# How Advances in Technology Keep Reducing Interventionist Policy Rationales

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*July 2015*

MERCATUS WORKING PAPER

MERCATUS CENTER
George Mason University

3434 Washington Blvd., 4th Floor, Arlington, Virginia 22201
www.mercatus.org

*Fred E. Foldvary and Eric J. Hammer. "How Advances in Technology Keep Reducing Interventionist Policy Rationales." Mercatus Working Paper, Mercatus Center at George Mason University, Arlington, VA, July 2015.*

**Abstract**

Rationales for government interventions in the market are typically based on theories of market failure set within a framework of fixed private-sector practices and technologies. However, continuous technological progress and entrepreneurial innovation are eroding the theoretical foundations of these policies, making them increasingly obsolete. This paper describes the four pillars of market failure doctrine and provides examples of how the market is using technology to solve problems previously considered to necessitate government intervention.

*JEL* codes: O33, H80

Keywords: technology, policy, property rights, market failure, information

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As technology continues to advance swiftly, its influence not only alters how people interact with one another and with the economy, but also changes policy rationales—that is, the justifications for the government taking corrective action. This proposition was the theme of *The Half-Life of Policy Rationales: How New Technology Affects Old Policy Issues* (2003), edited by Fred E. Foldvary and Daniel B. Klein. This study updates that theme, while also making it accessible to the public in one paper.

Some technological changes have merely made contributions to the quality of life, such as the now-ubiquitous Internet videos on any topic of interest, but the total effect of better technology has had profound implications for both market transactions and government interventions. Many of the facts and propositions on which policymakers and theorists base their case for government corrections and market supplements become less justified as the market itself generates new technology to solve previously intractable entrepreneurial difficulties.

Government intervention into markets occurs in many forms, including restrictions, mandates, and the government provision of services, as well as taxes and subsidies aimed at specific groups. The following are four classic categories of efficiency problems that offer a theoretical rationale for government intervention:

1. The market does not produce an important product that people value enough to cover the costs. The products most frequently said to experience such failure are collective goods.
2. Asymmetric information enables one party of a transaction to exploit the other.

3. The market price does not take into account external effects—that is, costs imposed on third parties or benefits enjoyed but not paid for by others.
4. Pricing power enables sellers to reduce the quantity of a product and sell it at a higher price than it would fetch in a more competitive industry.

In this paper, we show examples of corrective policies that are based on those perceived market failures. We also discuss the ways in which changing technology has made those policies increasingly obsolete, either by correcting the problem more effectively or by shifting the problem from one of regulation to one of property rights enforcement. Although a full rebuttal of the theory of market failures is beyond the scope of this paper, we believe that the examples provided demonstrate that the necessity of government intervention is increasingly being eroded and that the forward-thinking policymaker will be able to observe many new market-based solutions to problems traditionally solved by government action.

**Collective Goods That Were Previously More Costly or Difficult for Markets to Provide**

One of the most common government actions is the provision of collective or public goods and services, such as roads, schools, and parking. The economic rationalization for such activity is that although people are willing to pay the costs of production, thus making the provision of the good an efficient use of resources, the transaction costs of collecting those payments or excluding nonpayers are great enough that entrepreneurs will not provide an efficient amount based on the benefits. The economic term for these activities is *public goods*, which are typically defined as being nonrivalrous and nonexcludable.

A good is *nonrivalrous* if a group of people can benefit from its presence without reducing others' ability to benefit, and it is *nonexcludable* if it is physically impossible or very

costly to exclude those who do not pay for the good from consuming it once it is produced. National defense is a classic example: a US resident does not become less protected from foreign invasion if the population increases, and individuals obtain that protection merely by being located within the national territory, even if they reject a voluntary payment.

However, closer examination reveals that many government-provided goods and services do not fit this rubric. Some goods are easily excludable, but the efficient amount will not be produced because of difficulties in compensating the producer for the positive externalities to nonusers. For example, highways are excludable because reckless drivers can be arrested and tolls can be charged. Nevertheless, many people argue that the government must provide roadways because they are expensive to build and maintain, and financing them only from tolls would, in many cases, not provide sufficient funds. An open-access road financed by taxation would get more traffic, which would prevent the waste of an underused highway. Also, if improved roads have general benefits to the community that are not captured by the tolls, then it must be true that government provision corrects what would otherwise be a market failure.

However, private communities such as homeowners associations (discussed later) can also provide these efficiencies, and, in the current political climate, such contractual communities are more likely to adopt efficient pricing than the current taxes that have an "excess burden" (inefficiencies and a loss of social well-being due to less production and less consumer benefit). Private communities, including associations and condominiums, as well as proprietary communities such as office buildings and shopping centers, sometimes can and do pay for the neighborhood streets. These communities could also form higher- or broader-level associations for the provision of goods for a larger territory. The lower-level associations would be efficiently financed by rentals and assessments on property value and would pass on some of the revenues

to the higher-level associations. Higher-level associations would finance higher-level goods, such as the major boulevards and mass transit. Thus, private rental payments could efficiently pay for the streets and highways, along with tolls high enough to prevent congestion. Also, a privately organized network or hierarchy of contractual communities could supplement their road revenues with pollution charges by using remote sensing (Klein 2003).

As Peter Samuel (2003) notes, a market failure argument for highways has been that a highway that is privately owned by a profit-maximizing firm is a natural monopoly and has less traffic than it would if it didn't have a user charge. As such, it creates a *deadweight loss*, an inefficient use and waste of resources due to either government interventions or high private-sector pricing. When the marginal cost of one or more users of a highway is zero when the road is not congested, the efficient policy is to not charge tolls; therefore, charging a positive toll constitutes a market failure. But as explained earlier, this market failure argument overlooks the possibility of private communities that pay for the highways and use tolls only to prevent congestion.

Toll collection may have been impractical in the past, other than for heavily traveled bridges, but improving technology has been eroding the costs of collecting user fees and internalizing external benefits. Moreover, as Samuel (2003, 48) explains, major motorways are not necessarily natural monopolies, because "for most trips there are usually alternative routes and sometimes competing modes." Samuel notes that even if a particular road is a natural monopoly, that fact does not imply the remedy of government ownership, because utilities such as water providers are also natural monopolies and are often run by private enterprise, though they are regulated.

Toll collection for roads and bridges has become very inexpensive with the advent of radio frequency identification (RFID) systems such as E-ZPass, which allow tolls to be charged

to a prepaid account after a device passes the toll point. This system removes the need for human toll collectors for all lanes of traffic and allows vehicles to pay tolls at speed, improving the traffic flow and reducing injuries (E-ZPass Interagency Group 2013). As the price of toll collection drops, many projects have become viable that once were costly and difficult to provide privately. Examples of companies using such methods include the Dulles Greenway and the South Norfolk Jordan Bridge (SNJB) in Virginia.

The Dulles Greenway not only proves that the government does not need to supply roadways, but also shows that technology can make such projects more practicable. Completed in 1995, the Dulles Greenway is a privately funded and owned toll road that connects the west end of Dulles International Airport and Dulles Toll Road to the Leesburg, Virginia, area. The Greenway was the first private toll road to be constructed in Virginia since 1816 (Dulles Greenway 2014), and it was made possible by the passage of the Virginia Highway Corporation Act of 1988, which allows the construction of toll roads by corporations under the direction of the Virginia Corporation Commission (Virginia General Assembly Legislative Information System 2014). From the onset, the Greenway demonstrated the value of having private entrants to the road-building industry. Donald Beyer, a member of the Commonwealth Transportation Board in the late 1980s (when the Corporation Act was being passed), commented that "one of Virginia's most expensive transportation improvements was done at virtually no cost to the taxpayer and in a much more accelerated time frame" (Mummolo 2007).

Although originally feasible using the technology of the 1980s and 1990s, the Greenway now uses RFID tags (the Smart-Pass and E-ZPass systems) as well as automated credit card readers to improve traffic flow and remove the need for toll workers during periods of low use. Those technologies also allow for the use of congestion pricing, an increase in prices during rush

hours to encourage balance between the Greenway and nearby routes 28 and 7. The more efficient tolling technologies have helped increase yearly traffic from approximately 6.3 million in 1996 to 21 million in 2006 (Mummolo 2007) as more residents moved to the area.

The SNJB, which was built to replace the Jordan Bridge, is another example of costs lowered by improved technological efficiency. The effect demonstrates that private companies are capable of stepping in to provide services, even when local governments find those services no longer feasible. The Jordan Bridge was the first bridge to connect the city of Norfolk to the land mass of Virginia; previously, ferries were required to cross the Elizabeth River. Built in 1928 as a lift bridge, the Jordan Bridge served for 80 years, until repair and maintenance costs drove the Chesapeake City Council to shut down the bridge (*Richmond Times-Dispatch* 2008; South Norfolk Jordan Bridge 2013). Although the city originally decided to let the other nearby bridges carry the traffic previously handled by the Jordan Bridge, the private firm Figg Bridge Builders proposed building a privately owned and operated bridge where the previous bridge had stood. The cost to build was estimated at an impressive $100 million as opposed to the $373 million the city had calculated, although tolls would increase from $0.75 to $2.00. More importantly, all $100 million would come from private sources rather than from the cash-strapped city government (Newswanger 2012). The city approved the plans in 2009, and by 2012 the new SNJB was open to drivers (South Norfolk Jordan Bridge 2013).

Although bridges are perhaps an obvious good that can be provided privately because of their ease of excludability and the relatively low number produced by government because of the costs, the SNJB is notable for the method used to collect tolls. There are no toll booths on the bridge. Instead, tolls are collected exclusively through RFID (E-ZPass in this case) and billing; motorists crossing the bridge have their license plates photographed, and those without E-ZPass

are sent a bill for the toll in the mail. This, along with the change in the bridge design from lift to fixed deck, allows a continuous flow of traffic, as well as a reduction in rates for E-ZPass users from the original $2.00 to $1.50 (South Norfolk Jordan Bridge 2013).

The history of the SNJB demonstrates what might be called government failure. The city government had assigned the provision of bridges solely to itself and had, in turn, lacked available resources to provide those goods, despite a market demand. This type of failure is far from uncommon; other examples include the Kings Highway Bridge in Suffolk (Applegate 2006) and the 147,869 other bridges that are designated as deficient in terms of maintenance and safety by the Federal Highway Administration (2014). From the government's standpoint, ceasing to provide certain bridges is quite possibly rational, as evidenced by the $373 million price tag for repairing the Jordan Bridge, one of three bridges in the area. The private provision of the SNJB not only represents the private sector stepping in to correct government failure (by investing to provide a good that is efficient for both the users and the providers), but also moves closer to the efficient level of provision. The SNJB's success turns the rationale for government provision of infrastructure on its head, thanks in part to advancing technology that allows for lower operation costs.

**Asymmetric Information: What You Don't Know Can Cost You**

\Withholding of information by one party in a trade, known as asymmetric information, is one of the most common arguments for regulation. This argument addresses the practice in which providers of a good or service know much more about what they provide than the customers do, allowing them to take advantage of customers, generally by offering goods that are substandard, fraudulent, or harmful by their nature. Fraud, however, is not a market failure; it is a type of theft

and thus is outside the market and ought to be addressed through the legal system. The market failure argument claims that there is a knowledge problem aside from explicit fraud, such as not disclosing relevant information.

The classic example is the low-quality used car (a "lemon") sold to an unsuspecting customer as a quality vehicle. Using such consumer ignorance as a justification, government regulation extends to nearly every step of manufacturing, distribution, and consumption—from requirements that shops post information on workplace regulations to rules on sourcing products and labeling to warnings on every pack that cigarettes are unhealthy (Food Safety and Inspection Service 2013; Federal Trade Commission 2014; US Department of Labor 2014).

John Moorhouse (2003) describes some of the multitude of agencies and interventions instituted in the name of consumer safety and the more proscriptive approach taken, with requirements that move from information to controls. In particular, the Consumer Product Safety Commission originally existed to serve as a source of information on product safety and other consumer issues, but the commission quickly shifted its focus to command and control (e.g., banning products and mandating recalls) (Moorhouse 2003).

The actions of the Consumer Product Safety Commission highlight an important aspect of asymmetric information: it isn't just information that people care about, it is also assurance. Information is not an end in itself for most people, but rather an input that can be used to make assurances as to the outcome of a particular purchase. Klein (2011) describes trade as an exchange of promises, such as the promise that this gallon of white fluid contains a gallon of fresh milk instead of white paint, and the dollars presented as payment are in fact legal tender and not counterfeit. Those promises are important not only for confirmation of information but also for the goals of individuals on both sides of the trade. The information is valuable because it

allows the buyers to decide whether what is being offered is right for them, thereby ensuring that what they are getting is actually going to serve the purpose they want it for.

Just as people sometimes go to a restaurant and buy a meal instead of buying groceries and cooking it themselves, sometimes people just want assurance instead of taking the time to collect and use the requisite information themselves; information versus direct assurance is itself a decision that people must make themselves. Given this level of individualized complexity, a one-size-fits-all solution imposed by government is highly unlikely to come close to the optimum. Fortunately, advances in technology have made an abundance of both information and assurance available to consumers, at a price approaching the cost of the time to read it.

The Internet today is a remarkable source of information for consumers. One can quickly and relatively easily find information on nearly any aspect of a product on websites. Specifications can be obtained on manufacturers' and retailers' websites, as well as in product reviews. Consumers can quickly compare prices not only among online retailers but also among local stores, obviating the need to drive across town to compare prices. Product quality and user experiences are routinely rated on retailers' sites, such as Amazon.com or NewEgg.com, as well as on a multitude of forums and user groups, in addition to descriptions, evaluations, and recommendations by subscription services such as Consumer Reports and Angie's List. The quality of the ratings and raters themselves are tracked; Amazon confirms when reviewers have actually purchased an item and when they use their real names, to help the researcher decide whether an otherwise anonymous commenter is genuine or a company shill.

As John Moorhouse (2003) notes, the work of Kenneth Arrow in the early 1960s was influential in this regard. Arrow asserted that the high cost of collecting and analyzing information, coupled with the necessarily low sales price and difficulty in excluding nonpayers,

implies that the market could never efficiently provide product information. At the time of Arrow's publication, some consumer information already was being compiled and disseminated: *Consumer Reports* had been published since 1936 as a private, nonprofit magazine dedicated to product testing (Consumer Reports 2014).

Now, of course, much of this information is available online for free. Modern sources of information on the Internet often use a business model that existed during Arrow's time: content supported by advertising. Instead of charging user fees, many websites have advertisements and links as a source of funding, in the same way that broadcast television has been supported by advertisers. The marginal cost of provision is nearly zero, and many of the reviews and information are user-generated, so the costs are easily covered, and many stores feature whole discussion forums or build in reviews with every listing.

Other sites allow users to search reviews for free but offer membership subscriptions. Those fees fund enhanced services such as printed and mailed reviews, discounts, dispute moderation, and improved review quality (Angie's List 2014). Angie's List is particularly notable because it deals with local contractors such as plumbers and painters, occupations already licensed and presumably regulated in most locales. This shows that it represents a market response to consumer demand for information and assurance beyond what the local regulators provide.

The market has evolved to provide ample information in another area, one largely untouched by regulation: the secondhand market. Sites such as eBay and Craigslist are famous for enabling sellers to offer all manner of products, both new-in-box items and previously owned goods. Over the years, those sites have become huge markets, with eBay boasting thousands of listings every day. During this time, strong norms and strategies have evolved around listings,

one of the strongest being the provision of as much information as possible about the item to be sold. eBay's own selling guides for clothing recommend taking multiple, clear pictures of an item, along with listing any and all defects, the size in both listed and actual measurements, and clear conditions of sale, such as shipping prices (eBay Inc. 2014). Consumers, knowing that there is little legal recourse if the item is not what they thought, have learned to immediately steer clear of vague, indeterminate listings in favor of those with full, forthright information, and sellers have responded by providing the kind of information buyers need in order to feel comfortable with their purchases.

Of course some people do not want lots of information, just assurance regarding a product. If I am buying a coffeemaker, I do not ask for a test run in the store; a suitable return policy will do the trick. For purchases that cannot be returned, such as a meal at a restaurant, a multitude of sites offer reviews; a Google search for restaurant reviews yields 10 pages of results, including Google's own reviews. A search for doctor reviews yields approximately 378,000,000 results. New smartphones allow consumers to simply scan the barcode on a product to see local prices and reviews instantly. Clearly, there is a strong market for information on people's experiences with various vendors and service providers, and technological advances have made it much cheaper for people to share these experiences. The result is that reviewers scrutinize nearly every sale and customer interaction, while regulators normally only perform random spot-checks. When a few bad reviews or incidents can be seen by thousands of potential customers, businesses must work extra hard to protect and build their reputations. All this information is in addition to the assurances brought by brand names and product liability. In many ways, consumers have never been so well informed and suppliers so incentivized to provide the best service, with very little of the credit going to regulators.

**Externalities: Costs Imposed on, or Benefits Not Paid for, by Others**

The third common argument for government intervention is the presence of externalities, both negative and positive. An externality is an uncompensated effect on others. For instance, if my neighbors have a beautiful yard and house that I enjoy looking at, I benefit from this positive externality without paying them anything, both from my enjoyment of the beauty and from the higher property value of my home because of this external effect. However, if my neighbor starts a pig farm in his backyard, my home value will drop precipitously as the air quality plummets because of this negative externality.

The externality problem occurs when people either do not bear the full cost of their actions or do not reap all the benefits. The problem is compounded by a marginal effect—that is, the absence of compensation increases negative effects and reduces positive effects, relative to the theoretical efficient amounts. My neighbor has too many pigs because he does not bear the full cost their smell imposes on the neighbors, and I do not have a more beautiful lawn because I do not get rewarded for the benefits the beauty provides to my neighbors. Thus, the argument is made that if the neighborhood cannot work out some arrangement whereby residents pay each other to compensate for these issues, the government will have to prevent residents from causing problems for each other.

Ronald Coase (1960) pointed out that if transaction costs are low, then two parties to an external effect will negotiate an efficient solution among themselves, an activity known as Coasian bargaining. However, if many parties are involved and the transaction costs are high, then Coasian bargaining may not be effective. As a result, many towns do not allow farm animals to be kept in residential zones and have ordinances related to keeping one's front lawn tidy. Much of city zoning is based on the externality rationale, although often the prevention of

an external effect, such as higher density, implies creating other external effects, such as increasing housing costs.

The market failure argument for positive externalities raises three issues: (1) externalities are ubiquitous, which means that remedying them all is not possible; (2) the results of many external effects are subjective, and calculating the net effect may not be possible; (3) the effects include nonfinancial values.

First, it is not clear that any transaction is free from externalities. If my nice lawn benefits neighbors, what about a nice car in the driveway, or nice clothes while I mow the lawn? Is demanding a nice lawn really more reasonable than demanding that I wear nice clothing while standing in it? Perhaps so, but this is definitely a gray area.

Second, although some vegan neighbors might complain about the smell of their neighbor cooking barbeque, some others might enjoy it, whereas others might be entirely indifferent. How are external costs and benefits totaled in a practical way? Positive externalities, those uncompensated benefits to others, are often subjective, and if compensation is fully applied, the transaction costs can be overwhelming.

The third issue with the above argument is the reliance on pecuniary payments to counter externalities. As Adam Smith describes in *The Theory of Moral Sentiments* (1759), much of what people do is motivated by the approbation of their peers. That is to say, people do good things for others because people want to be thought highly of, and people avoid doing bad things to avoid others thinking poorly of them. Part of the way human society gets around the issue of pervasive externalities is by socially rewarding or punishing those who produce them. Neighbors rarely use monetary incentives to negotiate externalities but instead use social effects. Given the lower numbers of people involved at the neighborhood level, it is quite

reasonable to expect neighbors to use their personal costs to find an optimum solution among themselves, as Coase suggested.

Moreover, a moral argument can be made regarding positive externalities, which is that they are, for the most part, gifts people give to others. The recipient of a gift is not morally obliged to pay for it, because there is no contractual obligation. The absence of benevolent donations is not a market failure. Furthermore, systemic positive neighborhood externalities generate higher land rent, and a contractual (hence voluntary) community can preserve the effects with easements, covenants, and bylaws.

The problem associated with significant negative externalities, which are the more prominent rationales for government intervention, is the absence of enforced bounded property rights. In many cases, establishing property rights has not been feasible, and without such clear rights, the governments often punish or subsidize activities that might harm or benefit society. However, just as the invention of barbed wire and branding helped solve many of the property rights issues of the old West (De Alessi 2003), new technologies are lowering the price of assigning property rights, as well as internalizing the external costs and benefits.

One area in which a lack of property rights has led to a tragedy of the commons—that is, the exploitation of a shared resource to the extent that demand overwhelms supply—is the oceans and their fauna. Many commercial fisheries lie far enough off the coasts that they are not within any country's jurisdiction, and even for those that are, the property rights are generally owned by the state. De Alessi (2003) has noted the many attempts of governments to regulate the use of fisheries, such as the United Nations Law of the Sea Convention in 1982, the U.S. High Seas Fishing Compliance Act of 1995, and many limitations on equipment and harvest seasons. The result has been a large distortion in capitalization and techniques used to fish. As with most

areas of economic activity, entrepreneurs have found ways to work within the legislation to achieve their economic ends, despite the intentions of the legislators.

Entrepreneurs have been busy in other ways, however, using technology to improve understanding of the oceans and the resources they hold—technology that can be used to extend property rights to the great blue sea. The Tag-A-Giant (TAG) project has been advancing the knowledge of bluefin and yellowfin tuna, tracking their movements, habits, and spawning and feeding regions (Tag-A-Giant 2013). Using improved tracking tags that gather data over months and years before releasing and relaying information by satellite, TAG has been able to track migration patterns of bluefin throughout the Atlantic and Pacific oceans. The system has led to the discovery of a great deal of population mixing across the 45-degree longitude line that divides management of the species between western and eastern zones under the International Commission for the Conservation of Atlantic Tunas (ICCAT) (Tag-A-Giant 2013). The project highlights the difficulty in international command-and-control schemes, that of some countries underreporting their catches and fishermen ignoring restrictions that are inherently difficult to enforce.

The success of the TAG project, along with the possibilities offered by tuna farming and other fishery advances, suggests a way forward—transponder branding and fishery ownership. Transponder branding involves implanting a small transponder under the skin of the fish, in the same way that household pets are microchipped so they can be identified if lost. The transponder contains information on the owner of the fish as well as basic data on age and release location; more elaborate transponders can record movements over time and other data. For large, expensive fish such as bluefin tuna, these brands can allow fisheries to raise tuna to an age suitable for release into the wild and protect them for subsequent harvesting a few years later

when they have grown. By using this technology, the aquaculturists can track their own tuna's movements for harvesting at optimal times, or they can allow third-party fishermen to capture the fish for a bounty. Although many different market structures are possible, one can imagine tuna fishermen being paid at market only for fish with transponders, with the wholesaler paying the farmer directly for the fish brought in, and the farmer paying a bounty on the return of the transponder.

Such a system would induce greater incentives to catch only tuna that have been farmed or are otherwise clearly owned, as well as limit the incentives to underreport catches. Tuna fishermen would be prohibited from catching untagged tuna to avoid depleting the stock. Transponders could also act as beacons for fishermen, alerting them to the presence and location of fish that are of prime age to catch, making the process of collection even more efficient. In this way, fishermen can avoid many of the socially destructive externalities inherent in an open commons. Although the international range of the problem makes enforcement more difficult, international trade functions quite well across jurisdictions as long as property rights are clearly defined.

For the smaller fish, such as salmon, which do not sell for tens of thousands of dollars per animal, tagging may be inefficient. Because maintaining property rights in individual animals is difficult, it makes sense to instead enforce property rights to areas where they live. With the improvement of GPS technology to the point that it is nearly universally available, even the trackless sea can be cordoned off into plots owned by groups. Regions where fishing and other resources make exclusion desirable can be auctioned off to private owners who can then manage the resource for optimal output, much as on land. GPS technology not only allows nonowners to know where they are and whether they are crossing into private waters, but also can be used to track movements and alert owners to trespassers (De Alessi 2003).

Even areas seemingly devoid of economic value can benefit from this assignment of property rights. The creation of new underwater reefs for tourism and farming of various fish species currently occurs only infrequently, because entrepreneurs must rely on secrecy to reap the benefits of their investments in an area, and are also subject to legal restrictions (De Alessi 2003). The creation of enforceable property rights in coastal waters would encourage more creation of artificial reefs, reducing the strain on natural reefs and the wildlife populations they support.

Another way technology is helping reduce negative externalities is by making information on good and bad behavior much more accessible, as discussed earlier. The parties most interested in mitigating a certain behavior can very easily impose negative externalities. Just as a restaurant fears bad reviews on Yelp.com, polluters can very easily be shamed, boycotted, and otherwise avoided because of their behaviors. The University of Massachusetts Amherst's Political Economy Research Institute, for instance, compiles a Greenhouse 100 Polluters Index listing the organizations producing the most pollution in the United States (Political Economy Research Institute 2013). According to Google, the institutes' index is referenced in approximately 7.9 million other sites, including Forbes.com (Helman 2013). Organizations such as United Students Against Sweatshops use the Internet to spread awareness and drive boycotts and campaigns against companies for perceived impropriety around the globe (www.usas.org). The Internet has allowed those interested in any particular issue, from across the political spectrum, to more easily find each other and spread their message. By lowering the costs of association and communication, technology has raised the cost of imposing externalities on others.

**Monopolies**

The term *monopoly* has two economic definitions. An absolute monopoly is an industry in which there is only one seller (similarly, a monopsony is an industry with a single buyer, such as the military's purchase of tanks). The second meaning is an industry in which the number of firms, amount of resources, or number of products is fixed by law or by nature, such as when electricity is provided by a single regulated supplier in a certain territory. A monopoly caused by a government prohibition of entry, such as with patents or taxi permits, is, of course, not a market failure. The market failure argument has been applied to natural single-firm monopolies and to the monopoly-like pricing power of firms in oligopolies, that is, industries dominated by a few large firms. The market is said to fail when the pricing power of the firms enables them to increase the price and reduce the industry quantity relative to a more competitive case to generate an economic monopoly profit.

Advancing technology has reduced the pricing power of firms by reducing barriers to entry as computing ability has become cheaper and as the Internet has facilitated the distribution of products. Technological progress requires the dominating firms to innovate lest they fall behind. Companies such as IBM and AOL, which previously dominated their industries, within a decade lost their prime position to new firms such as Microsoft, Google, and Facebook or to firms such as Apple, which innovated with large technological and marketing leaps.

A natural monopoly is an industry for which the production of a product or resource has a high fixed cost and a low marginal cost. The high fixed cost makes it unprofitable for a second firm to enter the field. The socially efficient price for the product is its marginal cost—the cost of providing the extra unit—but the profit-maximizing firm will reduce the quantity so that the price is above the average cost as well as above marginal cost. The reduction in quantity, relative

to the competitive case, creates a deadweight loss—that is, a reduction of social well-being. This welfare loss is designated in conventional economics as a "market failure."

The policy response has been either to regulate the industry or to provide government ownership. One of the problems with price regulation is that if the regulated price is set at the firm's average cost, with a guaranteed rate of return on the asset value, then the firm's managers will seek to inflate their expenditures, and the customers have little choice but to pay that added cost. In the United States, two of the most heavily controlled natural monopolies are providers of electricity and water.

### *Electricity*

The production of electricity is not inherently a natural monopoly, as there are various sources of energy, including oil, natural gas, coal, sunlight, wind, water flow, and nuclear fission. Electricity can be generated on a small as well as a large scale. However, the transmission and distribution of electricity through the grid has been considered a natural monopoly. But the actual monopolies are also a result of government policy. The US states typically require a "certificate of convenience and necessity" for companies to compete in the provision of electricity. They also impose other regulatory barriers, all of which raise the cost of entry or allow the government to shut down the entire enterprise. As Lowi and Crews state (2003, 164), "electric utilities never achieved natural monopoly status before the advent of the state utility commissions." Regulation has thus increased the costs paid by the consumers.

One effect of advancing technology in electricity is to reduce the scale needed to achieve the lowest average cost. Usually the generation of electricity, such as from dams, has had economies of scale because of their large size, resulting in the lowest average cost. If generators

can achieve a low average cost at a small scale, then, by definition, the production of electricity is no longer a natural monopoly. Because advancing technology has already reduced the costs of generating electricity, on-site generation can now compete with large central stations, especially as the decentralized production eliminates the costs of transmission. On-site production can capture useful heat from the generation of electricity, further reducing overall costs and bringing the fuel efficiency into line with larger plants (Lowi and Crews 2003).

The barriers to further decentralized and deregulated electricity generation are political rather than economic. Small-scale on-site plants require local and state permits, which are costly and can take months or years to procure, or may be denied. Federal agencies such as the Occupational Safety and Health Administration and the Environmental Protection Agency can also block energy enterprise. Taxes on small-scale generation are also imposed. As Lowi and Crews report (2003, 176), in California, if a user seeks to exit the grid, "it must pay tribute of up to $6.40 per kW of its own generating capacity per month."

New technology also has fueled the evolution of cost-effective "gensets," self-contained electric generators and power plants, also called microturbines. Gensets already exist in hybrid cars and motor homes. Many buildings have generators that can be switched on when power from the grid is interrupted. Recent advances include natural-gas turbines, solar-powered gensets, and microturbogenerators that can power a store or apartment house. The operating costs of microturbines are competitive with conventional engine-powered units (Lowi and Crews 2003). As of this writing, one can order an 8 kW propane generator from Amazon.com for under $2,000 dollars delivered for the home user (Amazon.com 2014). Portable solar-powered generators are also available (Markheim 2014; Independent Living News 2014). Low upfront and maintenance costs of small-scale generation will increasingly

promote dispersed generation, if accurate electricity prices are allowed into the market (Lowi and Crews 2003).

Another effect of advancing technology in energy industries has been to make energy production "more complex and hence unknowable to regulatory authorities" (Lowi and Crews 2003, 162). Dynamic complexity is best handled by the flexibility of markets. Instead of recognizing this ever-increasing complexity and allowing the market to find the right balance of conventional and alternative energy sources, government regulators have instead created more rules regarding the ratios of generation sources.

The Renewable Portfolio Standard is a policy initiative at the state level that requires electricity providers to generate a certain percentage of their electricity from renewable sources by a particular date (Britt 2004). As of January 2012, 30 states and the District of Columbia had an enforceable Renewable Portfolio Standard or other mandated renewable-capacity policies, and seven states have voluntary goals (U.S. Energy Information Administration 2012). Each state sets its own requirements, with California requiring the most, at 20 percent, by 2017. The definitions for renewable energy and whether existing sources count also vary by state. Arizona, in 2004, had only a 1.1 percent portfolio requirement by 2007, but 60 percent of that number had to be solar; however, that number has since been changed to a 15 percent renewable overall by 2025 (Britt 2004; North Carolina State University 2014). As in any regulatory regime, exceptions are made for a variety of reasons, which allows the trading of political favors among favored groups, thus causing market distortion (Britt 2004).

Further distortions arise from various subsidies to favored electricity production methods. Britt (2004) reports, for instance,

> The Maryland Clean Energy Incentive Act, enacted in 2000, provides a personal or corporate income tax credit for the production of electricity from commercial and

> industrial waste, forestry (excluding old growth residue) and agricultural byproducts, and landfill and anaerobic digestion biogas. The credit is 0.850 ¢ per kWh or 0.50 ¢ per kWh for electricity generated in a co-fired plant.

At the federal level, wind production tax credits reached $22 per MWh, two-thirds to one-half the market price of electricity (World Nuclear Association 2014), before being allowed to expire at the end of 2013 (American Wind Energy Association 2014). This credit, combined with priority access to the grid, required that wind farms' electricity be used before other sources. The tax credit expired at the end of 2013, but while it was in effect, it slowed the expansion of nuclear energy in the US market. (Nuclear power-plant expansion is also suppressed by natural gas prices that are unnaturally low because of prohibitions on exporting.) This favoring of intermittent wind power at the expense of base-load sources erodes the stability of the entire grid, as well as limits the viability of constructing new plants, a process already retarded by a long and highly uncertain regulatory process (World Nuclear Association 2014).

In some ways it seems that governments at all levels attempt to encourage technological growth and diversity in the energy production marketplace, but such industrial policy is generally less efficient than pure market entrepreneurship: the tax in relation to the cost of subsidies generally is less than the gain to consumers, and the subsidies can waste resources on failing projects that would be canceled by investors. Subsidies to solar and wind energy, for example, finance operations that are too inefficient to be funded from customer payments, and they incur negative externalities such as the killing of birds and loss of habitat. Unfortunately, almost all forms of energy are subsidized, including the burning of fossil fuels, with no compensation for environmental damage, so it is not clear which forms of energy are most efficient.

### *Water*

The provision of piped water is a prime example of a natural monopoly given by economics textbooks, involving a large investment in pipes, pumps, dams, and canals, and a low marginal cost per gallon of water. Even if allowed, a competitor would not profit from providing infrastructure. People do buy bottled water for drinking, but the penny per gallon for washing cars and watering gardens precludes competition from private firms.

In the United States, local governments provide most of the water. Aside from the issue of whether user payments efficiently cover the costs of provision, the current (2014–2015) water crisis in the Southwest indicates that state policies for dealing with the drought have suffered from government failure. The reservoirs and water tables have been depleted, and only when they had sunk to alarming levels did the government respond to calls for reductions in use. Ideally, a private water provider would charge at least enough so that users can consume the annual surplus, preserving the stock of water needed for sustainable use. Even if one considers the people to be the proper owners of natural water, the government does not necessarily have to extract and deliver the water.

The case against private unrestricted water provision is that if the marginal cost of producing a gallon of water were close to zero, when depletion is not a problem, the competitive and efficient price of water would also be close to zero, and the quantity provided would be obtained by the users who would not obtain any unless it were nearly free. Because the profit-maximizing quantity would equal the revenue-maximizing quantity, a monopolist would provide half the amount provided by efficient provision, as the marginal revenue curve would reach the horizontal axis halfway between zero and the quantity demanded at that price. Hence, provision

by the government would price water at marginal cost, or perhaps average cost, thus providing much more water at a lower price.

One water source that can compete with hydraulic central planning is on-site water extraction and recycling—that is, cleaning up used water for reuse. It is common in the more remote rural areas for homes and farms to use well water. But even where city water is provided, there can be on-site provision from recycling. Local sources of water, plus bottled water and recycling, can also be an economical alternative to large-scale public works. For example, some rural areas depend on well water for uses such as bathing but then use purchased bottled water for drinking. Cleaned, recycled water could also be used for farming or gardening. In contrast, water provided by the government is typically treated to provide the uniform high standard needed for drinking.

Advances in water treatment have reduced the costs of decentralized private provision from recycling. Innovations include better distillation, deionization, electrodialysis, reverse osmosis, chelation (inorganic ion modification), anaerobic digestion (using bacteria that obtain oxygen from the materials), aerobic digestion (using microbes that absorb oxygen), filtration, and disinfection with chemicals or irradiation (Lowi and Crews 2003).

Another aspect of government provision is that utilities often inject additives that some people do not want. Fluoride is a prime example of a controversial additive. Some experts praise fluoride for preventing tooth decay, while others claim that the chemical is unhealthy. People are able to decentralize drinking water themselves by buying bottled water with or without fluoride, but localized provision would offer a greater variety of consumer choice.

Aside from recycling water, contractual communities can provide water to their members using wells or infrastructure similar to that used in government provision of water.

**Contractual Communities: Solving Many Problems, Voluntarily**

The greatest flaw of the prevailing market failure doctrine, especially regarding public goods and external effects, is that of not recognizing that private enterprise includes governance. The prime distinction for policy is not so much the market versus government, but rather consensual governance versus imposed government. Every firm provides management, not only of employees and production but also of the firm's assets, including its real estate. Firms such as hotels, shopping malls, and office buildings provide collective services such as security and fire protection, lighting, bathrooms, accessibility such as and elevators and escalators, and public transit such as shuttle buses.

Private residency provides an even greater scope for governance and collective goods. Apartment buildings have a private law in the form of a lease contract, and condominiums, cooperatives, and residential associations have a governance structure similar to that of a town, with an elected board of directors. Private communities may prevent many externalities with master deeds, bylaws, and covenants. They are able to place a lien on owners who violate the rules. The owners and tenants make clear their voluntary consent by signing written contracts. The market failure doctrine implicitly presumes that entrepreneurs are unable to contract with many individuals to, say, build a dam. But in a world of contractual communities, the entrepreneur need only contract with the already established private-sector community directors as defined by the private governing structures.

The two basic structures of private governance are proprietary communities and civic associations (Foldvary 1994). Spencer MacCallum at first called communities with a single owner "proprietary communities" (1970), but he later (2003) called them entrepreneurial communities or entrecomms. Industrial entrepreneurial communities are called estates in the

United Kingdom and multiple tenant income properties (MTIPs) in the United States. MTIPs are relative newcomers in real estate ownership, and as their scope grew after World War II, so did the extent of private governance and its provision of collective services. For example, there have long been inns and hotels, but the massive resort hotels such as those in Las Vegas offer much more than transient residency; they also provide entertainment, conference facilities, and professional services.

Spencer points out that an advantage of MTIPs is that the land is under a single title. When the owner is a corporation, it still acts as a single decision maker, in contrast to homeowner or other civic associations with multiple co-owners. Having title under a single owner provides the advantage of being able to redevelop the site as the local economy evolves.

In an entrepreneurial community, the title holder has the responsibility for the well-being of a community. A question posed by MacCallum (2003, 229) is, who in a government public works system "is liable for injuries caused by water contamination?" In government, nobody is usually held accountable, and the cost of cleanup is shifted to the taxpayers. In a proprietary community, the owner can be sued and bears the cost.

The entrepreneurial land title holder can create added value by customizing the environment for particular uses. The developer of a shopping center plans the locations and sizes and complementary types of stores, as well as the parking and landscaping, to maximize the property's total net rental income.

Advancing technology has enhanced competition among private communities. Hotel guests can compare features and prices on websites. Potential tenants, owners, and members of contractual communities are now able to obtain real estate information from websites, both those provided by the firms and communities and those that offer reviews.

The Internet has greatly facilitated the *sharing economy*, a peer-to-peer network of surplus resources that are either freely shared or rented out. For example, a household with a guest bedroom offers it to travelers at rates cheaper than hotel rooms through services such as airbnb (www.airbnb.com). Shared software is made available for free or for a voluntary payment. Households that grow fruits and vegetables share their surplus with neighbors or a cooperative. In house-sharing organizations such as a hospitality exchange and Servas (www.servas.org), members offer to let traveling members stay at their homes for no charge as a type of mutual aid. Car sharing includes carpooling for riders, time sharing of cars, and multiple ownership. This sharing, enhanced by websites and e-mail, has made economies more efficient by using resources that would otherwise be idle. But this greater productivity and lower cost also reduces the demand for the replaced services, such as taxis and hotels. Taxi companies, for example, have sought to restrict their technology-enabled new competitors such as Uber (Cohen 2013).

Improvements in telecommunications have, in many cases, made working remotely at a full-time job a possibility, allowing greater flexibility in choosing a place to live. MTIPs often offer shuttle service from their site to local office buildings according to the needs of their residents, which is a service that is more convenient than less focused public bus services.

Many people also want to have control over their neighborhood and so favor co-ownership in condominiums and homeowners associations (HOAs). These groups exist between communities with single title holders and those composed of clusters of fully independent property owners. HOAs generally have contractual rules regarding property maintenance and behaviors as well as provide and maintain roads and amenities within their territory. One of the often overlooked virtues of HOAs is their method of financing collective endeavors, either

through flat membership dues or property-based assessments, which may be a superior method to taxing of goods and services.

In practice, governments at all levels have had political reasons to levy taxes that burden the economy, as the political pressure to limit taxes is greatest on property taxes. But proprietary communities (with an owner and tenants) and HOAs have the opposite pressure. Because they cannot levy taxes on income and goods, they obtain revenues from dues or assessments on the co-owners. If private enterprise were ubiquitous, most likely the great majority of people would belong to civic associations or proprietary communities, and then the entrepreneur seeking to build a highway would contract with the affected communities to contribute to the financing. The property owners benefiting from the road, as well as their tenants who benefit from the road, would pay back some of the value received. If the assessments by private communities, plus highway tolls, are less than the cost of the road, this implies that the entrepreneur would not build the road, as the cost exceeds the benefit.

These voluntary private communities offer many examples of how society can move forward, solving collective action problems in ways that do not require state coercion. Furthermore, the polycentric nature of such organizations means that the solutions are sought after in numerous different ways, allowing a fuller use of human creativity in finding what works, while limiting the damage of mistakes.

**Conclusion**

Grasping the multitude of changes happening in the world is a challenge. It would take all of a person's time to track the changes in just a few industries in a few countries, much less all of them. When making policy decisions, the public as well as government officials are often

tempted to act as though the economy is a stable, unchanging system, one that can be tweaked and calibrated to achieve a desired end. Some commentators and officials justify permanent interventions that are based on rationales that work only under particular conditions, forgetting that conditions constantly change. New technological solutions develop almost as quickly as the problems they solve, as entrepreneurs see profit opportunities in bringing new technology to the market. Old problems such as overfishing can now be corrected by new technology applied in a variety of innovative ways. Although this article provides just a few examples of this phenomenon, the variety of new private solutions grows as fast as the advance of technology.

Of equal importance is the observation that most of the innovations exist to solve problems ostensibly already corrected by government intervention. At the same time, the unseen must be considered—the innovations through technological improvements that do not exist, either because they are deemed illegal or because the cost of developing them is too expensive given government requirements. As in the case of electricity and water provision, we must consider not only the new ways things could be done, but also what government interventions and regulations are doing to prevent these innovative improvements from being adopted.

Both the theory of the economic effects of advancing technology and the abundant examples demonstrate the proposition that technological progress continuously reduces the rationale for government interventions as problems get solved. Theory and evidence also show how government often fails because it lacks the knowledge as well as the incentives to handle the complexity of economies that are best handled by decentralized and unhampered entrepreneurship.

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