Benefit-Cost Analysis for Financial Regulation

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The Dodd-Frank Wall Street Reform Act calls for extensive rule-making for financial regulation, the details of which are left up to the relevant enforcement agencies. To help ensure that this wide discretion is not abused, regulators should be required to use Benefit-Cost Analysis (BCA). While BCA has been used extensively and increasingly in in environmental, health and safety regulation (EHS), as well as antitrust analysis (United States Department of Justice and Federal Trade Commission, 2010), it has little history in financial regulation (Whitehead, 2012).

This should not be surprising, given the contrasting literatures in economics on these subjects. The basis of BCA in the former areas was an extensive literature in economics that set a framework for such analysis (Harberger, 1971) and helped clarify key parameters (Viscusi and Aldy, 2003). By contrast, we are not aware of any analogous literature in financial economics. Most work in asset pricing is concerned with informational, rather than allocative, efficiency (whether prices are predictable rather than whether welfare is maximized). Normative work in corporate finance focuses on a relatively narrow set of issues from the perspective of a regulatory authority and on qualitative mechanisms rather than the quantitative tradeoffs at the heart of BCA.

In this paper, we make a modest start towards filling this gap. When an agency proposes a regulation, it should compare the compliance costs and the benefits. The former will usually be straightforward to calculate, and so, in each of the first three sections of this paper we examine how three different types of regulatory benefits can be quantified: avoiding systemic crises, solving informational externalities and reducing gambling. We conclude in Section IV by addressing when BCA should be applied to regulation or to actions (such as introducing a new product) by a firm.

I. Statistical Cost of a Crisis

The central trade-off in much EHS regulation is between costs incurred with certainty and a reduction in the probability of extreme harms to human life or health. The statistical value of human life and health (SVL), the willingness of individuals to pay to reduce the probability of such outcomes, has become perhaps *the* central economic parameter used to evaluate EHS regulations.

Broadly, financial regulation has a similar structure. Stricter regulations, such as tighter capital adequacy standards or limits on the breadth of activities institutions can undertake, slow the circulation of credit and liquidity. However, they also tend, at least when properly designed, to reduce the chance of both individual bank failures and systemic crises. While the former costs are perceived by the economy with very high probability, and are thus analogous to the costs of EHS regulations, the latter benefits mostly reduce the probability of a catastrophic negative outcome. Unfortunately a parameter for translating such a reduced probability of a crisis into a dollar value with certainty, call it the *statistical cost of a crisis* (SCC), has received far less attention than has SVL.

In fact we are not aware of any work that has proposed a value for this parameter. Various studies have considered and come to conflicting views about the social cost of economic fluctuations more broadly (Robert E. Lucas, 1987; Chauvin et al., 2011), but Reinhart and Rogoff (2009) document that the economic consequences of financial crises typically differ dramatically from other cycles. Estimates of the SCC combining the methodologies of these literatures are crucial for BCA.

Research proposing a parameter value will

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face many of the same problems that the SVL literature had to confront. Despite these challenges, we believe that, by much the same logic applied in the use of SVL, the waste associated with having no commonly used value for SCC will typically be greater than that associated with having a quite inaccurate number. Agreement on a figure in the range \$150 billion to \$3 trillion (viz. a crisis cost between 1% and 20% of US GDP of approximately \$15 trillion) would seem relatively easy to reach given the widely respected estimates of Reinhart and Rogoff. We would advocate a figure in the \$1-2 trillion range. On its own, implementing such a standard would eliminate many crossed decisions between different agencies and regulators that lead society to violate transitivity. While decisions made outside of this range might seem relatively rare, experience with EHS regulations indicate that in the absence of a numerical benchmark extreme waste in both directions is not only possible but common (Hahn, 2004). The one-and-a-half order-of-magnitude range casually suggested here is already only about twice as broad in logarithmic terms as consensus views about SVL (Viscusi and Aldy, 2003) and the narrower range we are sympathetic to is no broader in logarithmic terms.

Agencies will also need to estimate the magnitude of risk reduction associated with different regulatory options. This will, of course, be challenging; however, if agencies are forced to make such explicit their current implicit estimates, they will stimulate research and criticism, ultimately improving accuracy.

II. The Allocative Value of Price Discovery

Much of the asset pricing literature concerns *informational efficiency* of market prices, that is, the tendency, or not, of financial markets to bring asset prices into line with the risk-adjusted present-discounted value of the cash flows the asset will generate. Many, especially non-bank, financial regulations are either promulgated (e.g. limits on automated trading and transparency mandates) with the goal of aiding such informational efficiency or criticized by opponents for impairing (e.g. punitive regulation of short-selling and the "Tobin" tax) the informational efficiency of markets. Hirshleifer (1971) famously argued that the private supply of information to prices will typically not agree with the socially optimal supply. On the one hand, some of the value of information is captured by the other side of a trade as the price moves to its new equilibrium, leading investments in informational trading to be insufficient. On the other hand, traders have an incentive to be the first to incorporate a piece of information into market prices, even if the social value of this acceleration is small, leading to excessive investments in accelerating the pace of adjustments.

Yet as far as we know there is no quantitative model articulating when trading is likely to be net beneficial or harmful to what extent. Suppose that individuals in a market believe for a length of time T that the value of an asset is p (and thus it trades for this price) even though the true value of the asset is $p^\star$. What is the social loss from this mis-pricing?

For any loss to emerge, some decision of real economic consequence must depend on this price signal. While the price theory logic we develop is quite general, we present a simple model here for the sake of definiteness in which the quantity of the asset that exists depends on its price. Let $q\left(p\right)$ be the quantity of the assets that exists when, during the period of length T the market price of the asset is p. If supply is linear,

$$q\left(p\right) = q^\star \left(1 + \frac{T\epsilon^\star \left(p - p^\star\right)}{p^\star}\right)$$

where $q^\star$ is the equilibrium quantity when price is $p^\star$ and $T\epsilon^\star$ is the elasticity of the asset's supply with respect to a change in price per unit time over the period when $p = p^\star$. It seems reasonable to assume this elasticity is proportional to time if the arrival rate of opportunities to create or dispose of the assets is close to constant.

Assuming that the market for producing the asset is efficient and supply is linear, the welfare of asset suppliers over this period is

$$\frac{q^\star}{p^\star} \int_{\hat{p}=0}^{p} p^\star + T\epsilon^\star \left(\hat{p} - p^\star\right) d\hat{p} =$$

$$q^\star \left[\left(1 - T\epsilon^\star\right) p + \frac{T\epsilon^\star p^2}{2p^\star}\right],$$

while, for simplicity assuming all asset purchasers value the asset at its true price $p^\star$ their welfare is

$$(p^\star - p)\, q\,(\hat{p}) = q^\star \left[p^\star - p - \frac{T\epsilon^\star (p^\star - p)^2}{p^\star} \right].$$

Adding these and simplifying, aggregate welfare is

$$q^\star \left[p^\star \left(1 - \frac{T\epsilon^\star}{2} \right) - \frac{T\epsilon^\star}{2} (p - p^\star)^2 \right].$$

This is maximized at $p = p^\star$ and thus the social loss from mis-pricing is the Harberger (1964) triangle

$$(1) \qquad \frac{T\epsilon^\star q^\star (p - p^\star)^2}{2}.$$

While this expression is quite general and independent of details of the market's operation, the private profit to be made from correcting the mis-pricing by buying or shorting the asset until the price gap is closed depends on the microstructure of the market. The more liquid a market is (the less prices adjust to large purchases or sales) the greater will be the private profit. In any case, under a variety of models (monopolistic, competitive with trade limits, etc.), the profit is *linearly* proportional to the price difference $|p - p^\star|$ and to the size of the market, which if $|p - p^\star|$ is not too large, is approximately $q^\star$. We can therefore represent the private profit as

$$(2) \qquad l q^\star |p - p^\star|.$$

A first pass at quantifying the distortions of private incentives obtains from taking the ratio of Expressions (1) and (2):

$$(3) \qquad \frac{T\epsilon^\star |p - p^\star|}{2l}.$$

A few qualitative results emerge immediately from this analysis. First, corrections to small mis-pricings will be socially over-incentivized and thus over-supplied relative to corrections of large mis-pricings. Second, mis-pricings that persist for a long period will go under-corrected relative to those that are short-lived. Third, mis-pricing of assets whose supply responds elastically to market prices are under-corrected relative to assets in fairly fixed supply.[1] Finally, mis-pricings in liquid markets will be over-supplied relative to those in less liquid markets.

The first two points provide a simple quantification of the common intuition that while the acceleration of high-speed trading on many small bets is largely waste, arbitrage activity to close long-standing bubbles is likely to under-supplied relative to the social optimum. The third point expresses a different common intuition that improving the pricing of markets whose prices have little impact on real economic activity (e.g. certain derivative securities) has little value. The fourth point is perhaps best seen as a corrective to the first three: if policy interventions are being considered that impact the liquidity of markets they will be beneficial or harmful to the extent that they target liquidity at markets where otherwise correction of mis-pricing would be undersupplied or oversupplied respectively. This logic highlights the attractiveness of some commonly-advocated policies, such as a small Tobin tax on transactions that would filter out "small" arbitrages, as well as proposals to reduce the frequency with which trades can be made, while cautioning against others, such as high collateral requirements for long-term short positions that might reduce the incentive of market participants to pop bubbles.

By the same logic as in the derivation above, the social loss from failing to correctly incentivize the correction of mis-pricing is proportional to the square of the difference between Expression (1) and (2) and to the elasticity of arbitrage activity itself with respect to the profit it yields. Thus the costs and benefits of policies affecting market liquidity or any other factor facilitating or inhibiting price discovery may be quantified by measuring the parameters above and the elasticity of arbitrage activity with respect to its rewards.

III. Gambling v. Insurance

Along with their informational role, perhaps the most commonly touted virtue of financial

[1]This result is, perhaps, a bit overstated, as is the temporal dimension because the more elastic is economic activity over a period the easier it will be to profit on the differences in prices. However, we follow most of the finance literature (Kyle, 1985) in believing that real economic activity elasticity is a small part of the total liquidity of an asset and thus that this only dampens our result slightly.

markets is the efficiency with which they allocate risks to those most able to bear them, providing insurance against shocks individuals face. On the other hand if different investors have, or act as if they have, different priors over risks in the economy but have similar wealth, risk-aversion or exposure to risks they will tend to engage in bets against one another that increase risk (or allocate it less efficiently under any of their priors) but allow both to believe they are benefiting at the other's expense (Weyl, 2007). To the extent that financial interventions or regulations aid (e.g. position limits or asset purchases that prevent market collapse) or limit (e.g. prohibitions or high capital charges for innovative assets) market completion, regulators must account for the benefits and costs accompanying such new assets.

The simplest, though controversial, case in which market completing may be harmful is when different individuals simply have different beliefs. In this case, Brunnermeier et al. (2012) propose a criterion for determining if one or more transactions is beneficial or harmful. They argue that a transaction should be deemed inefficient if *under any single belief that is a convex combination of the beliefs held by the agents engaged in the trades* the transaction is Pareto-dominated by the transaction not taking place and instead some transfers being made among the agents. That is, all agents or anyone with a belief between theirs agree that the transaction is wealth-destroying in aggregate.

One natural way to make this principle quantitative is to adopt the least interventionist evaluation of transactions possible. This would count the social cost associated with a transaction that agents desire taking place as the smallest outside subsidy that would have to be given so that, under some convex-combination belief, the transaction would not be dominated by any set of transfers. Similarly beneficial privately-desired trades could be treated equally generous way, as generating gains equal to the largest tax that could be imposed on the trade such that there is some convex-combination belief under which it is not dominated by some set of transfers. Essentially this asks what is the most libertarian belief-consistent interpretation of welfare from the trades consistent with the actions of the agents and other available information. An alternative standard would be to estimate the true distribution of outcomes (viz. true belief) from available evidence including the behavior of agents and take the average welfare loss or gain from the trade.

In many cases, transactions that appear to be driven by differences in beliefs rather than in their utility functions or endowments do not originate, fundamentally, in belief differences but instead in the informational setting in which they operate. For example, suppose an individual invests her money with an active manager but is unaware of the full set of vehicles in which that manager is able to invest. If she observes only a subset of the dimensions of the products in which the investor places her money (e.g. average annual return and a coarse summary risk such as a credit rating), her manager will have an incentive to invest in products that perform well along these dimensions even at the cost of performing poorly along the dimensions that are unobservable to the investor (Holmström and Milgrom, 1991). The agent, combined with her manager, will thus act as if they are "optimistic" about their performance of products that do well along these observable dimensions but poorly along dimensions unobservable to the investor. If different agents are observable to different investors, who have different managers, opening markets between these investors may be harmful as it leads each investor's manager to exploit her imperfect information more effectively. Similar arguments apply for imperfectly informed principals of other sorts, such as tax authorities or capital regulators.

The welfare analytics of this more indirect channel for gambling are essentially identical to those when there are real differences in prior beliefs. In both cases, different reduced-form investors act as if they had different beliefs and engage in trades that are wealth-destroying under any convex combination of their perceived beliefs. The only significant difference is that the principal-agent scenario might call for stronger intervention both because the libertarian arguments are less compelling in this case and it might be even more appropriate to ignore the "beliefs" of the two investors as these are clearly distorted by the imperfections in their information. In both cases, of course, the standard insurance benefits of market completion must be weighed against the harms from gambling in judging the net value of market completion. In-

Posner and Weyl (2013) we provide informal examples of this calculus as applied to a range of new assets created over the past two centuries.

IV. Conclusion

In this paper we propose three principles for the quantitative evaluations of normative tradeoffs in the regulation of financial markets. While we anticipate that in the near future such analysis will be used primarily to evaluate the costs and benefits of restrictions on the operations of markets, in Posner and Weyl (2013) we advocate an alternative baseline for new derivative securities. In particular, we argue that a BCA should be applied to the introduction of new products into markets by private participants. Whether this more precautionary approach (products or practices are disallowed until they pass a BCA) or the more traditional, libertarian approach (regulations restricting products or practices must pass a BCA) is appropriate depends on the circumstances and should, itself, likely be subject to a BCA.

The importance of developing methods for benefit-cost analysis for financial regulation can scarcely be overstated. In recent years, courts have woken up to the fact that many such regulations lack a sound economic basis and have started blocking them (Trindle, 2012). Agencies are scrambling to develop reliable methods; we hope future research will come to their aid.

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