabilidad es simplemente trivial. Después de aclarar estos conceptos erróneos, exponemos lo que creemos que son dos puntos reales de desacuerdo entre nosotros y Crovelli. En concreto, argumentamos —contra Crovelli— que (1) el determinismo no requiere interpretar las probabilidades como grados de creencias y que (2) el frecuentismo es compatible tanto con la visión del mundo determinista como con la indeterminista. Por último, enumeramos algunos retos adicionales que Crovelli dejó sin tratar y que, en nuestra opinión, su teoría no podría abordar en ningún caso.

Palabras clave: Probabilidad; Economía Austriaca; subjetivismo; determinismo; frecuentismo.

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Abstract: This paper is a response to Crovelli's rejoinder to our original critique of his objection to Ludwig von Mises' supposedly misguided adoption of frequentism. First, we demonstrate the unimportance of Crovelli's favoured distinction between the *probability* and *method* for generating probabilities. Further on, we show that on some reading of "subjectivism" his claim that determinism necessitates embracing the *subjective* definition of probability is simply trivial. After clearing up these misconceptions, we state what we believe are two real points of disagreements between us and Crovelli. Specifically, we argue — *contra* Crovelli — that (1) determinism does not require construing probabilities as degrees of beliefs and that (2) frequentism is compatible with both the deterministic and the indeterministic worldview. Finally, we enumerate some additional challenges Crovelli left unaddressed and which, we believe, his theory would be powerless to address in any case.

1. **Introduction**

Crovelli (2009a, 2009b, 2010, 2011, 2012) has published a series of articles attacking the views on probability of the brothers Mises (Mises, L. ([1949] 1996) and Mises R. (1957)). The present authors attempted to defend the Mises brothers in Wysocki and Block (2020)[1]. Crovelli criticized these efforts of ours. The present paper is an attempt to respond to this latter publication.

In section 2 we explain why a debate about probability is important. Section 3 is given over to our analysis of how subjectivism and determinism functions in this debate. The burden of section 4 is to explain the role played by frequentism. We attempt to clear up some loose ends in section 5; section 6 is our conclusion.

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[1] We published on a related issue in Wysocki and Block (2017).

2. Why all the fuss: definition vs method and subjective probability

By far the most pervasive criticism Crovelli[2] levels at our position is the one alluding to the allegedly important distinction between a *definition* and a *method* of probability. While accusing us of obfuscating the distinction, he enumerates "[t]he classical *method* for generating numerical probabilities, the a priori *method* for generating numerical probabilities and Bayesian *methods* for generating numerical probabilities" as, surprise, surprise, "methods". (Crovelli, p. 7) Elsewhere in the same rejoinder he confusingly charges that we[3] provide little by way of illuminating probability itself.

Says our author (p. 5): "The first definition they give us, from Wolfram Mathworld, acknowledges the existence of subjective probability, [footnote deleted] while the second definition they offer us from the OED acknowledges the existence of a priori or classical methods for generating numerical probabilities."

Now note that reputedly the second *definition* we provided allows for "the existence of a priori or classical *method* for generating numerical probabilities" [emphasis added]. Fair enough. We can even generalize this point. Let it be the case that *any* definition of probability implies (or is equivalent with, if not identical to) a certain *method* for generating probabilities.

Consider the *a priori* or classical definition of probability. On this *definition*, the probability of a certain (simple or complex) event *is* the *ratio* of a number of 'favourable' cases (i.e., the ones exemplifying or subsumable under the event in question) to all the cases in a given universe. But here is the twist: if we were to ever find, say, the *a priori* probability of getting heads, while flipping the coin, how should we proceed? First, since we talk of the *a priori* probability, the principle of indifference is operative. That is to say, we have no reason to believe that either outcome (i.e., heads or tails) is more probable. Technically speaking, we treat them as equiprobable. Given this, to

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[2] Unless otherwise indicated, all our references to Crovelli will be to this one essay of his, Crovelli (forthcoming)

[3] Crovelli's references to the present authors, again unless otherwise indicated, will be solely to this one article of ours: Wysocki and Block (2020).

calculate the said probability, we would count a number of 'favourable' outcomes (1 outcome: getting heads) and count the number of possible outcomes in our universe (2 outcomes: getting heads and getting tails). But does not this *method* follow from the classical *definition* of probability?

Similarly, Richard von Mises ([1957] 1981, p. 12) *defines* probability only in terms of "encountering a certain attribute in a given collective". We wonder whether Crovelli would find it stunning that the *method* Richard von Mises would employ to discern the probability of a certain attribute is to determine the relative frequency of the said attribute in a given collective. For the sake of further illustration, let us take the Aristotelian *definition* of a human being as a rational animal. Would Crovelli, given this definition, recoil at the *method* of identifying human beings by consulting whether they have both the property of being rational and that of being an animal? Hence, we submit that there is little to make of Crovelli's beloved distinction. His criticism, even if valid, of ours' and that of the brothers von Mises' position would definitely prove too much, for the same apparent obfuscation applies to the classical *definition* (and method?) of probability as well as, alas, to Crovelli's own favoured subjective *definition* of probability.

After all, does not Crovelli's subjective *definition* (i.e., "a measure of a subjective belief") implies that the *method* of ascertaining the probability of a given outcome involves finding a degree to which a certain person believes that a certain outcome will occur? To put our point as generally as possible, we posit that a *method* of identifying a certain entity must involve checking in one way or another whether it satisfies its *definitional* properties. Given this, it appears as though *definition* of probability and *method* for generating probability cannot be as divorced as Crovelli interprets them.

3. **Subjectivism**

Having deflated Crovelli's cherished distinction[4], it is time to consider what we are to make of his extreme insistence on the *subjective*

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[4] At least to our own satisfaction

definition of probability itself as allegedly necessitated by the truth of determinism. We contend that this claim is at best trivial[5]. In particular, Crovelli (p. 3) insists that Ludwig von Mises' "espousal of determinism *logically requires* him to adopt a subjective definition for probability."

How does he reach this conclusion? It is pretty straightforward to rationally reconstruct his reasoning, for elsewhere Crovelli (2009, p. 8) argues that

> "if uncertainty is ascertained to derive solely from our limited mental capacity to comprehend all of the relevant factors involved in any given process, *while the process itself is governed by causally deterministic laws*, then this will force us to adopt a subjective definition of probability."

But if Ludwig von Mises were indeed "*logically* required" to adopt "a subjective definition of probability", then the *subjectivism* of the definition of probability he is supposedly forced to adopt must simply consist in the fact that even if ontological uncertainty (metaphysical indeterminism) is ruled out, *epistemic uncertainty* still remains. And no wonder, since Mises in fact subscribes to determinism, epistemic indeterminacy (or uncertainty) is the only thing that probability can rest upon.

Yet, if this is what the *subjective* definition of probability really reduces to in the eyes of Crovelli, then we take absolutely no issue with him. Nay, we were explicit about this point in our original paper. Here is the relevant quote: "A sufficient condition for *any* probability talk (be it class or case probability) is an element of our ignorance." (Wysocki and Block (2020), p. 265)

Hence, our claim is that human ignorance *alone* — regardless of whether determinism is true of false — suffices for a meaningful concept of probability. Then, rather obviously, if indeterminism is ruled out, then it can *only* be human ignorance that validates a discussion of probability. Therefore, if the *subjectivism* of the definition

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[5] In the next section, we are going to argue *substantively* — *contra* Crovelli — that the frequentist *method* works irrespective of whether determinism is true of false, and hence Crovelli's claim is invalid.

of probability that Ludwig von Mises is allegedly required to adopt were to be construed along these lines, we concur. Still, we contend that this thesis is uninteresting as it seemingly has nothing to do with Crovelli's "measure of subjective belief".

If Crovelli were to say something *informative* rather than *trivial*, he would have to demonstrate that under determinism, probabilities would have to *exclusively* reflect measures of subjective beliefs[6]. Sadly, throughout his corpus, he only reasserts his *subjectivism* without even hinting at possible ways in which the said "measures of subjective beliefs (sic!)" might be obtained. Additionally, Crovelli does not even bother to reply our objections to conceiving of probabilities "as opinions", the issues we turn to in the section 5.

Having cleared up some misconceptions and dispensed with Crovelli's indictment related to the *definition/method* distinction as unimportant[7], it is time to spell out a (the?) real point of disa-

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[6] Incidentally, we believe that is *the* real bone of contention between us and Crovelli. The latter *appears* to be saying that, given determinism, probability can only reflect measures of subjective beliefs (by which he presumably means the *degrees* of subjective beliefs), whereas we contend that probabilities concern relative frequencies of certain events (or attributes) in given collectives and that thus understood, probability cuts across the determinism/indeterminism dichotomy. This is the thesis we are going to defend in the forthcoming part of this rejoinder.

[7] As an aside, it is worth noting that Crovelli's big fuss about the *definition* of probability does not even arise when it comes to nominal or stipulative definitions. For instance, the definition of a unicorn is purely nominal. That is to say, as there are no unicorns out there, so any definition of a unicorn does not capture any *real* essential features of unicorns. Rather, such a definition simply reports what the word "unicorn" means. And note that such lexicographic definitions do not depend on what the external reality turns out to be. To wit, the word "unicorn" means what it means independently of whether unicorns are exemplified in reality. The same point applies to *stipulative* definitions, for what they amount to are terminological regulations. That is to say, the *definiendum* is introduced as a shorthand to stand for what the *definiens* precisely specifies (or stipulates). For instance, let us stipulate a concept of *human schmaction* and let it denote human action with, say, perfect knowledge. What prevents us from adopting such a definition? As a purely terminological move, such a definition is perfectly feasible with the contingency that humans do not act with perfect knowledge being irrelevant to the way we decided to use the word "schmaction". And it is probably for these reasons that in contemporary philosophy definitions are treated as more or less conventional rather than correct or incorrect. And given this, why should we bother with the *definition* of probability? For a very illuminating work (of both historical and philosophical nature) on definitions, see Charles (2010).

greement between us and him and defend our position vis-à-vis his criticism.

4. **Why the frequentist method does not depend on the deterministic/indeterministic worldview**

Let us now identify what we believe to be the core point of our disagreement with Crovelli. As noted earlier, his main thesis (the one permeating his works, hereinafter labelled *Thesis 1*) is that the truth of determinism requires adopting the s*ubjective* definition of probability. We claimed that when read non-trivially, the thesis has it that the fact that determinism is true necessitates conceiving of probabilities as degrees of beliefs. In other words, under determinism, the only sense one can make of probability statements is in terms of measuring the degree to which one believes certain propositions. This very thesis is indeed at least interesting; viz., not meaningless and even *informative*. Moreover, Crovelli (2009, pp. 13-15) avers that Richard von Mises' frequentism presupposes determinism, the thesis hereinafter referred to as *Thesis 2*. We believe both theses to be false and for the following reasons.

As for Thesis 1, it is certainly not the case that the necessity of adopting the "subjective definition of probability" follows from the truth of determinism. Just to reiterate, to render this particular thesis by Crovelli interesting (viz., informative, not meaningless) we must conceive of the subjectivity in question in terms of measuring the degrees of belief. That is to say, for Thesis 1 to be non-trivial, it must be predicated upon the truth of determinism, and then the only meaningful discussion of probability relates to measuring degrees of beliefs. However, in our original criticism of Crovelli, we took pains to demonstrate that obtaining certain relative frequencies might help shape our beliefs. Consider this example: suppose Crovelli is running an insurance company and is now studying the mortality ($Attribute_1$) rate among males in their seventies in Colorado ($Collective_1$)[8] and the mortality ($Attribute_2$) rate

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[8] Certainly, for this group to form a class we must assume that Crovelli does not know anything else about these males apart from the fact that they satisfy the properties in terms of which the group is defined.

among females in their fifties from the same state (Collective$_2$) and it turns out that the relative frequency of Attribute$_1$ amounts to 70% and of Attribute$_2$ to 30%. And now, crucially, let us assume, *arguendo*, that Crovelli's favoured probabilities of singular events are valid. If so, then what should Crovelli *believe* when he encounters a male in his seventies from Colorado and a female in her fifties from the same state? Should not he *believe* that the male has only 30% chance of survival through his seventies, whereas the female's chance of survival through her fifties is as high as 70%?[9] But if so, as should be granted, then interesting ramifications follow.

First, *contra* Crovelli, it appears as though probabilities are not mere opinions. Rather, the probabilities obtained *via* frequentist methods constitute legitimate *reasons* for holding particular opinions. In the example stipulated above, would not Crovelli *qua* entrepreneur have a reason to charge the male and female *differentially* (based on different frequencies of Attribute$_1$ and Attribute$_2$) for their respective life insurance policies? It is in this sense that probabilities (viz., relative frequencies) are prior to beliefs or opinions. But if so, they are not mere opinions, Crovelli's pretentions to the contrary notwithstanding. Incidentally, it is worth noting that Crovelli (p. 7) himself admits that "subjectivists do not claim that the relative frequency method is not useful for man, or that man should not utilize it" and that "if one confronts a problem that is amenable to running repeated trials, please do indeed use the frequency method!" Given these enunciations by our learned intellectual adversary, what is the problem with relative frequencies then? Certainly, Crovelli would not like to revert to the *subjective definition* and claim that relative frequencies (being objective) have nothing to do with probability. This definitional move would be irrelevant, for relative frequencies would still matter for the ways our beliefs ("opinions") should be formed. In conclusion, it seems

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[9] We hasten to add that we, following the lead of Richard von Mises, find numerical probabilities for singular events meaningless. We only assume their validity *arguendo* just to share Crovelli's critical assumption. This in turn allows us to show that Crovelli himself (*on his own grounds*) has a reason to take heed of relative frequencies.

that Crovelli's Thesis 1 is thus debunked. There is nothing to determinism that rules out the relevance of relative frequencies of certain phenomena. Nay, it is those frequencies that (should) directly guide our beliefs and (indirectly) our actions.

Does Crovelli's Thesis 2 fare any better? Thesis 2 avers that Richard von Mises' frequentism presupposes determinism. We, on the other hand, claim that frequentism is neutral between determinism and indeterminism. As opposed to Crovelli's (p. 7) allegations, who charged that we are "defending the indeterministic ideas of Richard von Mises", we are convinced that Richard von Mises' concept of probability is mute on the determinism/indeterminism distinction and hence that Crovelli is misrepresenting our position instead of doing justice to it. After all, for both von Mises brothers, probability of an attribute is identified with a frequency of that attribute within a given collective. No more, no less. Still, how does Crovelli substantiate his Thesis 2? Crucially, he contends that it is the Misesian idea of "collective" that presupposes time-invariant causation. Says Crovelli (2009, p. 14):

> «For, in order to classify several discreet events together as a "collective," *one must assume that the underlying causal factors affecting each of the events are virtually identical in every way*. Were one not to make the assumption that the same causal factors were operating on each of the events in virtually exactly the same way, one would not be in a position to say that the events were sufficiently similar to one another to be classified as members of the same "collective."»

However, in footnote 12 of the same paper, Crovelli reveals his misunderstanding of what collectives are. Our author says that:

> «[t]here is thus an inherent degree of subjectivity in the determination of whether two or more events in the world are sufficiently similar to one another to be classified as members of a "collective." Because events are necessarily different from one another in at least some respects, man must make a subjective judgment about whether these differences are so great as to make the events conceptually incommensurable, or whether they are so minor as to be able to treat the events (at least conceptually as) as identical». (Crovelli, (2009), p. 14)

However, clearly, what counts as a collective is *a function* of our knowledge. Why in one of the examples cited above, mortality rates of males in their seventies in Colorado was treated as a collective? Simply because *ex hypothesi* we did not know anything about the members of this group apart from the fact that they satisfied the definitional properties of the collective they belonged to. Specifically, a set of males in their seventies in Colorado is treated as a collective because we do not know anything relevant about these males apart from the facts that they are from Colorado and they are in their seventies. If, on the other hand, we were to study the mortality rate of *smoking* males in their seventies from Colorado, a new (and narrower) class or collective would be formed. Therefore, the boundaries of collectives do not seem to depend for their existence on any subjective determinations. Rather, the identities and sizes of collectives are negatively correlated with our knowledge of their respective members. The more we know, the smaller can be the class size.

Having elaborated how the identity (and size) of collectives depends on our knowledge of its members, it is time to pose a critical question. What prevents us from speaking of "collectives" under indeterminism? Or, in other words, could not we end up with valid collectives were determinism to prove to be false? It seems to us that there is nothing in the concept of "collective" that precludes forming them under indeterminism. Moreover, we submit that collectives under the assumption of indeterminism could still yield valuable information about the *propensities* of a tested object. To illustrate our thesis, it is worth bearing in mind that indeterminism does not necessarily have to reduce to complete chaos. That is, it is only an extreme sort of indeterminism wherein each of n events is $1/n$ probable.

Given this, it seems that we can *coherently* imagine the following situation obtaining under indeterminism. Crovelli is flipping a coin 1000 times and he obtains 800 heads and only 200 tails. First, why should all those 1000 flips form a collective? Remember, whether something counts as a collective is a function of our knowledge. Let us stipulate then that this series of 1000 flips forms a collective since we made sure that *at some conceptual level* all these flips were identical; that is, *by assumption*, they took place under

exactly the same conditions (e.g., same momentum, same distance, same air resistance, etc.). Note in passing that the thus described hypothetical experiment satisfies the requirement of indeterminism. After all, all causal factors accompanying every single flip are assumed to be identical but the outcomes are still different (i.e., sometimes heads, sometimes tails).

By contrast, if we were to introduce into our imaginary scenario the truth of determinism, then, everything else equal, all the outcomes would be identical. So, what is it in our hypothetical experiment that accounts for those differential outcomes (i.e., 800 heads and 200 tails, everything else equal)? The only explanation that can be offered at this point is that our coin has certain *propensities*[10]. After all, on a realist reading of propensities, they are exactly these dispositions that account for differential outcomes in two closely possible worlds in which all external conditions are assumed to be equal.

Just to illustrate further how propensities are presumed to work, suppose we deal with two worlds: W and W*. In W Crovelli flips a coin, say, 10 times and he obtains the following series: {H,H,H,H,H,H,H,H,T,T}, whereas in W* he obtains this series: {T,T,H,H,H,H,H,H,H,H}, with *literally everything else equal* across the two worlds. Note that the assumption of indeterminism is satisfied; that is, although the conditions are assumed to be identical throughout the experiment in both W and W*, Crovelli obtains *different* series under invariant conditions. For example, the first flip yields Heads in W, whereas the first flip in W* yields Tails. Remember, if determinism were true and all the conditions were to be identical at each flip, Crovelli would always get the same result (either Heads or Tails). By contrast, in our hypothetical example, even though all the information about external conditions and physical properties of the coin in question are assumed to be given, the ways in which Tails and Heads are distributed within respective collectives remains indeterminate. There is a world in which Crovelli would *first* obtain Heads and there is a world in which he would *first* get Tails, with everything else equal about the two

10 For propensities interpretation of probability statements, see Popper (1959), von Mises ([1957] 1981), Mackie (1973).

worlds, nothing short of indeterminism! Even more, the result of *any single* flip is indeterminate!

However, and that is our point, it is the *ratio* of Heads and Tails obtained in each world that yields very interesting information. To wit, it is the relative frequency of Heads that is *evidentiary* of the dominating propensity of an object to land Heads uppermost[11]. And once we make an inference to the underlying propensity, should we not adjust our belief related to prospective behaviour of the coin? And if so, should not — even under indeterminism — relative frequencies force us to adjust our prior beliefs? After all, it seems that before the frequencies are obtained the principle of indifference commits us to believing that the chance of getting Heads with the said coin is 50%. However, once the above-described experiment has taken place, should we not *believe* that the chance of getting Heads with this coin is actually much higher?[12] We therefore submit that it is both under determinism and indeterminism that relative frequencies should directly shape our beliefs and indirectly guide our actions.

5. **Tying up some loose ends**

In this section, we would like to (re)raise some issues which Crovelli's rejoinder still leaves unaddressed. It is a shame that this author so easily dismissed some criticisms we levelled at his position. Therefore, to help resolve whatever we find problematic in Crovelli's account, we enumerate the said issues here.

First and foremost, there is something truly ironic at Crovelli rejoicing at our "concession" to the effect that numerical probabilities can be assigned to singular events. In our paper (Wysocki and Block (2020), p. 247), we *charitably* imputed to Crovelli the only (as

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[11] Just to pre-empt a possible rejoinder at this point, we are not committed to indeterminism on this macroscale. Rather, the coin from our example represents the indeterministic behaviour so pervasive in quantum theory. So, if the reader is uncomfortable with the coin, he might *mutatis mutandis* substitute a subatomic particle for a coin.

[12] We nowhere stipulated that this was a fair or equally balanced coin.

we believe) reasonable understanding of numerical probabilities attached to singular events. Namely, we suggested that the only way to meaningfully ascribe degrees of beliefs is by resorting to the concept of *betting quotient*. The idea is that we can infer strengths of a person's beliefs based on the odds he would be willing to accept, while betting. To give one more example, if Crovelli is ready to have a wager against Block that it will rain next Sunday offering 3:1 odds, the former must believe that the probability of rain next Sunday is *at least* 25%. And yet, however ingenious betting quotients are, they go no way towards establishing *precise* degrees of beliefs. For, subjectively attaching the probability 25% to rain (and 75% to non-rain) would *only* establish the point of indifference between betting and not betting at all. After all, if Crovelli — by assumption — believes three times as strongly that it will not rain as that it will rain and at the same time bets on rain at 3:1 odds, his *expected* pay-off is zero. But not betting at all would bring Crovelli a certain zero. However, as an Austrian, Crovelli probably believes that man does not act on indifference[13]. So, if Crovelli were to accept the above-stipulated bet at 3:1 odds, we could *at most* infer that, everything else equal, the probability he attaches to rain is indeed *at least* 25%. Given this, we contend that Crovelli has no reason to savour our presumed "concession". For, first of all, it was *us* who filled the gap in Crovelli's account. And, second, even though the gap was narrowed, this still leaves a lot to be desired.

Moreover, it is surprising (though, on second thought, it probably is not) that Crovelli does not address our objection related to *rational* beliefs. For example, (pp. 8-9) he avowedly subscribes to Kolgomorov's axioms but why should he? If probabilities are opinions, why should opinions obey Kolgomorov's axioms? To take the simplest example, why shouldn't Crovelli *believe* that it will rain next Sunday to the degree of 60% and at the same time *believe* that it will not rain to the degree of 70%? We see absolutely no reason why subjective beliefs should *not* violate Kolgomorov's

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[13] For a debate between Walter Block and Hans-Hermann Hoppe on Nozick's methodology and indifference see: Block (1980, 2009a); Hoppe (2005; 2009); Block and Barnett (2010); and also Block (2009b, 2012).

axioms. Certainly, Crovelli might retort at this point that unless opinions (Crovelli's probabilities) conform to Kolgomorov's axioms, they cannot be ranked as probabilities. However, there would be more than just a hint of adhocness to such a rejoinder, for only some sets of opinions could be classified as probabilities, which would additionally complicate Crovelli's otherwise problematic theory.

Incidentally, it is worth noting that relative frequencies naturally obey Kolgomorov's axioms. Moreover, such operations as summing or multiplying easily apply to frequencies, whereas we are left in the dark as to how the said operations were to be performed, based on degrees of beliefs. For example, suppose Crovelli believes to the degree of 50% that he will have a breakfast tomorrow and he attaches 50% probability to the event of his having dinner tomorrow. Are we warranted in saying that he attaches $50\% \times 50\% = 25\%$ probability to the complex event of him having breakfast and dinner tomorrow? Then again, if probabilities are mere opinions, we cannot see why the above should follow? Crovelli's account is mute on this problem and no wonder.

Finally, it is unfortunate that Crovelli dismisses all the evidence we provided for the validity of the frequentist method. He indeed admits that this method is useful. However, he hedges this concession by saying that probability must be defined subjectively. This statement almost cries out for the characteristically Rothbardian "So what?". We concede that all probability talk is subjective under determinism in this sense that it is only human ignorance that gives significance to probabilities in the first place. For, indeed, if the world were to be fully determined and humans were to be omniscient, probabilities would be a useless device. Fair enough. Still, it is relative frequencies rather than degrees of beliefs attached to singular events that are exploited by actuaries, bookies or casinos. Dice are tested for their being unbiased not by "opinions" but by obtained relative frequencies. So, it is objective probabilities (i.e., frequencies) that (should) shape our opinions. And it is precisely in this sense that probabilities are *not* opinions but rather are objective phenomena serving to adjusting our prior beliefs (opinions).

6. **Conclusion**

It has been quite an adventure for us in this debate with Crovelli on probability. We benefited from it, and hope and trust that both he and the reading audience did, also. Although we did not see our way clear to agreeing with this author on his general thesis, we acknowledge that he argued for it in a spirited, intelligent, polite manner. In this era of hyper divisiveness, it is all the more important that advocates of divergent viewpoints, such as he and us, engage in discussion in a civilized manner. We compliment Crovelli in so doing, and hope and trust we, also, have adhered to this sort of debate.

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