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Abstract

Nanotechnology processes and nanoscale particles are widely used in consumer products. Yet relatively few products containing nanomaterials reveal this fact on the product label. Is this a problem? The use of nanotechnology in consumer products has many potential benefits, but it may also pose unforeseen risks. There is as yet no definitive evidence that nanoscale materials used in consumer products pose a threat to human health, but such risks may still exist. Do such risks justify mandatory labeling requirements? Mandatory labels would not reduce the threat posed by the use or disposal of nanotech products, but could increase consumer awareness and empower concerned consumers to limit their exposure. Properly designed product labels can help consumers manage their exposure to risky or unproven products without unduly inhibiting consumer preferences generally. On the other hand, poorly developed labeling requirements could frustrate market responses to changes in scientific understanding or consumer preferences, impose unnecessary costs on manufacturers, and fail to address marketplace inefficiencies. In the United States, mandatory labeling requirements also raise potential First Amendment concerns. Before adopting a mandatory labeling requirement, policymakers should consider whether mandatory labels are necessary, or whether voluntary labeling regimes may be superior, with or without government assistance.

LABELING THE LITTLE THINGS

Jonathan H. Adler[*]

The nanotechnology revolution is already underway. Over one-thousand consumer products sold in the United States use nanotechnology or contain nanoscale particles.[1] These products range from computer chips and stain-resistant pants to window coatings and sunscreens. By 2007, the global market for nanotech goods was almost $150 billion,[2] up from an estimated $30 billion in 2005.[3] By 2015, the global market for nanotech products is likely to be in the trillions.[4]

Some manufacturers have been happy to disclose their use of nanotechnology or have signed on to voluntary labeling guidelines. Others have adopted nanotech techniques or incorporated nanoscale particles into their products without any meaningful public disclosure. Relatively few products containing nanomaterials reveal this fact on the product label. In some cases, manufacturers' own public relations officials are unaware of whether their products include nanoscale materials.[5]

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[1] *See* The Project on Emerging Nanotechnologies, Inventory of Consumer Products, *available at* http://www.nanotechproject.org/inventories/consumer/

[2] David Rajeski, *The Molecular Economy*, ENVIRONMENTAL FORUM (Jan/Feb 2010), at 38.

[3] J. Clarence Davies, *EPA and Nanotechnology: Oversight for the 21st Century*, Woodrow Wilson International Center for Scholars, Project on Emerging Technologies, May 2007, at 13.

[4] *Id.* (citing estimate of $2.6 trillion market for goods with nano components by 2014).

[5] Consumers Union report.

The use of nanotechnology in consumer products has many potential benefits, but it may also pose unforeseen risks. Nanoscale particles have the potential to act differently than larger size particles of the same substance. This is their benefit, and their curse. Perhaps ironically, what makes nanomaterials useful and attractive to manufacturers – "their small size, chemical composition, surface structure, solubility, shape, and aggregative tendencies" – may also make them more dangerous.[6] Due to their unique characteristics, nanotech particles may pose unique threats to public health or the environment. While people have been exposed to naturally occurring nanoscale particles for centuries, human-created nanoparticles may be more persistent and have different properties or protective coatings.[7]

There is as yet no definitive evidence that nanoscale materials used in consumer products pose a threat to human health. Studies have demonstrated the potential for nanoscale materials to cause harm, but these threats have yet to materialize outside the laboratory setting. In 2007 it was still possible to claim "[t]here have been no known cases of people of the environment being harmed by nanomaterials."[8] Several dozen people in Germany reported respiratory problems connected with a cleaning product called "Magic Nano."[9] Yet subsequent investigation revealed that the only thing "nano" about this product was the name, and it did not contain any nanoscale materials.[10]

Some consumer and environmentalist groups are concerned nanomaterials are proliferating without much discussion or public awareness or discussion. These groups have

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[6] *See* Albert C. Lin, *Size Matters; Regulating Nanotechnology*, 31 HARV. ENVTL. L. REV. 349, 358 (2007).
[7] *See* Lin, *supra* at 356-57.
[8] Davies, *supra* at 14; *see also* Lin, *supra* at 360 (noting the lack of reports of scientist or worker injury or illness attributed to exposure to nanopatricles).
[9] Lin, *supra* at 360.
[10] Davies, *supra* at 14. There is a plausible claim that workers exposed to nanoparticles at production facilities may have been hurt, or even killed, but causation has not been established. *See* Tracy D. Hester, *Quiet So Far: A Muted Response to Allegations of the First Human Fatalities Linked to Nanoparticles*, 40 ENVTL. L. REP. 10007, 10007 (2010).

urged governments to adopt regulatory controls on the use of nanotechnology in consumer products. Some propose mandatory labeling for consumer products containing nanoscale particles, whether a generic nanotech label to indicate the presence of nanoscale particles or a more detailed disclosure. A labeling requirement would make it more likely that consumers are aware when they expose themselves to the fruits of nanotechnology. Right now, consumers are unaware they may be purchasing and using products containing nanoscale particles on a regular basis. Mandatory labels would not reduce the threat posed by the use or disposal of any particular product, but could empower concerned consumers to limit their exposure. Product labels can help consumers manage their exposure to risky or unproven products without unduly inhibiting consumer preferences generally.

Mandatory labels have their benefits, but they also have their costs – and not just to product manufacturers and sellers. Labeling requirements may increase marketplace efficiency and consumer autonomy. On the other hand, label requirements could frustrate market responses to changes in scientific understanding or consumer preferences, impose unnecessary costs on manufacturers, and fail to address marketplace inefficiencies. In the United States, mandatory labeling requirements also raise potential First Amendment concerns. Before adopting a mandatory labeling requirement, policymakers should consider whether mandatory labels are necessary, or whether voluntary labeling regimes may be superior, with or without government assistance.

The Push for Labels

Environmentalist and consumer groups as well as regulatory analysts and academics have called for the adoption of nanotechnology labels. Some groups have asked the FDA to require nanotech warning labels on cosmetics that contain nanoscale particles.[11] Others have called for the adoption of stringent labeling requirements across a wider range of consumer products.[12] Friends of the Earth (FOE) warned in a report that ""[i]n the absence of mandatory product labeling, public debate, or laws to ensure their safety, products created using nanotechnology have entered the food chain."[13] FOE advocates a "moratorium" on the use of nanotechnology in consumer products until nanotechnology-specific regulatory laws are adopted, including a mandatory labeling requirement.[14] Specifically, FOE advocates that "[a]ll manufactured nano ingredients must be clearly indicated on product labels to allow members of the public to make an informed choice about product use."[15] The Natural Resources Defense Council has likewise endorsed a label requirement.[16]

Regulatory analysts have also proposed labels for nanotechnology. J. Clarence Davies proposes a basic labeling regime for both nanomaterials and nanoproducts (products that contain nanomaterials).[17] Nanotech labels would be required to disclose the existence of nanoparticles in consumer products and a telephone number or e-mail address where consumers could report adverse effects. Davies also proposes that a government agency should have the power to ban,

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[11] *See* NANOTECHNOLOGY: A REPORT OF THE U.S. FOOD AND DRUG ADMINISTRATION NANOTECHNOLOGY TASK FORCE 34 (2007).
[12] *See generally* http://nanoaction.org.
[13] *Out of the Laboratory and On to Our Plates: Nanotechnology in Food and Agriculture*, Friends of the Earth, March 2008, at 2, *available at* http://www.foeeurope.org/activities/nanotechnology/Documents/Nano_food_report.pdf.
[14] *Id.* at 3.
[15] *Id.*
[16] *See* Jennifer Sass, *Nanotechnology's Invisible Threat: Small Science, Big Consequences*, Natural Resources Defense Council, May 2007, at 9, *available at* http://www.nrdc.org/health/science/nano/nano.pdf.
[17] Davies, *supra* at 34.

recall, or otherwise regulate nanoproducts and nanomaterials believed to be responsible for reported adverse effects.[18]

An alternative labeling regime loosely modeled on California's Proposition 65, would involve the development of a set of safety tests for products containing nanomaterials, and a requirement that manufacturers disclose the presence of nanomaterials in products that had not been subject to the required tests.[19] This label would have to disclose both the presence of nanomaterials and the lack of safety testing. In effect, the label would warn consumers that they are purchasing and using a nano-based product at their own risk. One problem with this sort of approach, Davies notes, is that "at present, it is not clear that the science is adequate to promulgate testing requirements."[20] Too little is known about nanoscale materials to design a particularly reliable or informative testing protocol. As a consequence, this approach would effectively require warning labels on virtually all products containing nanoscale materials, at least for the immediate future.

A third labeling regime suggested by Professor Albert C. Lin proposes to require all manufacturers of products containing nanoscale particles to disclose the particular nanomaterials contained in a product on its label and "to provide a brief comparison of the nanomaterial with the bulk version of the material."[21] Such a labeling requirement, according to Lin, would "convey information that consumers can use to make rational decisions."[22] Yet he also acknowledges that, even with an extensive labeling requirement, "consumers will not be able to make fully informed decisions because of the uncertainty surrounding the effects of exposure to

[18] *Id.* at 34-35.
[19] Davies, *supra* at 35.
[20] Davies, *supra* at 35.
[21] Lin, *supra* at 393. Lin would also require manufacturers to make similar disclosures to their employees. *Id.*
[22] Lin, *supra* at 395.

nanomaterials."[23] What they will be able to do, however, is make an active choice as to whether they prefer to purchase or avoid those products identified as containing nanomaterials and, by extension, whether they wish to expose themselves to any as-yet-unidentified risks some nanomaterials may pose. Like Davies' second proposal, Lin's recommendation would result in de facto warning labels for nanotechnology products.

Labeling proposals have not gotten far in the United States thus far. While several consumer and environmentalist organizations have urged federal agencies to adopt formal labeling or disclosure requirements, no such requirements have been adopted. In some cases, federal agencies lack statutory authority to impose a labeling requirement. In others, federal agencies have determined that a label requirement is not yet justified under current law.

A large proportion of nanotech products currently on the market fall under the jurisdiction of the Consumer Product Safety Commission (CPSC). At present, however, the CPSC does not have clear authority to require manufacturers to disclose the presence of nanomaterials in their products.[24] The Environmental Protection Agency (EPA), on the other hand, might be able to impose labeling rules for some nanotech products under existing laws, but only in selected product areas. For instance, if the EPA could be able to regulate some nanomaterials as "chemical substances" under the Toxic Substances Control Act (TSCA), though it must first find the product or substance "presents or will present an unreasonable risk of injury to health or the environment"[25] and might have to designate and regulate distinct types of nanomaterials separately.[26] If nanotech pesticides are registered with the EPA, they would have

[23] Lin, *supra* at 395.
[24] David Rejeski, Comments on CPSC FY2010 Agenda and Priorities, Woodrow Wilson International Center for Scholars Project on Emerging Nanotechnologies, Aug. 18, 2009.
[25] 15U.S.C. § 2605(a).
[26] *See* Davies, *supra* at 22-23. *See also* American Bar Association, Section of Environment, Energy, and Resources, *Regulation of Nanoscale Materials under the Toxic Substances Control Act*, June 2006.

to display a government-approved label under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), but this label would not necessarily have to disclose the presence of nanomaterials.[27]

The Food & Drug Administration (FDA) has broader authority over drugs, cosmetics, and some food products. The FDA has explicitly considered whether to pursue labeling requirements under any of its existing authorities. In 2007 the FDA's Nanotechnology Task Force concluded that a general nanotechnology labeling requirement cannot be justified scientifically based upon current knowledge. Instead, the FDA concluded, the need for any product disclosure about the presence of nanoscale materials should be evaluated on a case-by-case basis once there is evidence that a particular nanoscale particle may present a particular type of threat.[28]

According to the FDA, "the use of nanotechnology does not mean that a product's safety or effectiveness is necessarily increased, decreased, or affected in any way."[29] Use or inclusion of nanotechnology, by itself, does not provide an adequate basis for mandatory technology. If, however, the FDA were to conclude that the inclusion of nanoscale materials in a given product was a "material fact" for a category of products, it would require a disclosure label for that product.[30] But the FDA has yet to make any such determination. The FDA's task force concluded:

> Because the current science does not support a finding that classes of products with nanoscale materials necessarily present greater safety concerns than classes of products without nanoscale materials, the Task Force does not believe there is a basis for saying

[27] Davies, *supra* at 34.
[28] NANOTECHNOLOGY: A REPORT OF THE U.S. FOOD AND DRUG ADMINISTRATION NANOTECHNOLOGY TASK FORCE (2007).
[29] *Id.* at 34.
[30] *Id.* at 35.

> that, as a general matter, a product containing nanoscale materials must be labeled as such.[31]

The Task Force also recommended that producers consult with the agency before making voluntary nanotech claims about their products, "because claims regarding the use of nanoscale materials might be misleading and, therefore, misbrand a product,"[32]

While the FDA does not believe comprehensive labeling of nano-containing products is required, cosmetics manufacturers may be required to include information about the inclusion of nanoscale materials in their products nonetheless. Under the FDA's current regulations, all ingredients used in cosmetic products must be "adequately substantiated for safety."[33] If the safety of all ingredients cannot be substantiated, the product must bear a warning on the label disclosing that the product's safety "has not been determined," or it will be considered "misbranded" under the federal Food, Drug, and Cosmetics Act.[34] Insofar as nanoscale materials may not behave or perform like larger-scale materials within a product, cosmetic manufacturers may not be able to rely upon prior studies substantiating the safety of earlier product formulations, and might be required to label their products in order to comply with existing law.[35]

Though labeling has yet to advance in the United States, label proponents have found more fertile ground overseas. In 2008, the European Commission proposed specifically including nanotechnology under the EU's Novel Foods law.[36] In November 2009, the European

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[31] *Id.*
[32] *Id.*.
[33] 21 C.F.R. §740.10
[34] 21 C.F.R. §740.10
[35] *See* John C. Monica, Jr., *FDA Labeling of Cosmetics Containing Nanoscale Materials*, 5 NANOTECHNOLOGY L. & BUS. 63(2008).
[36] *See* Robert Falkner, et al., *Consumer Labeling of Nanomaterials in the EU and U.S.: Convergence or Divergence?* Chatham House Briefing Paper, October 2009, at 7.

Union also adopted new regulations to require the labeling of cosmetics that contain nanoscale materials. Specifically, the new rules require including the word "nano" in cosmetic product ingredient listings.[37] While US and EU officials have begun efforts to coordinate, if not harmonize, some regulation of chemicals and food products, such efforts have yet to encompass nanotechnology.[38]

Looking at Labels

Government mandated product labels are usually adopted for one or more of several purposes, such as reducing potential information asymmetries between producers and consumers, ensuring fair competition among producers, reducing potential threats to public health and safety, or altering consumer behavior in line with a broader social objective.[39] Economic arguments for labels typically boil down to either a) the market fails to provide consumers with sufficient information to make purchasing decisions that align with their preferences or b) individual purchasing decisions have a different effect on social welfare than on the welfare of individual consumers.[40] Measures designed to address the former problem seek to enhance economic efficiency by providing consumers with greater information upon which to base their decisions. The aim "is not so much to *alter* consumption behavior but to increase *informed* consumption."[41] The assumption here is not that there is imperfect information – there is always imperfect information – but that there is an information asymmetry between producers and consumers that

[37] John Pendergrass, et al., *Consumer Labeling of Nanomaterials in the European Union and the United States*, 40 ENVTL. L. REP. 10117, 10117 (2010).
[38] Falkner, et al., *supra* at 11.
[39] Elise Golan, et al., *Economics of Food Labeling*, 24 J. CONSUMER POL'Y 117, 118 (2001).
[40] Golan, et al., *supra*, at 136.
[41] Golan, et al., *supra*, at 137. *See also* WESLEY MAGAT & W. KIP VISCUSI, INFORMATIONAL APPROACHES TO REGULATION (1992).

reduces economic efficiency. Measures designed to address the latter problem, on the other hand, do seek to use information disclosure to alter consumer behavior so as to advance social welfare. Empirical studies of labeling rules suggest such disclosures are more effective at addressing potential information asymmetries than environmental or other spillover effects.[42]

Information disclosure can increase marketplace efficiency by overcoming the problem of asymmetric information.[43] Put in the simplest terms, producers know more about the characteristics of the products they sell than do consumers. As a consequence, consumers may have a more difficult time identifying and acquiring utility-maximizing products. Requiring producers to disclose certain information on a product label can reduce the information asymmetry and facilitate consumer choices that are more closely aligned with consumer preferences.[44] Labeling may enhance economic efficiency by making it easier for consumers to make welfare-maximizing decisions.[45]

Product labeling is a particularly effective way to address potential asymmetric information problems, as labels provide information when a purchase is made.[46] This can make labels superior to government or industry-sponsored education campaigns. Ippolito and Mathios found that "government and general sources of information appear to be effective at reaching

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[42] *Id.* at 119 (reporting mandatory labels "are best suited to alleviating problems of asymmetric information and are rarely effective in redressing environmental or other spillovers associated with food production and consumption.").
[43] The classic discussion of the problem of information asymmetry as a source of market failure is George A. Akerloff, *The Market for "Lemons": Quality Uncertainty and the Market Mechanism*, 84 Q.J. ECON. 488 (1970). *See also*, Sanford J. Grossman & Joseph E. Stiglitz, *On the Impossibility of Informationally Efficient Markets*, 70 AMER. ECON. REV. 393 (1980).
[44] *See, e.g.*, Mario F. Teisl and Brian Roe, *The Economics of Labeling: An Overview of Issues for Health and Environmental Disclosure*, 27 AGRIC. & RES. ECON. REV. 140, 141 (1998).
[45] Golan, et al., *supra*, at 127 ("Labeling decisions may enhance economic efficiency by helping consumers target expenditures toward products they most want.").
[46] *See* Pauline M. Ippolito & Alan D. Mathios, *The Regulation of Science-Based Claims in Advertising*, 12 J. CONSUMER POL'Y 413, 419 (1990) (noting that health information provided by producers, as in advertising, "is likely to be linked directly to product choices, making it simpler to incorporate . . . into behavior").

some subgroups of the population, but not all groups."[47] Labels, however, have the potential to reach all consumers a given product – provided they are sufficiently clear and contain useful and relevant information easily understood by consumers.

The value of the information conveyed by a label depends on the degree to which consumers are able to identify relative product characteristics. Some product attributes, "search attributes," are easy for a consumer to identify and assess prior to making a purchase.[48] For this sort of product attribute, labeling requirements add little value.[49] For example, a consumer can assess the size, shape and color of a product quite easily and inexpensively before making purchase. So requiring the disclosure of such information on the label would add nothing.

Some attributes are just as easy to assess, but can only be evaluated after a purchase is made. A consumer must actually experience a product to evaluate such "experience attributes," such as taste or quality. Insofar as such product characteristics can be measured and assessed relatively objectively, labeling experience attributes may be valuable to consumers, particularly if the product at issue is not the sort that is relatively inexpensive and purchased repeatedly. Whether a labeling requirement for experience attributes is justified depends in part on the cost of the good and whether it is likely to be the subject of a repeat purchase.[50] For some experience characteristics, such as food content, labels can be particularly valuable insofar as they help consumers avoid harm, such as by indicating the presence of allergens or other ingredients that could cause health problems for some consumers. In such contexts, labeling allows consumers with particular sensitivities to avoid products that could cause harm without constraining choices for other consumers.

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[47] Ippolito and Mathios, *supra* at 421-22.
[48] For a discussion of different types of good attributes, see Golan, et al., at 127-28.
[49] *See* Paul H. Rubin, *The Economics of Regulating Deception*, 10 CATO J. 667, 673 (1991).
[50] *See* Rubin, at 673. Rubin notes that for some experience goods, advertising can serve as a powerful indicator of product quality, lessening the value of potential government intervention. *Id.* at 673-74.

The potential value of labeling is greatest with "credence attributes" – those attributes like the nutritional content of food or how a product was made, that "cannot be easily verified even after purchase and use but whose value effects utility."[51] A good example is organic food. Some consumers prefer food products that were produced in a particular way. It does not matter whether this preference is driven by health or ideological concerns. A consumer does not know whether a given good meets their desired standard unless it discloses (and even then there is a risk of deception or puffery).

Insofar as labeling requirements ensure that certain types of consumer-relevant information is presented in an easy-to-digest and standardized fashion, it could further enhance consumer welfare. Consumers are most likely to read and respond to product labels that are "clear and concise."[52] Where labels are ambiguous or unclear, on the other hand, consumers may not pay them much attention at all.[53] Standardization of product labels can also facilitate their use by consumers.[54]

Labeling is a particularly useful approach to product regulation where there is no consensus about the desirability of a given product's attribute and the effects of a product's consumption are borne primarily by the purchaser or user.. Whereas a ban deprives all consumers of the opportunity to purchase a given good or service, labels "allows consumers to match their individual preferences with their individual purchases."[55] This is even true where product ingredients or characteristics may cause a health threat, as with allergens in foods. As noted above, ingredient labeling enable those with a particular allergy to avoid those products

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[51] Teisl and Roe, *supra* at 141.
[52] Golan, et al., *supra*, at 139.
[53] Noah, *supra* at 365 ("ambiguous warnings will undermine consumer confidence in the reliability of truly important label information").
[54] Teisl and Roe, *supra* at 144 (""standardizing the presentation of information can reduce the cognitive costs of information processing.").
[55] Golan, et al., *supra*, at 145.

that could pose a threat to them without appreciably narrowing product choices available to other consumers.[56] This is also true where individuals have ethical, spiritual, or ideological preferences about the sorts of products they purchase or consume. Labels enable them to satisfy their preferences without foreclosing others from making different consumption choices. As Beales, Craswell and Salop explain:

> Remedies which simply adjust the information available to consumers still leave consumers free to make their own choices, thus introducing less rigidity into the market. Such remedies leave the market free to respond as consumer preferences and production technologies change over time. For the same reason, information remedies pose less risk of serious harm if the regulator turns out to have been mistaken.[57]

Nanotechnology labels could divide markets in interesting ways, as it is not clear whether consumers would view nanotech labels in a positive or negative fashion. As Davies notes, "A peculiarity of labeling nanoproducts is that for some people the nano label would be a plus and for others it would be a negative. . . . For most other types of labels this kind of ambiguity does not exist."[58] Nanotech labels could serve a signaling function, and suggest other product attributes that are potentially desirable (or not). Disclosing that a product contains nanomaterials may indicate that a product is "new" or cutting-edge, whereas as a "nanotech-free" label may indicate a producer's commitment to sustainability or other environmental values.[59]

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[56] Beales, Craswell & Salop, *supra* at 513 ("information remedies allow consumers to protect themselves according to personal preferences rather than place on regulators the difficult task of compromising diverse preferences with a common standard.").
[57] Beales, Craswell & Salop, *supra* at 513.
[58] Davies, *supra* at 34.
[59] The claim here is not that there is something "unsustainable" about nanotechnology, but that refusal to use nanotechnology may be seen by some as environmentally preferable as is the refusal to use biotechnology.

There are also non-economic arguments for a mandatory labeling requirement. According to some, labeling promotes "personal liberty and democratic deliberation."[60] Specifically, "a labeling requirement for nanomaterials would enable consumers to decide whether to purchase conventional products, whose risks may be better known, or 'new and improved' products containing nanomaterials, whose health effects are uncertain."[61] From this perspective, consumers have a "right to know" that they are being exposed to potential-albeit-unproven risks.[62] According to Lin, mandatory labels would also "raise public awareness of the growing presence of nanotechnology and stimulate dialogue on the future role of nanotechnology in society."[63] This connection between mandatory product labels and democratic government could raise constitutional problems, however, insofar as producers are compelled to present what amounts to a political message, or politically relevant symbol, on their products. As discussed below, the First Amendment may product producers against regulatory measures that would require them to stigmatize their own products without a sufficiently substantial government justification.

An additional problem with relying upon a generic "right to know" as the basis for a labeling requirement is that it could encompass just about anything.[64] Consumers have a wide range of preferences that may influence their purchasing decisions. For many consumers, price and quality are primary. Others care about how a product choice influences their self-image or reinforces their ethical, spiritual, or religious values. Consumers care not just about the products

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[60] Lin, *supra* at 393.
[61] Lin, *supra* at 393.
[62] Lin, *supra* at 395.
[63] Lin, *supra* at 394.
[64] J. Howard Beales, *Modification and Consumer Information: Modern Biotechnology and the Regulation of Information*, 55 FOOD & DRUG L.J. 105, 109 (2000) ("It is impossible to list all the things that might matter to everyone.").

the purchase, but also about those who make the products and how the process are made.[65] Just as a consumer may want to know about the use of a given technology, another consumer may care about whether a product was tested on animals, made in a country without unions or limitations on child labor, or perhaps even by a company that shares the consumers ideological preferences.[66] Labeling for one of these characteristics could justify labeling for them all, and yet not everything can be on a product label.

A regulatory requirement that a manufacturer disclose some product facts, but not others, is not a neutral act. For some consumers, the mere fact that the government has required companies to disclose particular information or place a warning or consumer advisory on a product package contains the implicit message that the government has determined that *this* specific information is important. This is particularly likely in the case of a warning or a specific disclosure about the presence of nanoscale materials, as opposed to the inclusion of such information in a preexisting list of ingredients. Why does the government think the lack of testing for nanoscale ingredients is more relevant or important to highlight than the lack of testing of other ingredients?

If, as recent polls indicate, most Americans know relatively little about nanotechnology, the adoption of a mandatory label for consumer products that contain nanoscale materials could stigmatize those products with a portion of the market. Some consumers who would have bought such products without a second thought may be discouraged were they to see a nano-specific warning, particularly if it in any way suggested that nanoscale particles were particularly unsafe. This could not only have effects on producers of products containing nanoscale materials, it could have effects on consumers as well. In some cases, products containing

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[65] *See generally*, Douglas A. Kysar, *Preferences for Processes.*
[66] CITE RESPONSE TO MACKEY OP-ED.

nanoscale materials may be superior, or even safer, than conventional alternatives. As a consequence, a warning label that stigmatizes non-containing products could discourage the use of products that could be more beneficial to consumers.

The existence of labels or disclosure may alter consumer preferences. Indeed, for some labeling advocates, that would appear to be the point. If all consumer products containing nanoscale materials were required to disclose this information, and were perhaps also required to highlight the relative lack of scientific information about the potential risks posed by such materials, some consumers might alter their consumption patterns because they are now concerned about a product characteristic about which they had been previously unaware. This may or may not enhance consumer welfare. If nanotechnology labels are viewed as warnings, rather than simple disclosures, they may discourage consumers from purchasing more welfare-enhancing products. While some environmental and consumer organizations have gone after sunscreen producers for failing to disclose the use of nanoscale materials, an analysis by the Environmental Working Group found that "nanotech-based sunscreens may be among the safest and most effective on the market."[67]

The disclosure of information can also influence producer behavior. Indeed, that is part of the point as well. Some information-based regulatory tools are explicitly designed to "shame" companies to change their behavior.[68] If producers are required to disclose potentially undesirable aspects of their products, they may alter their production methods or product content so as to more closely match consumer preferences. So, for instance, if a substantial portion of consumers are reluctant to purchase certain types of products if they contain nanoscale materials, even if those products are "superior" or more effective in some other way, producers that

[67] Barnaby J. Feder, *Nanoparticles in Your Sunscreen: Too Hot to Handle?* N.Y. TIMES, Aug. 13, 2007.
[68] *See, e.g.*, Davies, *supra* at 34 (discussing value of "public shame" to "discourage bad behavior" in context of mandatory disclosure laws).

currently incorporate nanotechnology into their product design may make changes. Information can be quite powerful. When food companies were allowed to begin making modest health claims on their labels, this altered both consumer purchasing patterns but the relative supply of products.

Labels seek to improve market efficiency by increasing information in the hands of consumers when they make decisions. Yet just as there can be too little information, there can also be too much. It is wrong to assume that more information is always better for consumers or always enhances market efficiency. Information is not free.[69] It is costly to acquire, disclose and evaluate.[70] The more information on a label, the more information a consumer must process or the more time a consumer must take to identify that information most important to her given her preferences. In short, just as there can be too little information, there can be too much information as well. As Professor Lars Noah notes, too many labels or product warnings "may dilute the impact of truly important cautionary information."[71] If there is too much information on the label, a consumer may not read it at all.[72] Further, a "required disclosure necessarily displaces other information" which the producer or seller would rather convey to the consumer, and which they consumer may actually find to be more valuable.[73]

When embodied in statute or an administrative rules, labeling requirements can cause "excess inertia" or "lock-in" within a product market, slowing the rate at which information

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[69] Howard Beales, Richard Craswell, and Steven C. Salop, *The Efficient Regulation of Consumer Information*, 24 J.L. & ECON. 491, 500 (1981) ("Information is costly, and perfect information is neither feasible nor desirable").
[70] Beales, Craswell & Salop, *supra* at 503 ("Information is costly to produce and disseminate.").
[71] Lars Noah, *The Imperative to Warn: Disentangling the 'Right to Know' from the 'Need to Know' About Consumer Product Hazards*, 11 YALE J. ON REG. 293, 374-75 (1994); *see also* Golan, et al., *supra*, at 143 (""Costs of additional labeling also include the extent to which it dilutes the effectiveness of the information already included on the product label.").
[72] Golan, et al., *supra*, at 139 ("A large number of warnings or a large list of detailed product information may cause many consumers to disregard the label completely.").
[73] Beales, Craswell & Salop, *supra* at 528.

flows respond to changes in consumer preferences, scientific knowledge, or market conditions.[74] In the case of nutritional labeling, for example, over time there expert medical opinion has changed about whether consumers should seek or avoid particular substances, e.g. types of cholesterol, sources of fat, etc. If labeling requirements are imposed through a legislative or administrative process, there is a risk that the requirements will not keep pace with such changes. Government standards, whether embodied in statute or regulation, "may be less flexible than industry standards, and may reduce innovation."[75] As Ippolito and Mathios note:

> Excessive disclosure requirements, standardized language, rules that do not react to new information in a timely fashion, and sharp limits on who can make such claims, all have the potential to limit firms' incentives to compete by improving and promoting better products.[76]

A complicating factor in any discussion of a labeling regime is that what precisely constitutes "nanotechnology" is still open to dispute. A nanometer is one-billionth of a meter, and most analysts refer to "nanoscale" particles or materials as those between one and one-hundred nanometers in diameter or length. Nonetheless, analysts and regulatory agencies are uncertain about how to define the field. The U.S. Food and Drug Administration, for example, does not believe it should adopt "formal, fixed definitions for regulatory purposes" until scientists understand more about the effects of and risks posed by such particles.[77] As a consequence, adopting a meaningful labeling standard, particularly one that is not appreciably over or under-inclusive, would be quite difficult. The FDA Nanotechnology Task Force further concluded:

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[74] Teisl and Roe, *supra* at 142.
[75] Golan, et al., *supra*, at 164.
[76] Ippolito and Mathios, *supra* at 440.
[77] NANOTECHNOLOGY: A REPORT OF THE U.S. FOOD AND DRUG ADMINISTRATION NANOTECHNOLOGY TASK FORCE 6-7 (2007).

> The available information does not suggest that all materials with nanoscale dimensions will be hazardous. Furthermore, if all nanoscale materials are compared to all non-nanoscale materials, whether larger or smaller, it is not apparent that the nanoscale materials as a group would have more inherent hazard.[78]

Constitutional Concerns

Whatever its other merits, a mandatory labeling requirement could raise constitutional concerns in the United States. Product labels are commercial speech subject to First Amendment protection, albeit significantly less protection than most core political speech. In 1976 the U.S. Supreme Court first held the commercial speech is eligible for protection under the First Amendment, even if it does no more than propose a commercial transaction.[79] As the Court has explained, "A commercial advertisement is constitutionally protected not so much because it pertains to the seller's business as because it furthers the societal interest in the free flow of commercial information."[80] The Court has repeatedly reaffirmed the constitutional protection of commercial speech over the past several decades, In 2001, for example, the Court stated clearly that "The fact that the speech is in aid of a commercial purpose does not deprive respondent of all First Amendment protection."[81]

[78] NANOTECHNOLOGY, at 11.
[79] Virginia Board of Pharmacy v. Virginia Citizens Consumer Council, Inc., 425 U.S. 748 (1976).
[80] First National Bank v. Belotti, 435 U.S. 765, 783 (1978) (internal quotation omitted).
[81] United States v. United Foods, Inc., 533 U.S. 405, 410 (2001).

The First Amendment applies both when the government seeks to restrict speech as well as when it seeks to compel speech.[82] As a consequence, the First Amendment can prevent the government from requiring corporations from communicating messages with which they disagree, even in the commercial context. In *Pacific Gas & Electric Company v. Public Utilities Commission of California*, for instance, the Court struck down a requirement that a public utility enclose a message in its billing statements to which it objected.[83] Laws that compel speech, even by commercial actors, "pose the inherent risk that the Government seeks not to advance a legitimate regulatory goal, but to suppress unpopular ideas or information or manipulate the public debate through coercion rather than persuasion."[84]

While commercial speech receives constitutional protection, government regulation of commercial speech is subject to a less-demanding level of scrutiny than other types of speech. In *Central Hudson Gas & Electric Corp. v. Public Service Commission*, the Supreme Court established a four-part test for government restrictions on commercial speech. First, the speech must concern lawful activity and not be misleading to qualify for protection. If the speech qualifies, courts next consider whether the government has asserted a "substantial" governmental interest, such as preventing consumer deception or protecting public health. If so, courts proceed to consider whether the regulation "directly advances" the government's asserted interest and whether or not it is "more extensive than is necessary to serve that interest."[85] The government bears the burden of establishing that its regulation meets these requirements.[86]

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[82] United States v. United Foods, Inc., 533 U.S. 405, 410 (2001) ("Just as the First Amendment may prevent the government from prohibiting speech, the Amendment may prevent the government from compelling individuals to express certain views.").
[83] 475 U.S. 1 (1986).
[84] Turner Broadcasting System, Inc. v. FCC, 512 U.S. 622, __ (1994).
[85] 447 U.S. 566 (1980). It should be noted that while the Court continues to apply the *Central Hudson* test, several justices on the Court have signaled their disagreement with it. *See* 44 Liquormart, Inc. v. Rhode Island, 517 U.S. 484 (1996); *see also* United States v. United Foods, 533 U.S. 405, 409-10 (2001) (noting "criticism" of *Central*

Where the speech in question is actually or potentially misleading, courts have given government agencies wide latitude to impose curative labeling or disclosure requirements. In *Zauderer v. Office of Disciplinary Counsel*, for example, the Court upheld a requirement that attorney's who advertise they will take cases on a contingency fee basis must also disclose that clients could be liable for court costs.[87] Under *Zauderer*, a requirement that the purveyor of a good or service disclose factual information will be upheld so long as the requirement is not unduly burdensome and the requirement is "reasonably related to the State's interest in preventing deception of consumers."[88] In the government's view, promoting contingency-fee services without disclosing a client's potential liability was inherently misleading, as potential clients would not be aware that a "contingency-fee" could still cost them out of pocket. As the Court held more recently, the "essential features of the rule at issue in *Zauderer*" were that the disclosure requirement was "intended to combat the problem of inherently misleading commercial advertisements" and only entailed "an accurate statement' about the nature of what was being advertised that did not prevent those regulated from "conveying any additional information" about the services they provide.[89] Though courts purport to impose a less stringent test in such instances, their approach is consonant with *Central Hudson* as only non-fraudulent speech is protected, preventing consumer deception is clearly a substantial government interest, and disclosure requirements are almost necessarily more narrowly tailored to prevent potential deception or miscommunication than bans or limitations on commercial messages.

Hudson test by multiple justices); Thompson v. Western States Medical Center, 535 U.S. 357, 367-68 (2002) (same).

[86] *Central Hudson*, 447 U.S. at 570.

[87] Zauderer v. Office of Disciplinary Counsel of Supreme Court of Ohio, 471 U.S. 626 (1985).

[88] *Zauderer*, 471 U.S. at 651; *see also* Milavetz, Gallop & Milavetz, P.A. v. United States, __ U.S. __ (2010) (slip op. at 20).

[89] *Milavetz, Gallop, & Milavetz*, slip op. at 20.

Where speech is potentially misleading, a requirement of curative counter-speech is preferable to a limitation on speech. In short, where possible the remedy for potentially misleading speech should be yet more speech. On this basis, requirements that producers or vendors qualify claims about products in advertisements and labels are more permissible than limitations on label or ad claims. This does not mean that affirmative labeling requirements are always permissible, however, as a recent fight over the labeling of products using biotechnology shows.

In 1994 Vermont adopted a law mandating disclosure labels for milk and milk products offered for retail sale if the dairy cows from which the milk was taken had been injected with recombinant bovine somatotropin (aka rBST or rBGH).[90] Bovine somatotropin (BST) is a naturally occurring growth hormone that affects the amount of milk dairy cows produce. Recombinant bovine somatotropin (rBST) is produced in a lab through recombinant DNA techniques. Injected into dairy cows, rBST increases milk production. According to the Food and Drug Administration, the use of rBST affects the dairy cows, but has no effect on the chemical composition of the milk produced, and raises no human health or safety concerns.[91] Use of rBST on dairy cows results in no measurable increase in milk BST levels, although it does increase the incidence of mastitis in cows. The FDA even went further to declare that any suggestion that milk from non-rBST-treated cows would be "false and misleading."[92] Lacking any definitive scientific basis for claiming the labeling law protected human health or safety, Vermont justified its law on the grounds that the public had a "right to know" whether given milk products had come from cows treated with rBST. Vermont consumers, the state argued,

[90] 6 V.S.A. § 254 (1995) provided: "If rBST has been used in the production of milk or a milk product for retail sale in this state, the retail milk or milk product shall be labeled as such."

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[92] 59 Fed. Reg. 6280.

would benefit from knowing which milk products came from cows treated with BST and the consequent ability of altering their buying habits accordingly.

Dairy manufacturers successfully challenged Vermont's labeling requirement in federal court.[93] In *International Dairy Foods Association v. Amestoy*, the U.S. Court of Appeals for the Second Circuit found that Vermont's labeling requirement violated dairy manufacturers First Amendment rights. Applying the *Central Hudson* analysis, the Court found that Vermont did not have a substantial interest in compelling dairy manufacturers to adopt mandatory rBST labels. Vermont cited no evidence that milk from rBST-treated cows posed any risk to public health, and did not claim that health or safety concerns motivated adoption of the labeling requirement. Indeed, as the court noted, it was "undisputed that the dairy products derived from herds treated with rBST are indistinguishable from products derived from untreated herds."[94] Rather, Vermont adopted the standard due to "strong consumer interest and the public's 'right to know.'"[95] This, the court held, was insufficient.

The Second Circuit pointedly rejected the argument that consumer interest or an alleged "right to know" about how a product was made constituted a sufficiently substantial government interest to justify compelling commercial speech.[96] In the court's words, "consumer curiosity alone is not a strong enough state interest to sustain the compulsion of even an accurate, factual statement."[97] While the court accepted that some consumers may wish to know which milk products came from rBST-treated or rBST-free cows, in the absence of some health or safety-related concern, this interest was not sufficient to impose a requirement on producers.[98]

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[93] International Dairy Foods Association v. Amestoy, 92 F.3d 67 (1995).
[94] 92 F.3d at 69.
[95] *See* International Dairy Foods Association v. Amestoy, 898 F.Supp. 246, 249 (D. Vt. 1995).
[96] *See* 92 F.3d at 73 n.1 ("mere consumer concern is not, in itself, a substantial interest.").
[97] 92 F.3d at 74.
[98] 92 F.3d at 74.

There is a virtually infinite array of characteristics about any given product or the process through which it was made that may interest consumers. Thus, if consumer interest by alone were sufficient to authorize a labeling requirement, the court observed, "there is no end to the information that states could require manufacturers to disclose about their production methods."[99] A consumer interest standard would empower governments to force producers to stigmatize their own products. Yet the court reported that it could find no case in which a federal court had upheld a regulation "requiring a product's manufacturers to publish the functional equivalent of a warning about a production method that has no discernible impact on a final product."[100] If the First Amendment freedom to speak includes a "concomitant freedom not to speak publicly"[101] – and if the Amendment's protection extends to commercial speech – the court found that an undifferentiated consumer interest would not be enough.

Does this mean that a mandatory labeling requirement for nanomaterial content would run afoul of the First Amendment? Not necessarily. The Second Circuit's *Amestoy* decision rested on the court's finding that there was no public health or safety justification for the mandated disclosure. The FDA and others had reviewed extensive evidence concerning milk from rBST-treated cows and found the milk to be indistinguishable from milk from untreated cows. Had there been a difference, and had there been a plausible argument that the difference could have a health effect, the labeling requirement would likely have been upheld.

Whereas milk from rBST-treated cows was no different from other milk, products containing nanoscale materials are physically different from other products. In addition, those differences could have health or safety consequences. Because nanoscale particles often behave

[99] 92 F.3d at 74.
[100] 92 F.3d at 73.
[101] Harper & Row Publishers v. Nation Enterprise, 471 U.S. 539, 559 (1985).

differently than larger particles of the same substance, the switch from larger material to nanoscale material in a product could alter the product's effects.

Where there is scientific evidence that the inclusion of nanoscale materials poses a health or safety risk, it should be relatively easy to impose a product or material-specific labeling requirement without violating constitutional norms. Where health and safety risks are hypothesized, but not demonstrated, a labeling rule might be more vulnerable challenge. In neither *Amestoy* nor other cases have courts addressed whether government agencies may adopt a "precautionary" approach to disclosure, and mandate a label on the basis of potential but unverified risks. The question with such labels is that the government has a greater interest in allowing consumers to pursue their subjective risk preferences than with their product preferences generally.

Courts have also upheld disclosure or compelled speech requirements where the speech or message was part of a broader regulatory scheme of which the compelled disclosure or communication was merely one element of the broader scheme.[102] On this basis the Supreme Court has upheld compelled contributions to agricultural marketing programs,[103] and lower courts have upheld labeling requirements designed to facilitate compliance with other state regulations. In *National Electrical Manufacturers Association v. Sorrell*, for example, the U.S. Court of Appeals for the Second Circuit upheld a state labeling requirement for light bulbs containing mercury.[104] This law, the court held, facilitated the state's efforts to reduce mercury pollution and to ensure the proper disposal and recycling of mercury-containing products. In accordance with these precedents, a nanomaterial content labeling requirement that is part of,

[102] *See* Glickman v. Wileman Brothers & Elliott, Inc., 521 U.S. 457 (1997) (upholding compelled assessments on tree fruit growers to support advertising as part of larger regulatory marketing scheme).
[103] *Glicksman*.
[104] 272 F.3d 104 (2d Cir. 2001).

and facilitates the administration or enforcement of, a broader regulatory initiative program would be more insulated against First Amendment challenge. So, for instance, were the FDA to require cosmetics manufacturers to disclose nanomaterial content that has not been subject to safety testing, such a requirement might be justified as part of the agency's broader regulation and disclosure rules for cosmetics.

Where labels are permissible, not any mandatory label will do, however. There would have to be a sufficiently close relationship between the government's interest, such as a specific health or safety threat, and the label. Therefore, a requirement that manufacturers disclose specific types of nanoparticles believed to pose a potential risk would be easier to defend than a generic "contains nanoscale particles" label applied across a wide range of products, irrespective of the types of nanomaterial content. While any labeling requirement would be subject to First Amendment scrutiny, a label rule tied to a particular health or safety concern would be more likely to withstand legal challenge.

The Promise of Voluntary Labeling

Government regulation is not the only impetus for product labels. Manufacturers have substantial economic incentives to provide consumers within information about their products, particularly information that serves to differentiate one maker's products from another's. Firms use labels to attract customers, differentiate their products from those of their competitors and to promote the presence of potentially desirable product characteristics.[105] Indeed, in competitive markets producers have an incentive to disclose any information that is likely to make their

[105] Golan, et al., *supra*, at 119.

product more desirable to consumers, at least so long as the cost of providing the information is less than its value to consumers.[106]

At the same time, consumers have a strong incentive to search out products that satisfy their preferences. If a preference is strongly held, consumers are likely to invest time and effort to satisfy that preference. As Beales, Craswell & Salop note, "Increases in the efficiency of purchase decisions made are equivalent to increases in real income."[107] Where consumers do not seek out such information, this is because the cost of obtaining the information is greater than the value of the information to the consumer, indicating the information is costly to obtain (as with a credence attribute) or the preference is not particularly strong.

In competitive markets, firms have an incentive to provide consumers with positive information about their products, and failure to disclose information consumers desire can be costly. In a competitive marketplace, rational consumers may assume that firms highlight the positive attributes of their products. The failure to disclose something positive creates a negative inference.[108] As Golan, et al. note "competitive disclosure," also referred to as "unfolding," often "results in explicit claims for all positive aspects of products and allows consumers to make appropriate inferences about foods without claims."[109] As Ippolito and Mathios report, "in cases where an issue is important to consumers and there is adequate competition among producers of goods with varied levels of characteristics, competition will generate the desirable information."[110]

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[106] Beales, Craswell, & Salop, *supra* at 502.
[107] Howard Beales, Richard Craswell, and Steven C. Salop, *The Efficient Regulation of Consumer Information*, 24 J.L. & ECON. 491, 502 (1981).
[108] Golan, et al., *supra*, at 128.
[109] Golan, et al., *supra*, at 129; *see also* Ippoloito and Mathios, *supra* at 427 ("If consumers value the characteristic and if firms have a credible means of disclosing the characteristic, economic theory predicts that firms with superior products would have an incentive to highlight that fact voluntarily.").
[110] Ippoloito and Mathios, *supra* at 428.

If all products in a given market share a negative characteristic, however, competitive disclosure will only occur if producers of potential substitutes draw attention to these product attributes.[111] This situation is likely to occur with product categories in which there is a certain degree of uniformity or a basic characteristic that all must share. It's unlikely that any egg producer is going to advertise or voluntarily disclose the cholesterol content of eggs.[112] Where products differ with a given category, comparative marketing is common. So if only some products in a given category contain nanoscale ingredients, and this information is relevant to consumers, manufacturers have adequate incentive to disclose this information, on the product label or otherwise.

The ability to make positive health claims about their products has provided food producers with an incentive to improve the healthfulness of their products.[113] By extension, if the presence or lack of nanoscale materials is desirable, and producers are allowed or required to disclose this information, they will have a greater incentive to alter their product designs in accord with consumer preferences.[114] Even for those product lines in which nanoscale ingredients are common, such as sunscreens, they are not universal, and there is ample market space for a competing firm to promote itself as a "nano-free" alternative.

Consider the development of kosher foods. Religiously observant Jews demand food that is prepared in accordance with Kosher laws. In response to this demand, many food producers submit their products to evaluation by a Rabbinical council so that it can be certified as "kosher,"

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[111] Golan, et al., *supra*, at 129.
[112] Though, it should be noted, where a given product category shares a negative characteristic, this creates an incentive for other firms to create a competing substitute that does not have this negative feature and promote this attribute, as has occurred with egg substitutes.
[113] Ippolito and Mathios, *supra* at 419.
[114] Beales, *supra* at 111 ("If there are enough consumers willing to pay to avoid a particular process, or obtaina process they prefer, manufacturers have every incentive to provide those products.").

and be eligible for a voluntary label. Even though the demand for kosher foods is only a small part of the market, many large corporations participate in this process.

Producers are more likely to underprovide information about the consequences and risks associated with nanomaterials than with the presence or use of nanotechnology. This may be because some of the potential risks and characteristics of nanotech materials may have public good properties.[115] Product-specific information, such as whether nanoscale particles were used and what their specific benefits are in a particular product, is more likely to be provided. As a consequence, mandatory disclosure or labeling requirements are "most likely to be appropriate when information affects an entire product class without differentiating the brands within that class."[116] It is unclear whether this is the case with nanotechnology, however.

If a substantial minority of consumers desires information about the nanomaterial content of consumer products, it is likely that more firms will begin to label their products accordingly. Firms making products containing nanoscale materials might not so label their products, but firms that make competing nano-free products will have ample incentive to differentiate their products in this fashion so as to attract those consumers for whom this is a plus. In this way, voluntary nano-content labeling could develop along a path followed by organic labels. A non-trivial portion of consumers had a preference for organic products, prompting many producers to identify their products as organic. This drew consumers away from "conventional" products toward those with the desired characteristics. Over time, the organic share of the market grew. Federal agencies facilitated this process not by mandating labels, but rather by issuing labeling guidelines to ensure that label terms would be commonly understood. The promulgation of such

[115] Beales, Craswell & Salop, *supra* at 503 (discussing how producers are likely to underprovide information that has public good properties); *id.* at 504 "When information benefits all sellers equally" there is less incentive for sellers to disclose).
[116] Beales, Craswell & Salop, *supra* at 527.

definitions may have actually enhanced the value of organic labels, as it may have buttressed consumer confidence by making such labels m ore trustworthy and reliable. Federal agencies, or private third party organizations, could play a similar role to facilitate voluntary nanotech labeling. There are already a handful of third-party entities offering or promoting nano-related certification and private labeling.

In many contexts, the best first step for the government to take is to remove or reduce barriers to greater private provision of information. Restraints on information disclosure inhibit competition in addition to limiting consumer choice.[117] Insofar as the FDA or other agencies are discouraging firms from making claims about nanotechnology, it may be inhibiting welfare-maximizing disclosures.

Some fear the absence of an official labeling requirement, or government standards defining what label terms mean, will undermine consumer confidence.[118] This is a reasonable concern. If consumers lack confidence in a label, and cannot be sure it provides accurate or relevant information, they are unlikely to pay it much heed. This is true whether the label is mandatory or voluntary. The adoption of regulatory definitions and standards by regulatory agencies can address this concern by clarifying what relevant terms mean. Standardizing terminology in this way can given consumers greater confidence in labels and other disclosures without inhibiting market efficiency or consumer choice.

Conclusion

[117] Beales, Craswell & Salop, *supra* at 514.
[118] *See, e.g.*, Kenneth W. Abbott, Gary E. Marchant, & Douglas J. Sylvester, *A Framework Convention for Nanotechnology?* 36 ENVTL. L. REP. 10931, 10932 (2006) ("an official process is needed to provide assurances of safety and regulatory capacity so that the public can have confidence in this new technooogy, which will not occur with informal or voluntary controls.").

Consumers do not know much about nanotechnology,[119] nor much about the nanomaterial content of the products they buy. At present, it is also not clear that consumers care. The primary purpose of a mandatory labeling requirement is to increase market efficiency by making it easier for consumers to identify those products that match their preferences. But in the case of nanotechnology, do consumers even have preferences to match?

The purpose of a labeling requirement cannot be to give consumers "perfect" information or to prevent them from relying on "incomplete" information. Consumers never have perfect information. The question is thus whether labeling regulations will enhance market place efficiency over the what is likely to emerge in the alternative. [120] Absent evidence that there is an existing market failure to justify intervention, many analysts would argue that regulators should leave well enough alone.[121] This is particularly true in an area like nanotechnology in which it is not clear what a labeling regime would require.

A generic "contains nanomaterials" label would not be particularly informative to consumers. While some nanoscale particles may pose new or unique risks, others will not. While the small size of nanoscale particles is part of what may make them dangerous, small size itself is not an indicatory of a health or safety threat. A labeling regime that suggests any and all products containing nanoscale materials pose the same degree of risk would likely mislead more than inform. Yet scientific understanding of nanotechnology is not sufficient for a more detailed labeling regime – at least not yet.

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[119] Pew Survey.
[120] Howard Beales, Richard Craswell, and Steven C. Salop, *The Efficient Regulation of Consumer Information*, 24 J.L. & ECON. 491, 501 (1981) ("the real issue is when the government can or ought to intervene in the information market to improve the market's performance.").
[121] Beales, Craswell & Salop, *supra* at 512 ("intervention must be limited to those instances in which infomraiton imperfections demonstrably lead to significant consumer injury and which can be corrected in a cost-effective manner—without creating serious distortions or side effects which lead to even greater injury.").

One possible approach to disclosure is that embodied in the FDA's regulation of cosmetics. As discussed above, cosmetic manufacturers are required to disclose the presence of ingredients the safety of which they cannot assure. Insofar as some nanoscale materials have not been tested or used long enough to indicate whether they have potentially deleterious effects, cosmetic makers may be required to disclose this information with their ingredients. This sort of mandatory disclosure would provide a degree of accurate and worthwhile information – the lack of scientific knowledge about an ingredient that may or may not be dangerous – without imposing a blanket and uninformative label requirement.

The absence of mandatory labels would not necessarily leave consumers without information. When a group of consumers have a strong preference for products with particular characteristics, producers have an incentive to cater to that group's preferences. Several organizations have begun to develop labels or labeling guidelines, and little stops other consumer or industry organizations from following suit. If the public, or a substantial minority, begins to care about the use or presence of nanomaterials in consumer products, producers will have an incentive to identify those products which match strongly held consumer preferences. There will also be market opportunities for firms that seek to augment consumer awareness of nanotechnology, and market products accordingly. So even if "consumer curiosity" provides an inadequate legal or policy basis for mandating a disclosure or warning label, it is more than ample reason for producers to disclose information that consumers desire.[122]

[122] Frederick H. Degnan, *The Food Label and the Right-to-Know*, 52 FOOD & DRUG L.J. 49, 59 (1997).