

Investing in Frankenfirm: Predicting Socially Unacceptable Risks

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When the public decides that a product or production process is socially unacceptable, the share price of the firms involved may suffer. The danger is that, out of distaste, people will refrain from buying the product or the shares. But being able to assess the degree of unacceptability can mean being better able to assess how it will affect a firm's profitability, and being better able to assess the value of a firm. Over the past twenty-five years, many psychological studies have considered predictors of unacceptability for one class of industrial activities: those perceived as producing risks to health, safety, and the environment.

We compare results from several studies of risk perception conducted from 1975–1994 with current consumer boycotts and the screening criteria of socially responsible investment firms—two forms of organized distaste. From both perspectives, high historic ratings on undesirable risk characteristics have predicted current organized aversion. These relationships are discussed in terms of how to make more precise estimates of the direct and indirect effects of social unacceptability on share price. One way is to pay critical attention to the financial disclosures of firms that may have such problems in light of the concurrent state of scientific knowledge. We illustrate these issues with the case of genetically modified organisms.

“Farmers Are Scaling Back Genetically Altered Crops: Opposition Abroad Spurs a Drop in Acreage. ... Farmers have asked if they plant biotech will they have a market, a federal economist says.”

—*New York Times*, April 1, 2000, p. A6

Investors are sometimes dismayed to discover that they have invested in firms whose products and conduct are deemed socially unacceptable by enough of the public for their investments to lose value. An ongoing example involves genetically manipulated organisms (GMOs), whose agricultural applications have been labeled “Frankenfoods” by opponents. This particular drama is still playing itself out (Friedman, 2000). At the least, the firms that produce Frankenfoods have lost portions of several seasons' sales (as farmers and distributors await the public's verdict or deal with regulatory bans) and the \$50 million recently dedicated to an advertising campaign designed to rescue their products. Hanging over them, however, is the

possibility of losing their entire line of business. Table 1 shows some of the mechanisms by which social unacceptability can affect profitability.

Such threats make the shares of such firms less valuable. However, their share prices may be hurt further if individual or institutional investors decide to systematically avoid firms that fail their screening criteria for socially responsible investment (SRI).¹ Investors may try to protect themselves by avoiding firms they expect to be deemed unacceptable—or to profit by investing in firms whose share prices are only temporarily depressed by concerns that investors believe will be resolved favorably (Friedman, 1996). Investors might even try to predict the outcome of converging streams of unacceptability.

For example, the biotech firm, Aventis is currently paying a short-term economic penalty for having allowed its genetically modified corn StarLink, which is approved only for animals, to find its way into human food in the U.S. and Japan (Glover, 2001). This penalty is estimated by Aventis to be between \$100 million and \$1 billion. Aventis may, however, benefit from the increased demand for corn as animal feed caused by the furor over mad cow disease (which results from feeding healthy animals with parts of infected ones). Currently, though, many genetically modified corn varieties are not approved in the EU, even if grown in the U.S.

A recent U.S. survey found that 62% of the public “avoided or considered avoiding” a product or brand for environmental reasons (“How Green is Your Market?” 2000). Another survey reports that 35%–45% of

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Table 1. *Potential Costs of Social Unacceptability: Examples for Agricultural Use of Genetically Manipulated Organisms (GMOs)*

Potential Cost Category	Examples
Direct Action	Damage to research property, lost data, heightened security needs, investigation, litigation, collateral damage to non-GMOs
Reduced Public Support for GMO Research	Loss of public research funds, opposition to siting research facilities, difficulty attracting talented researchers (especially graduate students)
Regulatory Changes and Uncertainty	Lawsuits, capital tied up waiting for resolution, lobbying expenses, mandatory labeling, safety measures, banning from school lunches (e.g., Scotland), mandatory identity preservation costs (segregation, tracking, testing), product reformulation
Consumer Preferences for Non-GMO Foods	Lost sales, voluntary labeling, voluntary testing, additional advertising, product reformulation, crisis management, voluntary identity preservation costs, spillover to other products
Farmer Preferences for Non-GMO Crops	Lost sales, reduced prices for GMO seeds, lost sales of ancillary products (e.g., pesticides for bt corn)
Investor Preferences for Non-GMO Firms	Individual purchases, SRI funds, SRI advisory services

investors in the U.S., Canada, Britain, and Australia believe that corporations should be responsible for setting higher ethical standards and building a better society for all (“Tough on Business,” 2000). The National Association of Investors Corporation [1999] reported that 54.7% of attendees at its annual convention had acted on their ethical beliefs when deciding which stocks to purchase.

According to *The Nelson Directory of Investment Managers*, funds managed by U.S. SRI firms reached \$1.19 trillion in 1997 and \$2.16 trillion in 1999, 13% of the total \$16.3 trillion under management (Stanton, 2000). In 1999, Morningstar gave its top rating to 21% of SRI mutual funds, twice the rate for all funds. In 2000, Lipper Analytical Services or Morningstar gave top one- or three-year performance ratings to fourteen of the sixteen U.S. SRI funds with over \$100 million in assets (Larsen, 2001). Such success may lead to greater market share in the future for purely economic reasons (Hall and Hale, 1999). But, given the current size of SRI, it may also be a self-fulfilling prophecy, because withholding this share of possible market demand could depress the price of stocks deemed ethically unacceptable.

Investors in what have become “Frankenfirms” may wonder how predictable such developments were. Did these firms truly fulfill their burden of disclosure for these risks? And how can investors reasonably foresee a firm’s future social acceptability? For example, is current opposition to agricultural GMOs just a hiccup on the way to a successful product introduction, akin to a manufacturing or a shipping delay? Will public concerns be addressed legally (e.g., through regulatory reforms), but leave a shadow over such products, reducing their future sales—and share prices? Will these concerns delay full introduction (or market saturation) until the products have been redesigned to meet social objections? Will GMOs find themselves restricted to niche markets? Recently, key GMO firms have moved to divest agricultural biotechnology operations; to the extent

that public opposition is motivating these moves, do they represent prudent risk shifting, or needless alarm?

What *should* happen is a matter of social policy. Opponents of a technology question the gambles that its adoption takes with health, safety, and the environment. Defenders question the costs and risks of doing without the technology. Bystanders may well question the propriety of setting such public policies through the marketplace. In the meantime, investors have choices to make. They will do better, financially, to the extent that they can predict which companies will come to be seen as Frankenfirms because of public perceptions of their risks.

A full predictive account would ask the following for each suspect firm and product:

1. To what extent will a product’s features be deemed unacceptable?
2. To what extent will the public (investors or consumers) act on such concerns, and how will those actions affect the firm’s sales, profits, and share price?
3. To what extent will the public organize their opposition, and how will coordinated actions affect the firm’s fortunes and future?
4. How well does the firm understand its own circumstances, both for increasing the social acceptability of its products and for fulfilling its duty to report on these risks?

These are complex processes that are playing themselves out alongside other events that can confound their interpretation. As mentioned, the impact of public aversion to Aventis’s handling of StarLink corn may be mitigated by increased demand for grain-fed beef. The development of medicinal GMOs (e.g., golden rice) could be thwarted or reduced by opposition to production-driven GMOs. The recent financial success of SRI mutual funds was enhanced by the fact that many of these funds overweighted technology when that sector did particularly well, and underweighted investment in

less favored sectors (e.g., metal recycling and alternative energy before their recent boomlet). Arora [2000a] finds relatively better share value for firms engaging in pollution prevention; however, that could have reflected cost savings (from reduced resource consumption), as well as (or rather than) greater social acceptance. A further complication arises from how accounting practices treat the up-front capital costs of pollution prevention—and how investors react to their impact on short- and long-term profits.

Arora [2000b] finds that consistent pollution prevention is better rewarded than episodic efforts. That could reflect the value of having a clear public image or of stable management practices. Looking outside technological risks, Teoh, Welch and Wazzan [1999] find no discernible effect of shareholder opposition on the valuations of corporations with South African operations, and only a small increase following divestiture. That could mean that the available analytical methods were too weak to detect the effects of the boycott, or that there was little to be detected. Perhaps the South African operations were not as central to these firms' operations as, say, GMOs for an agricultural biotech firm or nuclear power for a utility owning such plants. Without a direct measurement of public attitudes and associated actions, in the context of larger social and economic trends, it is hard to gauge exactly what the impact of a certain trend is on a firm's fortunes.

Next we show how to add behavioral decision research to the repertoire of approaches investors can use to answer these questions. The next section summarizes some potentially relevant research results, after setting their context as a component of technological risk management. The "Predicting Unacceptability" section applies these results to predict which technologies are judged socially unacceptable to the extent that they trigger visible, organized aversion to a firm's products (as expressed in consumer boycotts) or shares (as expressed in screening by SRI mutual funds). Next, the "Financial Accounting for Public Distaste" section offers a framework for translating these predictions into estimates of financial impacts by considering the direct and indirect processes by which those may occur. We follow with a brief discussion of risk disclosure practices, using Monsanto as an example. Such disclosures may provide investors with clues to both a firm's market risks and its risk management practices. The conclusion considers the limits to our analysis, the need for additional research, and the uncertainties facing investors.

Risk Perceptions

Public Acceptability of Technology

In the most general terms, a product has a chance to succeed if people judge that its benefits outweigh its

costs. When a product's impacts are internalized, the relevant people making those judgments are its potential consumers. Where it produces externalities, the set of relevant people may expand. Some non-consuming citizens may view themselves as innocent bystanders, bearing costs (including risks) from transactions that provide benefits to others. Some may not be directly affected at all, but may act as guardians for those they see as disenfranchised (e.g., future generations, developing countries, the natural world). Thus, individuals who are both directly and indirectly affected by a business line may evaluate its unacceptability, and then act on those judgments. Any aversion may be expressed through private protests (e.g., purchasing decisions, letters of complaint, word of mouth) or organized ones (boycotts, shareholder resolutions).

Conversely, consumers may pay a premium for products with positive externalities—as when they purchase organic food not only because of perceived health benefits, but also because they view such foods as kinder to the environment and farmers. These actions, too, may be individual or organized (e.g., belonging to a food co-op that screens products, using an affinity credit card).

As we've noted, judgments about individual products may extend to the firms that produce them. For example, people concerned about Nestle's sales of infant formula in developing countries have also boycotted its chocolates; on the other hand, some consumers patronize Patagonia's clothing stores because of its philanthropy and environmentally sensitive production practices. As investors, people may generalize their concerns about specific products to a firm's stock by investing in SRI mutual funds or by using SRI asset management services. Of course, these types of organized activities are more readily observed, and thus provide the focus for our research.

Determinants of Acceptability Evaluations

In order to evaluate products effectively, individuals need to understand their costs and benefits. When a negative impact is certain and will be public knowledge, firms take calculated risks. Unless they hope to hide their actions, firms know they will alienate some consumers and investors with products like tobacco or production practices like clear-cutting and sweatshops. The gamble rests on how many people will care enough about these impacts to act on their concerns, and how negatively that will impact the business as a whole.

With many modern technologies, however, the impacts are not as clear (Fischhoff et al., 1981; Fischhoff, Bostrom, and Quadrel, 1997; Fischhoff, 1999; Krinsky and Golding, 1992; Slovic, 1987). Risk levels

are in dispute among experts, not to mention between experts and laypeople. These disagreements can be over how “risk” is defined, how it should be measured, which studies are relevant, what they show, and how far to trust the science. Even when there is agreement about the magnitude of risks, there may still be disagreements about their acceptability. The results can be acrimonious debates played out on a larger stage.

Despite (or because of) these uncertainties, risk perceptions can imperil entire business lines through boycotts, regulatory actions, public pressure, and escalating costs of risk management. This can happen even when industry experts (and independent ones) steadfastly maintain (and believe) that the risks are negligible, or at least acceptable. Highly publicized examples include nuclear power, the Audi 4000 in North America (which was believed by some to accelerate spontaneously), the Ford Pinto (held by the courts to have unreasonably explosive gas tanks), silicone breast implants, and Aventis’s StarLink corn. Certainly, the existence of such controversies should be of interest to investors. Other things being equal, a firm is worth less if an integral product line could be endangered by embarrassing recalls, product liability suits, and added regulatory hurdles—no matter how real the actual dangers are.

Attempting to anticipate and satisfy concerns about risks is a very old pursuit (Bernstein, 1996; Tarr, 1996; Tebeau and Tarr, 1996). But developing generally applicable rules to do it effectively is relatively recent. Quantitative risk analyses were first conducted in the 1960s, emerging somewhat independently from the nuclear power, aerospace, and chemical industries. Early studies of public responses to risks include Starr [1969]; Fischhoff et al. [1978, 1981]; Lowrance [1976]; Slovic, Kunreuther, and White [1974]; Slovic, Fischhoff, and Lichtenstein [1979]; and White [1961]. By 1980, the risk analysis and risk perception streams of research had merged into the Society for Risk Analysis. The two streams of thought have shared stages at various dedicated conferences and prompted a series of high-profile committees iteratively defining the field (e.g., Institute of Medicine, 1998, 1999; National Research Council, 1982, 1983, 1989, 1996; Royal Society, 1983, 1992).

The emerging consensus from these activities is that risk perception and communication are essential elements for all stages of risk management (Canadian Standard Association, 1997; Health Canada, 2000; National Research Council, 1996; U.S. Congressional and Presidential Commission on Risk, 1998; U.K. Royal Commission on Environmental Protection, 1998). This status reflects both proactive and reactive recognition of the importance of public concerns. On the one hand, there is a growing commitment to democratizing risk management, which requires ensuring that citizens have the information they need to par-

ticipate effectively. On the other hand, there is growing awareness of citizens’ ability to assert themselves, even when not invited and possibly misinformed.

Dimensions of Risk

Debates over risk often raise a welter of concerns. One common research strategy for discerning patterns among these concerns is to have individuals rate technologies on various potentially relevant features, including whether a technology’s risks are assumed voluntarily, how much dread a technology evokes, how well individuals can control its risks, how reversible its effects are, and so on. Table 2 shows some of the features that have been studied. These studies have used a variety of features, technologies, subjects, and data reduction procedures (reviewed most recently in Jenni, 1997). Nonetheless, they have found rather similar patterns.

Two factors account for much of the variance in attribute ratings. These factors are typically described as capturing 1) how well the risks seem to be known, and 2) how much they are dreaded. Where a third factor emerges, it centers on the perceived catastrophic potential for present and future generations (reducing the influence of those features on the other two factors). Both major factors are associated with lower risk acceptance and the desire for stronger regulation (for a given level of benefit) (Slovic, 1987, 2000).

Figure 1 shows the *risk spaces* emerging from four administrations of the first task studied in this manner, completed in the late 1970s. Thirty activities and technologies were rated on nine attributes by four subject samples: college students, technical experts, League of Women Voters members, and Active 20–30 Club members (similar to a Junior Chamber of Commerce). The polygons connect the positions of each item in the factor spaces derived for each sample, superimposed on one another. The extreme position of nuclear power (and, to a lesser extent, pesticides) suggests that attention was drawn to technologies “out there” in the first quadrant. The study was conducted during the height of concern over CFCs, whose use in spray cans was then being phased out.

Although the factor structure has proven fairly constant across studies, ratings of individual technologies vary somewhat across respondents and contexts. For example, nuclear power stands out in almost any set of technologies; other technologies, however, might appear the same way if compared with relatively benign alternatives. When a technology falls near the origin, that may reflect a consensus of respondents or the mean of divergent views. In the latter case, different subject samples could produce different placements. As a result, studies are most relevant to a real-world context when they question similar individuals about a

Table 2. *Some Features Evaluated in Risk Space Studies***Voluntariness of risk**

Do people face this risk voluntarily?

Immediacy of effect

To what extent is the risk of death immediate—or is death likely to occur at some later time?

Knowledge about risk

To what extent are the risks known precisely by the persons who are exposed to those risks?

To what extent are the risks known to science?

Control over risk

Risks can be controlled either by preventing mishaps or by reducing the severity of mishaps after they occur.

To what extent can people, by personal skill or diligence, prevent mishaps or illnesses from occurring?

Control over risk

Risks can be controlled either by preventing mishaps or by reducing the severity of mishaps after they occur.

After a mishap or illness does occur, to what extent can proper action reduce the likelihood or number of fatalities (i.e., the severity)?

Newness

Is this risk new and novel or old and familiar?

Chronic–Catastrophic

Is this a risk that kills people one at a time (chronic risk) or a risk that kills large numbers of people at once?

Common-Dread

Is this a risk that people have learned to live with and can think about reasonably calmly, or is it one that people have great dread for—on the level of a gut reaction?

Severity of consequences

When the risk from the activity is realized in the form of a mishap or illness, how likely is it that the consequence will be fatal?

Number exposed

How many people are exposed to this risk in the United States?

Equity

To what extent are those who are exposed to the risks the same people as those who receive the benefits?

Future generations

To what extent does the present pursuit of this activity or technology pose risks to future generations?

Personal exposure

To what extent do you believe that you are personally at risk from this activity, substance, or technology?

Global catastrophe

To what extent does pursuit of this activity, substance, or technology have the potential to cause catastrophic death and destruction across the whole world?

Observability

When something bad is in the process of happening because of this activity, substance, or technology, to what extent is the damage observable?

Change

Are the risks from this activity, substance, or technology changing?

Ease of reduction

How easily can risks from this activity or technology be reduced?

Source: Jenni [1997].

set of technologies resembling the one that those individuals naturally consider. In this light, extrapolation to investor behavior may be strengthened by the fact that so many studies have sampled relatively well-educated individuals.

Predicting Unacceptability

If this dimensional characterization is accurate, it should be reflected in actual citizen behavior. Thus, technologies falling in the first quadrant of the risk space should be relatively more prone to citizen action. We examine this hypothesis using two organized reflections of unacceptability judgments: 1) ongoing consumer boycotts, and 2) SRI investment criteria.

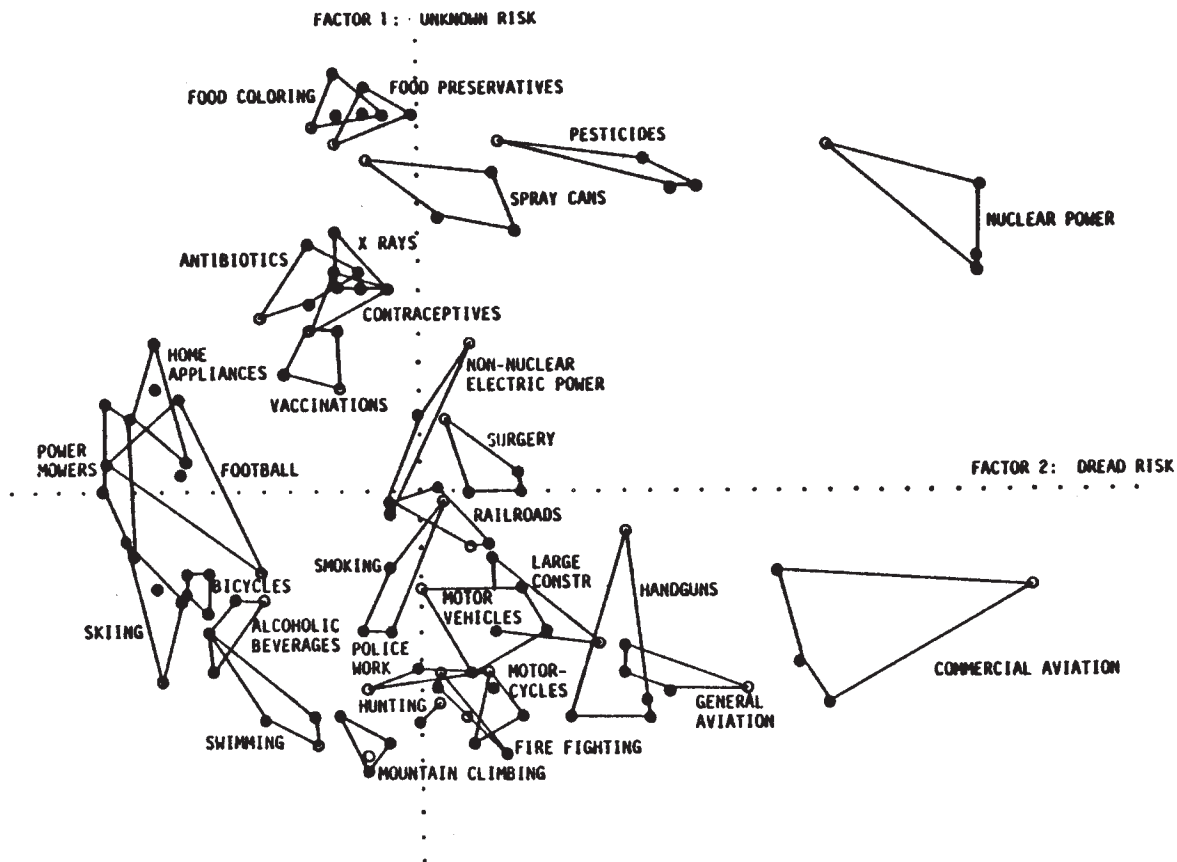
As noted earlier, discerning the effects of such collective actions is far from trivial. They occur against a background of other social and economic events, possibly including similar actions against competing firms and changes spurred by the sanctions. Determining these impacts is beyond the scope of this article. We ask the first half of the third question above (can collective action be predicted?), and leave the second half (can their economic impacts be predicted?) to others (e.g., Carraro and L  v  que, 1999; Duchin et al., 1998).

Boycott Targets

One way for citizens to register their opposition to a technology is by refusing to purchase it or anything else from the firm producing it. Boycotts of products are, obviously, easier to interpret in risk space terms than boycotts of companies (some of whose products may be unobjectionable by themselves, like the bakery lines of a tobacco firm). We focus on product-specific boycotts, identified by screening three April 2000 compilations of ongoing boycotts for entries clearly associated with human health risks from a particular technology (www.coopamerica.org/boycotts; www.greenpeace.org; www.motherjones.org). This screen excluded non-risk concerns (e.g., sweatshop labor, operating in Myanmar), the foci of some two-thirds of current boycotts. Each qualifying entry was then coded into the risk spaces from five studies reviewed by Jenni [1997], selected because they 1) appeared in readily accessible outlets, 2) used diverse technologies (e.g., not just railroad accidents), and 3) published the full risk spaces, showing the location of each technology being evaluated. Although these studies use relatively small convenience samples, the robustness of results (noted above) suggests some ability to generalize.

One disadvantage to using existing studies is that the organizers of boycotts and the designers of studies

FIGURE 1
Location of 30 Hazards Within the Two-Factor Space Obtained From League, Student, Active Club and Expert Groups



Note: Connected lines join or enclose loci of four group points for each hazard. Open circles represent data from the expert group. Unattached points represent groups that fall within the triangle created by the other three groups. Reprinted from Slovic, Fischhoff, and Lichtenstein [1985]; published by Westview Press.

may describe a technology differently. As a result, the coding was done twice, once looking for literal matches, once with approximate ones. In principle, one could collect new data focusing on specific technologies in boycott lists. Although not expensive, such studies are still beyond the resources of individual investors (or even firms without appropriate staffing). Thus, the analyses here show what investors can predict on the basis of existing studies. One advantage of using archival data is that it reduces any influence of respondents' knowledge of boycotts on their technology ratings.

For example, data collected in 1981 (and published in Slovic, Fischhoff, and Lichtenstein, 1985) placed "DNA technology" in the first quadrant. That label is too general to fit any of the currently controversial agricultural biotechnologies, which arose from the recombinant DNA technology of twenty years ago. Some GMOs, notably those incorporating the bacterium *bt*, are in effect pesticides—although not in the sense considered by most people (or even the origina-

tors of the laws under which they might be regulated). Many are designed to be tolerant of herbicides that farmers use to kill competing plants—another use of agricultural chemicals that few individuals could have imagined twenty years ago. However, these ratings were collected before most respondents would have known about any incipient consumer actions. As a result, they provide a purer measure of what investors could have predicted about that class of technologies, assuming that the perceived riskiness of its members remained unchanged and that reasonable extrapolations can be made from the technologies described to the ones that reached the market.

The data analyses look in two directions, each imperfect. One considers the percentage of boycotted technologies falling in each quadrant of the risk space from each study, relative to the overall percentage of technologies falling there. The second looks at the percentage of technologies in each study that is currently the target of boycotts, by quadrant. We expected a disproportionate share of boycotted technologies to fall in

the first quadrant and a disproportionate share of first-quadrant technologies to be boycotted.

These comparisons are imperfect because the factor analytical procedure used to derive the risk space makes the means of the factor scores zero. As a result, the origin (and, hence, the quadrants) depends on the set of technologies being rated. In the five studies used here, investigators sought technologies varying widely in perceived risk levels—hoping to best replicate the world that individuals consider when thinking about “risk.” However, the representativeness of such a set is not meaningful unless one can identify the universe of technologies that individuals naturally consider when thinking about risk and acceptability (Fischer et al., 1991).

The sites yield a large number of boycotts, sorted into those focused on risks (e.g., uncertain and unintended effects on health, safety, and the environment), deliberate environmental damage (e.g., deforestation), and deliberate human damage (e.g., child labor and human rights abuses). The first category is the focus of the risk space studies and the target of our coding. The latter two involve consumer objections to actions with relatively well-understood consequences (although their occurrence and importance might be in dispute).

Table 3 shows the results of coding the boycotted technologies into the five risk spaces, using strict matching and loose matching (which allows coding an additional three boycotts). The final row of the table shows that the vast majority of the coded boycotts involve items in the first quadrant, with technologies whose risks were relatively unknown and dreaded. The remaining boycotts were in the second quadrant, where risks are relatively unknown but not dreaded. Roughly 20%–25% of first-quadrant technologies were targets of boycotts listed on these three web sites. Thus, first-quadrant technologies are highly and disproportionately vulnerable to current consumer boycotts. This is true despite the fact that these studies were conducted from five to twenty-five years ago.

Investment Screening Criteria

Investors who employ socially responsible investing criteria want to avoid associating themselves with technologies they consider unacceptable, and from benefiting from any related profits (Cullis, Lewis, and Winnett, 1992; *Socially Responsible Investing*, 1999). Other things being equal, their actions should depress share prices directly (by suppressing stock market demand), just as boycotting products should depress those prices indirectly. Investors who have no principled objection to a firm’s actions may still attribute diagnostic value to its failing SRI screens. They may believe the firm has outdated management practices or a weakened ability to attract talented employees (reluctant to work for stigmatized firms, either as a matter of principle or out of concern for the firm’s financial future).

Whatever its source and justification, any factor that reduces potential demand for a firm’s shares should interest investors. As with boycotts, these impacts may not be large in the overall scheme of things, and may be hard to establish empirically even if they are. The goal of our analysis is to predict such aversion from the risk characteristics of the technology involved.

SRI criteria may be expressed in terms of general principles or of specific products. For some issues (e.g., community relations), SRI firms may both apply exclusionary screens and actively seek firms that perform positively. Some also take part in stakeholder advocacy. Single-technology screens can be analyzed like the product boycotts in the previous section. When criteria express broader principles, a more qualitative analysis is needed. Three examples of management firms employing relatively explicit SRI screens are:

1. The Aquinas funds (\$2.3 billion in assets on April 20, 2000) focus on Catholic values. Of their eight screens, one appears in the risk space. These funds do not invest in firms producing hazardous wastes (a first-quadrant technology).

Table 3. Risk Space Coding of Boycotted Technologies

Study	Number Boycotted/Total Technologies							
	Tight Coding Quadrant				Loose Coding Quadrant			
	1	2	3	4	1	2	3	4
Slovic et al. [1980]	2/5	0/9	0/8	0/8	2/5	0/9	0/8	0/8
Slovic et al. [1985] Study 2	2/19	0/21	0/30	0/20	3/19	0/21	0/30	0/20
Slovic et al. [1985] Study 3	2/21	1/21	0/20	0/19	5/21	2/21	0/20	0/19
Morgan et al. [1985]	2/4	0/5	0/3	0/4	2/4	0/5	0/3	0/4
Sparks and Shepherd [1994]	2/6	0/7	0/6	0/3	3/6	1/7	0/6	0/3
Totals	10/55	1/63	0/67	0/54	15/55	3/63	0/67	0/54
Percentage boycotted	18.1	1.6	0	0	27.3	4.8	0	0
Percentage of boycotts	90.9	9.1	0	0	83.3	16.7	0	0

2. The Citizens funds (\$181.2 billion) promote general environmental principles (environmental record-keeping, energy efficiency) and single out only one risk space technology: nuclear power (the prototypical first-quadrant technology) (www.citizensfund.com).

3. The Domini funds (\$84.3 billion), one of the earliest SRIs, lists both principles (innovative remediation, pollution prevention, recycling, energy efficiency, dialogue) and an explicit set of exclusions (www.domini.com). About half appear in the five risk space studies, all in the first quadrant (hazardous waste, ozone-depleting chemicals, toxic emissions, agricultural chemicals). (The others are landfills, incinerators, deep-injection wells, and greenhouse gases.)

Looking at the full set, on January 31, 2001, the Social Investment Forum included sixty-four mutual funds (www.socialinvest.org). Unfortunately, these were characterized by screening criteria that were too general to allow risk space mapping. The most common criteria include tobacco (90% of funds), weapons and defense (88%), environment (82%), employment and equality practices (74%), gambling (70%), alcohol (70%), community relations (51%), human rights (49%), labor relations (47%), community investment (46%), and animal testing (39%). Nuclear power is the only technology explicitly proscribed (by 59% of the funds). Otherwise, typical language used is “environmentally sustainable business practices,” “[no] consistent or significant violations of environmental regulations,” and “efficient energy, water, land, and raw material use.”

The investable Dow–Jones Sustainability Group Indexes (DJSI) provide another set of potential indicators of ethically preferred and avoided firms (<http://indexes.dowjones.com/djsi>). Sixteen European asset management companies are licensed to use the DJSI. Defined globally, regionally (North America, Europe, and Asia–Pacific), and for the U.S., these indexes focus on larger firms with sustainability scores in the top 10% for their industry. “Sustainability” is defined as “innovative technology, corporate governance, shareholder relations, industrial leadership, and social well-being.” As of February 6, 2001, DJSI licensees have 1.5 billion euros (\$1.4 billion) under management.

The detailed questionnaires used to characterize the firms’ sustainability include many qualitative features of risk (as well as sometimes excluding companies involved in gambling, alcohol, or tobacco, products that are sources of damage rather than risk). Each firm is asked to describe their involvement with particular technologies. For example, drug companies are asked about GMOs (and, if so, whether products containing them are labeled), transgenic animals (a type of GMO), xenotransplantation, and human embryos. Although not an exclusionary criterion, the use of GMOs is negatively weighted because it increases a company’s

sustainability risk exposure. Specifically, “a company loses points if it uses GMOs in seeds and enzymes. ... For other industry groups, a company is negatively weighted if they use GMO fibers (Textiles) or sell GMO products (Food)” (Prestbo, 2001). Individual companies can request exclusionary screens on these or other criteria.

Financial Accounting for Public Distaste

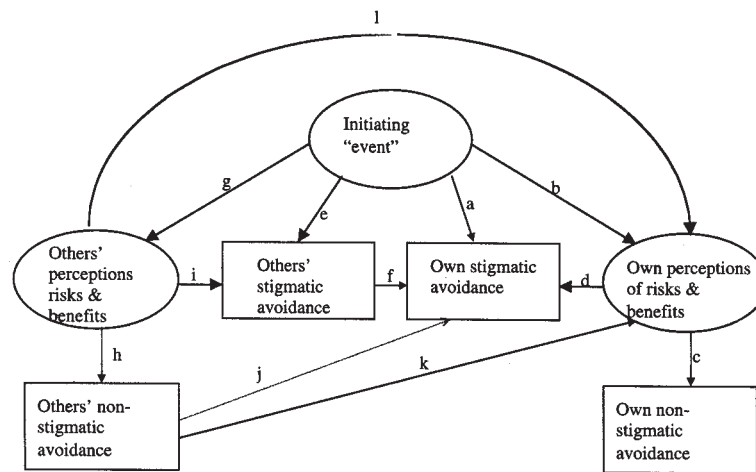
These analyses show what features of technologies may increase the chance they will be judged socially unacceptable. But that alone does not provide an estimate of the associated financial risk, which depends on the effectiveness of organized and individual adverse action directed at firms’ products or shares. Being stigmatized can’t be good, but determining how bad it is can be methodologically challenging. The impacts of past boycotts can be obscured by concurrent changes in products, markets, and politics—not to mention the ordinary complications of case study research, including the need for counterfactual analyses of how things would have gone had a firm acted differently. Even measuring effects can be complicated. The *New York Times* article quoted in the opening of this article notes widely divergent assessments of how the controversy affected GMO purchases for the 2000 planting season. It attributed the differences to competing data sources, analytical methods, and political agendas. (The U.S. Department of Agriculture later reported that GMO usage had declined from 49% of major crop acreage in 1999 to 41% in 2000.)

Although additional case studies are beyond the scope of this article, we offer a framework for tracing potential effects of stigmatization that can be used for a full accounting of past episodes or anticipation of future effects. Depicted in Figure 2, it shows the direct and indirect ways in which social unacceptability can affect behavior (and profits). It can be applied either to effects on the market for a firm’s products (as the result of organized boycotts or individual actions) or to effects on the market for a firm’s shares (as the result of socially responsible investing). It can be applied to socially preferential evaluations as well.

The framework proposes that some initiating “event” gets people thinking about a technology. That event could lead directly to a *fundamental* evaluation of the technology as unacceptable in principle (link a). Such an evaluation means that it is “just not done,” whatever the other consequences. For example, some people see GMOs as intolerable tinkering with nature. They do not care what benefits the technology claims.

But others may consider the technology’s *instrumental* value, the costs or benefits that it creates for the evaluating individual (link b). These judgments should

FIGURE 2
A General Model of Stigma-Related Avoidance



Note: Reprinted from Fischhoff [2001]; published by Earthscan Publications.

depend on the technology's anticipated performance as filtered through communications about it. Once summarized, they contribute to an overall instrumental evaluation (link c). That summary can also trigger fundamental judgments (link d). For example, a technology that is acceptable in principle may be managed in ways that take it beyond the pale of acceptability.

An individual's evaluation is formed in the contexts of others' analogous judgments, which can influence it in several ways (links e–h). An individual may be for or against a technology because valued others are for or against it (link f). Other individuals' instrumental judgments may provide needed information on costs and benefits (link l). Others' summary instrumental evaluations may also trigger fundamental evaluations (link j) or inform instrumental ones (link k). These links might be articulated as, "If people whom I respect have singled out a technology for such scorn, then it must be unconscionable," or "then it must have significant consequences (even if I don't quite know what they are)."

Applying this framework to a financial context, we would initially ask how individual consumers and investors will perform fundamental and instrumental evaluations based on existing behavioral research or dedicated studies (e.g., Alsop, 2001; Kunreuther and Slovic, 1996, 2001). Then we consider what individuals would infer from the responses of socially relevant others. Because such individual responses are the constituents of organized social responses, there is time-lagged feedback from individuals' evaluations to those of groups (which they may join or leave). These dynamics determine how the issue unfolds over time. They are topics for sociology and political science research into technological protests, boycotts, and other enthusiasms (e.g., Krinsky and Golding, 1992; Kunreuther and Slovic, 1996; Leiss and Chociolko,

1994). The cognitive factors in the risk space studies provide some of the finer structure for how such processes begin and evolve.

What's a Potential Frankenfirm to Do?

Investors may hope that firms will do the work for them, and attempt to approximate the risk of their products being judged socially unacceptable. Doing so does not mean conferring legitimacy on those allegations, any more than it would mean that a firm is admitting malfeasance when it acknowledges being a party to legal proceedings. Indeed, the 1995 U.S. Private Securities Litigation Reform Law seemed to open the way for such frank discussions by providing companies with a "safe harbor" for making forward-looking statements about the potential risks and rewards of corporate strategies.

Consider, for example, the case of Monsanto (the "old" Monsanto, before its absorption into Pharmacia and partial relaunch within a year as the "new" Monsanto, in which Pharmacia holds a majority share). By 1990, the firm could reasonably have realized that social acceptability would be an issue for GMOs. The research literature on risk perception was well developed by then, and some GMOs had already aroused controversy (frost-resistant strawberries and potatoes, field tests of which were destroyed by activists in 1987, which contributed to the demise of the company that created them). As a chemical company, Monsanto was no stranger to public skepticism and hostility. Indeed, it was an early affiliate of the Chemical Manufacturers Association's Responsible Care program—designed both to create more acceptable products (by managing risks better) and to communi-

cate about them better. In 1990, genetically manipulated corn had its first field trials in France, Argentina, and the U.S., and the European Community issued its first directives on the topic (EC90/220).

Monsanto's K-10 filings for the early 1990s, however, said nothing about social acceptability. Such silence could reflect a lack of awareness, a desire to hide, an inability to speak freely, or an unquestioning conviction about the value of GMOs. Each would be troubling to investors, but without access to confidential company decision-making, it is hard to decide what to attribute the silence to.² The 1995 Private Securities Litigation Reform Law should have reduced the inability to speak freely, allowing (even encouraging) firms to speak freely—if they understand their circumstances and wish to reveal their concerns.

In Monsanto's 1996 K-10 filing, the only direct reference to social acceptability is that "Monsanto is addressing issues of consumer acceptance for some of these products, particularly in Europe" (p. 13, § "Segment Data"). (The same sentence mentions the risks from "patent disputes with several parties," suggesting the firm's threshold for raising issues.) The 1997 filing added, "Monsanto continues its efforts to address concerns of government regulators, public interest groups and consumers, particularly in Europe. Such concerns are not uncommon as new technologies are commercialized" (p. 10, "Outlook: Agricultural Products"). It explicitly cites the 1995 Act, noting that its "forward-looking statements include [...] the potential for the development, regulatory approval and public acceptance of new products from our pipeline, and other factors that could affect Monsanto's future operations or financial position" (p. 9).

Monsanto's 1998 K-10 devotes a paragraph to each of several risks (consumer and governmental acceptance, technological change and competition, successful integration of recent transactions, planting decisions and weather), explicitly noting that:

The commercial success of agricultural and food products developed through biotechnology will depend in part on government and public acceptance of their cultivation, distribution and consumption. Monsanto continues to work with consumers, customers and regulatory bodies to encourage understanding of nutritional and agricultural biotechnology products. However, public attitudes may be influenced by claims that genetically modified plant products are unsafe for consumption or pose unknown risks to the environment or to traditional social or economic practices. Securing governmental approvals for, and consumer confidence in, such products poses numerous challenges, particularly outside the United States. For instance, France has instituted a moratorium on the planting of certain genetically modified seeds, and consumer groups have brought lawsuits in various countries seeking to halt industry activities with respect to products developed

through biotechnology. Some countries also have labeling requirements. In some markets, because these crops are not yet approved for import, growers in other countries may be restricted from introducing or selling their grain. In these cases, the grower may have to arrange to sell the grain only in the domestic market or to use the grain for feed on his or her farm. The market success of Monsanto's products developed through biotechnology could be delayed or impaired in certain geographical areas because of such factors (p. 57).

The "Risk Factors" section of the "new" Monsanto's IPO prospectus went further in outlining "claims that genetically modified plant products are unsafe for consumption, pose risks of damage to the environment, and create legal, social and ethical dilemmas." It provided examples of how "adverse public perception or regulatory concerns" could affect its business: The EU's de facto moratorium on new GMO approvals (since mid-April 1998), EU and Japanese labeling requirements, studies showing harm to Monarch butterflies by bt corn, the recall of corn products illegally containing Aventis StarLink corn, the U.S. announcement of forthcoming "steps to strengthen science-based governmental regulation ... and consumers' access to information" about GMO products, premiums on non-GM crops, exclusion of GM ingredients by food companies, and campaigns and lawsuits against GMOs by advocacy groups. Other countries are evaluating analogous requirements.

An investor would have to decide how fully these advisories capture the nature and strength of opposition to Monsanto and its GMOs. For example, one might compare the 1998 summary with the fact that, in July 1998, France imposed a national moratorium on GM rapeseed and beets while asking the EU Commission to consider a moratorium on GM plants and products. (The 1990 Directive on the Release of GM Organisms into the Environment (CE 90/220) allowed a minority of member States to impose "precautionary" actions on their own, a step that had been taken eight times by 2000.) An investor would also have to consider Monsanto's strategic focus on securing legal authority to sell these products, rather than on scientific efforts to reduce the uncertainties about GMOs (Eichenwald, Kolata, and Petersen, 2001). These choices might reflect a belief that the science would eventually support Monsanto, or a disregard for fundamental aspects of its predicament.

A litigious investor might ask whether Monsanto had fulfilled its legal duty to inform investors. Answering that question is not our purpose, however, nor is it to evaluate the social acceptability of Monsanto's behavior or that of its critics. We focus here only on what investors can predict regarding social acceptability, insofar as it affects the value of an investment. As such, social acceptability is like any other taste (e.g., price, convenience, reliability) that potentially affects

product line viability. Some individuals may focus their judgments on what a firm produces, others on how candid it is about that production. The fuller disclosure in Monsanto's 2000 IPO might have reassured the latter group, while confirming the opposition of the former. Awareness and disclosure of such risks may be seen as proof of good management, and hence a predictor of future share prices.

Blacconiere and Patten [1994] find that fuller historic disclosure of environmental issues provided chemical companies with partial protection after the Bhopal disaster. Their market value declined less than that of less forthcoming firms. La Porta et al. [2000] find that market value has statutory limits on the behavior of individuals controlling publicly traded companies. If socially responsible investing increases, there may be an increasing premium for firms that understand and manage this category of exposures well.

Conclusion

We offer a framework to help investors assess the risk of product lines becoming socially unacceptable, as well as the risk that the offering companies will come to be viewed as "Frankenfirms," threatening their sales and share prices. The empirical basis for these predictions comes from behavioral decision-making studies of risk perceptions. Although our results are suggestive, the risk space studies we use here were not conducted with this purpose in mind. As a result, if the approach seems promising, more specific studies are needed. Those studies could improve the match between their stimuli and the actual technologies, and between their respondents and those whose behavior must be predicted. Until those data are in, the residual uncertainty about social acceptability adds to the other uncertainties facing investors when they evaluate firms whose product lines are at all controversial. Those investors should require appropriate compensation for taking such risks.

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Notes

1. Of course, firms may also benefit from sales (of shares or products) to individuals committed to showing solidarity with behavior that they favor (a strategy pursued by firms like the Body Shop, Patagonia, and, most recently, BP).
2. Monsanto Chief Executive Hendrik Verfaillie recently said, "What we did two or three years ago is certainly not what I would recommend to be the best approach. We basically didn't listen. We tried to convince the opponents or the activists that we were right and they were wrong, that they should listen to us and that they should basically shut up. We learned that that doesn't work. ... Some 18 months ago, I decided to change the course of action. I started talking to a large number of NGOs" (Croft, 2001).

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