

# Challenges to A Policy Treatment of Speculative Trading Motivated by Differences in Beliefs\*

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## Abstract

This note discusses some challenges faced by a policy treatment of speculative trading that is motivated by differences in beliefs. The first challenge is philosophical. Suppose two investors prefer to speculate with each other, under common knowledge that they are motivated to trade purely by a difference in beliefs (unconditional probability assessments). In the absence of third-party costs, are there conditions under which society should try to prevent them from doing so? The second challenge is the existence of a rationale for a policy based on beliefs, as distinct from other determinants of risk preferences. The third challenge is the ability of enforcement agencies to monitor the distinction between belief-motivated trade and trade motivated by “more obvious” welfare enhancing activities such as hedging, liquidity provision, or acquiring payoff-relevant information.

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## 1 Introduction

People often have different beliefs without apparent reason. An example selected for its amusement value at the setting of this conference is the finding cited by Gilovich (1991) that 94% of university professors believe they are better at their jobs than their average colleague. While speculation is often motivated by differences in information or risk tolerance, many people are willing to wager even in settings, such as casinos, in which the odds should be easily understood to be unfavorable. A subset of casino gamblers appear to have neurological conditions similar to those of drug addicts.<sup>1</sup> Although “risk-loving” behavior by gamblers is typical, financial markets show strong evidence of aversion to risk, at least on average. Higher expected returns are offered to investors who are willing to bear risk, particularly systematic risk.

In a series of recent papers,<sup>2</sup> Eric Posner and Glen Weyl have generally suggested that purely speculative behavior in financial markets is nevertheless excessive and should be reduced through regulation, except in situations with a clear and offsetting social benefit that is based on something other than expected profits associated with differences in beliefs. Without taking a normative stance, Simsek (2013) shows that differences in beliefs provide an incentive for financial innovation whose purpose is facilitate trade based on differences in beliefs, and which has a tendency to raise the volatility of consumption.

Here, I raise several narrowly framed challenges, both theoretical and pragmatic, to the policy treatment of speculation motivated purely by differences in beliefs. Despite my misgivings about foundations for the view that trade motivated purely by belief differences is socially harmful and should be outlawed, I am not personally a fan of “gambling.” I’ve never actually entered a casino. Nevertheless, even if I were to reach the intermediate conclusion that I would prefer to live in a world where purely speculative trade does not occur, I don’t yet see much in the way of philosophical justifications or practical grounds for successful state intervention here.

## 2 The “Consenting-Adults” Criterion

The first challenge is philosophical. Suppose two investors prefer to speculate with each other, under common knowledge that they are motivated to trade purely by a difference in beliefs (unconditional probability assessments). I am putting aside here the potential for third-party harm. Negative externalities are clearly policy-relevant, for example when

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<sup>1</sup>See Bowden-Jones and Clark (2011) and Potenza, Fiellin, Heninger, Rounsaville, and Mazure (2002).

<sup>2</sup>See Posner and Weyl (2012, 2013a, 2013b).

purely speculative trading increases the risk of failure of systemically important financial firms.

I focus first on whether there are conditions under which society should prevent our two hypothetical investors from trading with each other, in settings without third-party effects. Posner and Weyl appear to believe this situation is, at least in principle, an appropriate case for anti-trade regulation.<sup>3</sup> Their central concern here is that belief-motivated trade unnecessarily increases the consumption volatility of both investors, under any probability measure, without clear social benefit. It cannot be the case, with a zero-sum contingent contract, that both have expected gains with respect to any given probability assessments.<sup>4</sup> The investors know that, but wish to go ahead anyway. Should they be stopped? Morris (1995) has provided a theoretical foundation for settings in which two investors, neither impaired by irrationality, may have different beliefs. The Pareto criterion, under which an action that makes both investors believe they are strictly better off, as here, is usually viewed by economists as a compelling case *in favor* of the trade.<sup>5</sup> What is special about this speculative-trade setting?

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<sup>3</sup>Posner and Weyl (2013a) write: “By contrast, when a person speculates, that person exposes herself to increased net risk without offsetting a risk faced by a counterparty: she merely gambles in hopes of gaining at the expense of her counterparty or her counterparty’s regulator. Speculation is a zero-sum activity, which, in the aggregate, harms the people who engage in it, and which can also produce negative third-party effects by increasing systemic risk in the economy.” Further, they write: “When two people bet over whether a coin will turn up heads, they each incur the risk that they will be poorer in the future, when, assuming that they are risk-averse, the gain will not be sufficient to outweigh the loss in terms of utility. Thus, rational people will not engage in speculation in the first place unless (1) they like to gamble (in which case there are cheaper ways, like casinos, to satisfy this preference), (2) at least one party is confused (which we believe is extremely common), or (3) they are engaging in regulatory arbitrage (which is also extremely common). Thus, there is no social gain from permitting speculation.” As for the policy prescription, “The [proposed] agency would approve financial products if they satisfy a test for social utility that focuses on whether the product will likely be used more often for hedging than for speculation.” In a 2012 *Slate* essay, “Why It Should be Illegal to Speculate Using Financial Derivatives,” they write: “Suppose that two individuals, neither of whom uses or produces oil, harbor different opinions about the future price of oil and decide to wager on it. Both parties willingly participate, because they think they are each getting the best of their confused counterparty. Clearly, both of them cannot gain from this transaction, and the wager itself creates rather than reduces risk. While each party thinks it is getting the better of the other, both agree that on average both of them will be worse off because on average they will win and lose on the same number of bets, and both of their incomes will be less smooth and predictable on account of their wagering. As a consequence, this sort of speculation is socially harmful. That’s why gambling and wagers are heavily regulated or banned outright in nearly every country.”

<sup>4</sup>Suppose the remaining consumption of each of the two agents is, to keep things simple, constant. Since the mean total gain, under any measure, is preserved, our hypothetical trade would thus typically fail the criteria of Brunnermeier, Simsek, and Xiong (2013) and Gilboa, Samuelson, and Schmeidler (2013) for a beneficial trade. A closely related criterion is provided by Blume, Cogley, Easley, Sargent, and Tsyrennikov (2013).

<sup>5</sup> The Pareto Criterion has long been taken as a minimalist axiom of social choice. See, for instance,

Suppose, further, that one of the two agents is “believed by society to have reasonably accurate beliefs,” and the other is believed to have “incorrect beliefs.” Does that influence the policy answer? For example, suppose that one investor believes that an asset market is experiencing a bubble. Presumably most other investors are willing to engage in trade based on the view that prices are not as likely to crash as soon as the skeptic expects. Should society, in principle, attempt to prevent such a trade?

While subjective probability assessments need not be aligned in some cases with frequentist measures of event likelihoods that are based on stationary statistical setting, there is often no opportunity to test trade-motivating beliefs with statistical models. Should rules be designed to curb trading based on contrarian expectations?

Are there conditions that bring the financial-market situation closer to that motivating laws against self harm, for example anti-gambling regulation? If belief-based speculation between consenting adults without third-party harm is in general to be condoned, should there be exceptions for the case of “gambling addiction” based on demonstrable neurological conditions? Here, I am more open minded to policy treatments, under some sort of cost-benefit analysis. Such “addressable” neurological conditions, moreover, are likely to affect the trading behavior of some individuals in a financial market setting.

### **3 Are Personal Beliefs a Proper Subject for Regulation?**

The second challenge is to provide a normative foundation for why differences in beliefs are somehow distinct from other differences in risk preferences, as a policy basis for ruling out trade.

In particular, a policy motivated by the presence of a difference in probability assessments relies heavily on the notion of probabilistic sophistication (Machina and Schmeidler, 1992), meaning that the choices of an individual can, theoretically at least, be used to identify a unique set of probability assignments.

Axiomatic foundations for risk preferences that imply probability assignments go back to Ramsey (1931), Savage (1954), and Anscombe and Aumann (1963), who restricted attention to the expected-utility representation of a complete transitive binary

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Arrow (1951). The Pareto Criterion provides that whenever one or more agents strictly prefer some choice  $A$  over another choice  $B$ , and no agents strictly prefer  $B$  over  $A$ , then  $A$  is the socially preferred alternative between  $A$  and  $B$ . In this setting,  $A$  is any choice by which two agents who prefer to trade with each other based solely on a differences in beliefs do so, and by doing so cause no harm to other agents. Of course, no particular social choice is suggested by the Pareto Criterion in cases for which such a trade based on belief differences would harm other agents, for example by destabilizing financial markets.

preference order  $\succsim$  over lotteries, under which  $X \succsim Y$  if and only if  $E_P[u(X)] \geq E_P[u(Y)]$ , for some  $u : S \rightarrow \mathbb{R}$ . where  $S$  is an outcome space  $S$ , and for some probability measure  $P$  on  $S$ . For simplicity, I will take  $S$  to be the real line. In this setting,  $P$  is a *subjective* aspect of preferences.

Machina and Schmeidler (1992) relax the expected-utility axioms for probabilistic sophistication, and most importantly do not rely on the independence axiom, which is commonly violated in practice. Their axioms nevertheless impose some structure on an individual's choices that may not be observable in many cases. One could perhaps run experiments or use consumer choices to see if individuals are indeed probabilistically sophisticated, and in that case elicit enough information to determine the probability assessments of all relevant investors and restrict any pair of them from trading based mainly on a differences in beliefs. This could be difficult in practice, especially given the need to create incentives appropriate for measuring beliefs based on actions.

Suppose, hypothetically, that two individuals satisfy axioms implying expected-utility decompositions  $(P, u(\cdot))$  and  $(Q, v(\cdot))$  of their respective preferences. (Here, we treat  $u$  as an equivalence class of functions that are equal up to an increasing affine transformation, because any such transformation has no effect on choice.) Suppose further that  $P$  and  $Q$  have been identified and that trade motivated by the difference between  $P$  and  $Q$  can be feasibly restricted. Is there any appealing normative foundation for a rule under which trade motivated by differences in  $u$  and  $v$  is acceptable, whereas trade motivated by differences in  $P$  and  $Q$  is not? What is it? Both  $u$  and  $P$  are reflections of personal taste. I do not have much personal affinity for axioms that reject the validity of exchanges that increase consumption volatility without increasing mean consumption under a *fixed* probability measure, in a setting in which agents have *different* probability measures.<sup>6</sup> Perhaps this is a question of taste, but as I have explained, this axiom contradicts the Pareto criterion, which I find more persuasive.

In this setting, a difference in  $P$  and  $Q$  is observationally equivalent to a setting with identical beliefs and state-dependent utilities, under merely the assumption that  $P$  and  $Q$  assign zero probabilities to the same set of events.<sup>7</sup> In that case, we have  $E_Q[v(X)] = E_P[v(X)Z]$ , where  $Z$  is the Radon-Nikoym derivative  $\frac{dQ}{dP}$ .

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<sup>6</sup>Examples of such axioms are suggested by Brunnermeier, Simsek, and Xiong (2013) and Gilboa, Samuelson, and Schmeidler (2013). A closely related criterion is provided by Blume, Cogley, Easley, Sargent, and Tsyrennikov (2013).

<sup>7</sup>This equivalence, and the resulting indeterminacy (absent additional restrictions) of the separation between beliefs and utilities has long been recognized. See, for example, Karni, Schmeidler, and Vind (1983), who note this indeterminacy for general cases, and then provide additional axiomatic restrictions that pin down beliefs in a setting of state-dependent utilities.

So, as far as choices are concerned, a difference in beliefs is observationally equivalent to a case in which beliefs are identical but at least one of the agents has a preference order represented by a state-dependent utility function, meaning that  $X \succeq Y$  whenever  $E_P[f(X, Z)] \geq E_P[f(Y, Z)]$ , where  $f : \mathbb{R} \times \mathbb{R} \rightarrow \mathbb{R}$  and  $Z$  is a fixed random variable that is specific to the individual. The special multiplicatively-separable case  $f(x, z) = u(x)z$  corresponds to the representation above of a simple expected utility under a different probability measure.<sup>8</sup>

Suppose two agents have state-dependent expected-utility preferences, with respective underlying utility functions  $f : \mathbb{R} \times \mathbb{R} \rightarrow \mathbb{R}$  and  $g : \mathbb{R} \times \mathbb{R} \rightarrow \mathbb{R}$  with  $f(x, z)$  and  $g(x, z)$  both approximately multiplicatively-separable, that is, nearly linear in  $z$ . Should preference-motivated trade be prohibited precisely when  $f$  and  $g$  are linear in  $z$  and are consistent with different implied probability assignments? Why is the linear case distinctly different, from a policy perspective, from the slightly non-linear case? This distinction implies an obvious discontinuity in both social welfare and policy, with respect to agent preferences, at the point at which preference representation functions become linear with respect to states, in this sense.

#### 4 Can Regulators Identify Trading Motivated by Hedging, Liquidity Provision, or Asymmetric Information?

The third challenge is the ability of enforcement agencies to monitor the distinction between belief-motivated trade and trade motivated by activities that may seem to have more social support, such as hedging, liquidity provision, or investment in information.

In the United States, Congress has endorsed hedging and liquidity provision (“market making”) as worthy of exemptions from its prohibition of purely speculative trading by banks. In this setting of the Volcker Rule, it is natural on efficiency grounds to promote both lower-risk banks and liquid markets, but doubts have been expressed about the ability of regulators to obtain a reasonable separation of trading activities that places market making and hedging on one side, and speculation that is not motivated by either of these on the other.<sup>9</sup>

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<sup>8</sup>The role of  $Z$  in the linear case  $E_P[u(X)Z]$  can also be interpreted as a state-dependent discount factor. When time preference enters, it may play a closely related role, and a further potential difficulty for separating the role of beliefs from other determinants of preferences.

<sup>9</sup>I am one of the doubters, in Duffie (2012).

#### 4.1 Belief Differences or Hedging Motives?

Suppose Agents 1 and 2 have expected-utility preferences with probability measures  $P$  and  $Q$  that assign different respective mean vectors  $\mu$  and  $m$  to a  $k$ -dimensional Gaussian vector  $W$ , which represents the sources of risk to which the investors may be exposed. The two measures assign a common covariance matrix  $\Lambda$  to  $W$ . Suppose that the investors have a common utility index  $u : \mathbb{R} \rightarrow \mathbb{R}$ , where  $u(x) = -e^{-\theta x}$ , for some risk aversion coefficient  $\theta$ .

For Agent 2, the indirect utility  $V(y)$  for a financial market position represented by an exposure vector  $y$  in  $\mathbb{R}^k$  to the risk vector  $W$  is

$$\begin{aligned} V(y) = -E_Q \left( e^{-\theta y'W} \right) &= -E_P \left( e^{-\theta y'W} \frac{dQ}{dP} \right) \\ &= -E_P \left( e^{-\theta x'v} \frac{e^{-\frac{1}{2}[W'\Lambda W + c'W + d_c]}}{e^{-\frac{1}{2}[W'\Lambda W + a'W + d_a]}} \right) \\ &= -k E_P \left( e^{-\theta y'W} e^{-\frac{1}{2}(c-a)'W} \right) \\ &= -k E_P \left( e^{-\theta[y'W + h'W]} \right), \end{aligned}$$

where

$$h = \frac{1}{2\theta} \Lambda(m - \mu).$$

Thus, the situation is observationally equivalent to one in which Agent 2 has the same probability assignments as Agent 1, but has an initial exposure to the underlying risks represented by the position  $h'W$ . This is a special case of the change-of-measure representation given earlier.

One can interpret the motive for trade between Agents 1 and 2 as either a desire to speculate based purely on their difference in beliefs, or as a situation in which Agent 1 offers risk bearing services that allow Agent 2 to hedge his or her exposure to the risk  $h'W$ . Should Agent 2 be asked by regulators to demonstrate the exposure  $h$  to  $W$ , or else give up the opportunity to trade? Agent 2 could, as in the previous section, legitimately claim that he or she is hedging a preference-related risk that is inherent in the state-dependence of her utility. How could her claim be validated?

#### 4.2 Market Making or Speculation?

As I have argued in Duffie (2012), the provision of immediacy by market makers benefits efficient markets and is itself a form of purely speculative trade. The market maker is

typically willing to take on risk by absorbing a client's requested trade, but only provided there is a sufficient expected profit. That is, the market maker typically demands a price concession from the client in return for holding a risky position in its inventory. If the client expects the price of an asset to go down and wishes to sell the asset to the market maker, should the market maker be prevented from offering immediacy unless the market maker agrees with the expected price decline? That would rule out the provision of immediacy to the client unless the regulator or market maker can verify that the trade is motivated by hedging, capital raising, or some other motive unrelated to expectations. Is this a reasonable approach in practice?

In the case of the Volcker Rule, U.S. regulators have been asked by Congress to implement a method for separating market making from other forms of speculation by banks. In my 2012 submission to government agencies, I have explained why it will be difficult to obtain a reasonable separation in practice.

### **4.3 Could regulators separate belief differences from asymmetric information?**

Suppose two investors have identical beliefs, represented by a probability measure  $P$ . One of the two has made an effort to explore sources of information for the purpose of better understanding the likely performance of a financial asset, whereas the other investor has not, perhaps due to different abilities or different risk preferences. Posner and Weyl recognize the useful social role of speculatively motivated information gathering in improving the informational efficiency of prices, for purposes such as allocating capital to projects. They would not generally wish to suppress this form of speculation.<sup>10</sup> But can it be feasibly separated from other forms of speculation?

The no-speculative-trade theorem of Milgrom and Stokey (1982) tells us that if two traders have common knowledge that they differ only in terms of their information, then they will not choose to trade. There are many practical cases, however, in which a trade could be rational, and serve the *ex ante* interests of both investors. For example, the uninformed investor may have a hedging motive. There could be a non-zero probability that the informed investor has a hedging motive or a capital-raising motive. Could regulators distinguish between trade motivated by a difference in beliefs and trade motivated in part by differences in information?

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<sup>10</sup>Posner and Weyl believe that one should limit the formation of markets that are used primarily for speculation. I do not agree with their suggestion that many existing derivatives markets are unhelpful. The markets they name have extensive price discovery and hedging benefits, in my view.

#### 4.4 When Trade is Multilateral

How would we know whether a trade is motivated by belief differences when it is arranged on an anonymous active exchange, where investors are allocated positions on the basis of a multilateral algorithm, such as a double auction? I believe the Posner-Weyl view is that if there is significant concern that speculative trade is a dominant activity on an exchange, the exchange should be outlawed. While that principle is arguable from social-welfare viewpoint, I believe it would be difficult in practice to discern whether trade on most exchanges is predominantly based on differences in beliefs. (I don't agree with the examples they offer, but that is a separate argument.) I have explained that this form of distinction between trading motives is already quite difficult in a bilateral-trade environment, in which the pair of individuals might be identified. It would be much harder to implement in an anonymous market in which orders may be split by algorithms and allocated to a wide range of counter parties.

### 5 Concluding Remarks

My challenge to those proposing regulations that would ban speculative trade motivated by differences in beliefs is to offer stronger foundations for their policies, not only for the underlying social-welfare principles but also for the ability to implement the regulations in practice without also eliminating significant types of trading activities whose motives they support.

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