

CHAPTER 2:

A Taxonomy of Regulatory Forms

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Regulations involve the use of complex policy instruments with the potential to generate substantial benefits and costs for the public. However, as discussed in Chapter 1, satisfactory understanding of the effects of regulation remains scarce. Different types of regulation—such as price controls, disclosure requirements, or performance standards—work differently and can be expected to have different effects on benefits, costs, and other economic factors. An accurate understanding of the effects of regulation, therefore, requires an understanding of how different forms of regulation achieve intended and unintended outcomes. To further this understanding, we propose a framework to classify regulations in a systematic and comprehensive manner by the form they take. Regulatory form in this paper refers to the particular regulatory policy instruments employed to achieve a desired end.

We combine economic rationales for regulation with regulatory designs to develop a three-tiered taxonomy to facilitate classification of regulatory forms. The first tier contains four broad categories of regulations. Each category of regulation is designed to include a set of second-tier policy instruments that government agencies employ to achieve intended outcomes. The third tier allows for identification of greater nuance between policy instruments within the same category. For instance, command-and-control regulations might specify in detail the particular procedures that regulated entities must follow to comply, while others might only specify a required outcome to be achieved—leaving regulated entities with greater flexibility.

This taxonomy is the first comprehensive typology of regulation by form that can be applied to regulations across policy areas. We expect the taxonomy to be useful for practitioners as well as researchers to better understand the relationship between regulatory activity and public outcomes. Chapters 3 and 4 of this report employ the taxonomy empirically to estimate the effects of regulation on input productivity of land in agriculture.

In keeping with the taxonomy's broad applicability across policy areas, this chapter includes discussion of several forms not found in our agricultural dataset—detailed in Chapter 3—or not used to regulate

agriculture (e.g., certificate-of-need regulations). However, this chapter provides examples of each form as it relates to agriculture whenever possible. We define regulations to include “all administrative laws or rules...by which the federal government implements laws and agency objectives.”¹

I. Overview of the Taxonomy

The taxonomy contains three tiers of regulatory forms. The first tier corresponds to four categories of regulations: 1) economic, 2) social, 3) transfer, and 4) administrative. Economic regulations affect firm behavior with the primary goal of addressing market power by directly constraining who can participate in a market, and prices they can charge. Social regulations, on the other hand, mainly address externalities and information asymmetries related to issues of health, safety, security, and the environment.² In contrast, transfer and administrative regulations differ from economic and social regulation in their intended goals and intended outcomes. Transfer regulations specify monetary support or technical services provided by the government to address a specified public need while administrative regulations are procedural regulations with which only government agencies are obligated to comply.

The second tier focuses on a set of regulatory forms nested within each first-tier category based on a wide scope of regulatory designs. For example, economic regulations themselves may take various forms including those that regulate price, quantity, entry & exit, and service quality.³ Social regulations include command-and-control, market-based, and information-based regulations. The third tier contains more narrowly-specified regulatory forms nested within each second-tier form. For instance, command-and-control regulations include performance standards, means-based standards, monitoring, reporting and verification requirements, permitting, pre-market notice, pre-market approval, and prohibitions. Altogether, there are 36, third-tier forms of regulation in the taxonomy.

Our logic for designing the taxonomy with three tiers is that this approach provides flexibility for different purposes. For example, scholars interested in comparisons of specific regulatory forms, such as means-based versus performance standards, can use third-tier forms to classify regulation, whereas those interested in higher-level comparisons can easily aggregate third-tier forms into second or first tier (i.e., to study differences between command-and-control and market-based instruments or between economic and social regulation—more broadly). The Appendix to this chapter presents the complete taxonomy, including each form’s definition and select examples. The following sections discuss each form in greater detail.

¹ Susan E. Dudley and Jerry Brito, *Regulation: A Primer* (George Washington University Regulatory Studies Center and Mercatus Center at George Mason University, 2012), 1.

https://regulatorystudies.columbian.gwu.edu/sites/g/files/zaxdzs1866/f/downloads/RegulatoryPrimer_DudleyBrito.pdf.

² Susan Dudley and Melinda Warren, “Regulators’ Budget: More for Homeland Security, Less for Environmental Regulation,” The George Washington University Regulatory Studies Center, May 2018, <https://regulatorystudies.columbian.gwu.edu/fy-2019-regulators-budget-more-homeland-security-less-environmental-regulation>.

³ Dudley and Brito 2012.

II. Economic Regulation

Economic regulation includes regulatory forms that generally limit who can enter a business and what prices they may charge.⁴ Regulators set prices, establish mandates regarding the quantity of goods and services, control market entry and exit, and set parameters related to service quality. The primary efficiency justification for economic regulation is market power,⁵ particularly in cases where markets can be served at lowest cost by a single firm—a “natural monopoly”—and so competition cannot be relied upon to regulate rates and terms of service.⁶ Another common public policy justification for economic regulation separate from the efficiency justification is that fairness requires that all customers should have access to at least a minimum level of service at “reasonable” rates and terms of service.⁷ Finally, economic regulation (particularly the use of antitrust) can preserve or increase competition in certain contexts.⁸

The earliest example in the U.S. of a federal entity established to use economic regulation is the Interstate Commerce Commission—created by Congress in 1887 to regulate railroad rates in an attempt to lower prices.⁹ Interestingly, evidence suggests that economic regulation of the railroad industry had the unintended effect of inflating prices as a result of reduced competition—which benefited regulated entities “at the expense of consumers.”¹⁰ As the railroad example demonstrates, economic regulation can serve as government protection for cartels in markets where competition is possible.¹¹ Experts in both government and academia shifted over time towards preferring alternative policy tools, such as opening markets to competition where competition is possible, confining monopoly regulation to segments of the industry still believed to be natural monopolies, and regulating monopolies’ prices instead of their profits to provide superior incentives for innovation.¹² Figure 1 presents an overview of our typology of second- and third-tier forms of economic regulation.

⁴ Robert Litan, “Regulation,” Econlib, accessed May 06, 2019, <https://www.econlib.org/library/Enc/Regulation.html>.

⁵ U.S. Office of Management and Budget (OMB), “Regulatory Analysis,” September 17, 2003, 4-5, accessed November 12, 2018, https://obamawhitehouse.archives.gov/omb/circulars_a004_a-4/.

⁶ William J. Baumol, John C. Panzar, and Robert D. Willig, *Contestable Markets and the Theory of Industry Structure* (San Diego: Harcourt Brace Jovanovich, 1988), 17.

⁷ Brian F. Mannix, “Regulatory Subsidies: A Primer,” The George Washington University Regulatory Studies Center, Working Paper March 2012, 6, <https://regulatorystudies.columbian.gwu.edu/regulatory-subsidies-primer>.

⁸ Niamh Dunne, “Between Competition Law and Regulation: Hybridized Approaches to Market Control,” *Journal of Antitrust Enforcement* 2, no. 2 (2014): 225-269.

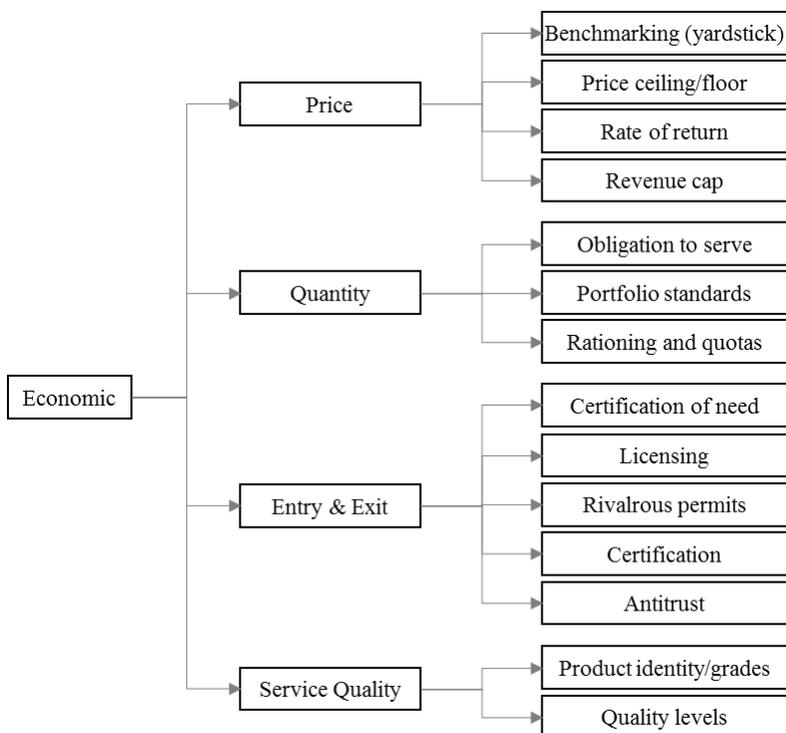
⁹ Susan E. Dudley, “Improving Regulatory Accountability: Lessons from the Past and Prospects for the Future,” *Case Western Reserve Law Review* 65, no. 4 (2015): 1027-1057.

¹⁰ *Ibid.*, 1033.

¹¹ United States, Transportation Research Board, *Modernizing Freight Rail Regulation* (Washington, DC: National Academy of Sciences, 2015), 16. Describing how provisions of the Interstate Commerce Act were intended to stabilize railroad cartel pricing agreements that frequently broke down prior to federal regulation.

¹² Robert W. Crandall and Jerome Ellig, *Economic Deregulation and Customer Choice: Lessons for the Electric Industry* (Fairfax, VA.: George Mason University, Center for Market Processes, 1997); Dudley 2015; Clifford Winston,

Figure 1: Forms of Economic Regulation



A. Price

Price regulations include instruments that set maximum or minimum prices. These take four third-tier forms: 1) benchmarking, 2) price ceiling/floor, 3) rate of return, and 4) revenue cap. Benchmarking limits prices by reference to a specific standard—such as the prevailing wage rate or prices within an area. Examples include the prevailing wage provisions for agricultural employers under the Fair Labor Standards Act and the Centers for Medicare & Medicaid Services regional rates and benchmarks for pharmaceuticals and medical services. Price ceilings and floors are a form of regulation that sets the lowest or highest price that can be charged for a product.¹³ A commonly-observed example of this form would be rent control regulation specifying the maximum price a landlord may charge for a housing unit.¹⁴ In the agriculture sector, Federal Milk Marketing Orders (FMMOs), authorized by the Agricultural Marketing Agreement Act, “assure dairy farmers a reasonable minimum price for their milk throughout the year.”¹⁵

Government Failure versus Market Failure: Microeconomics Policy Research and Government Performance (Washington, D.C: Brookings Institution Press, 2006).

¹³ Michael M. Murphy, “Price Controls and the Behavior of the Firm,” *International Economic Review* 21, no. 2 (1980): 285-291.

¹⁴ Richard Arnott, “Rent Control,” *The New Palgrave Dictionary of Economics and the Law*, 2002.

¹⁵ Agricultural Marketing Service, U.S. Department of Agriculture (AMS), “Federal Milk Marketing Orders,” accessed November 8, 2018, <https://www.ams.usda.gov/rules-regulations/moa/dairy>.

The final two forms of price regulation often apply to monopolies.¹⁶ The first is rate-of-return regulation—a form in which regulators set prices designed to give the regulated firm the opportunity to earn a “reasonable” rate of return on its capital. A common example of rate-of-return regulations occurs in the setting of electricity rates by state public service commissions.¹⁷ Rate-of-return regulation often inhibits efficiency and innovation for several reasons. First, if the regulated firm’s authorized rate of return exceeds its cost of capital, it has an incentive to use too much capital because more investment means more profit. Second, the firm has little incentive to cut costs or innovate because it will be penalized for this performance with lower rates at the next rate case.

The second form, revenue cap regulation, sets a limit on the total revenue an entity can receive from its customer base—that is, the entity’s revenue is capped regardless of changes in customer demand (i.e., in the case of utilities, increased customer use of electricity would not result in greater total revenue). Studies suggest that this approach reduces the incentives for firms to increase energy use—which may run counter to a regulator’s desired outcome (i.e., achieving reductions in aggregate consumption)—relative to rate-of-return regulation.¹⁸

B. Quantity

In place of setting prices, regulators can also attempt to control the quantity of goods and services provided.¹⁹ Quantity regulation take the following forms: 1) obligation to serve, 2) portfolio standards, and 3) rationing and quotas. The obligation to serve is a form of regulation requiring firms to make their products and/or services available to the general public—usually at predetermined rates. For example, railroads, telephone companies, and some trucking companies have historically been obliged to offer their services to the public, and in some cases they could not even discontinue service to particular locations without regulatory approval.²⁰

Portfolio standards specify a ratio of particular inputs or outputs that regulated entities must achieve. For example, regulators could mandate that a certain percentage of energy be produced from qualifying renewable energy sources (often requiring an increasing percentage over time).²¹ This form of regulation

¹⁶ Our sample of regulations affecting agriculture in the U.S. (detailed in Chapter 3) did not include any of these forms of regulation.

¹⁷ Steve Kihm, Janice Beecher, and Ronald L. Lehr, Regulatory Incentives and Disincentives for Utility Investments in Grid Modernization, report no. 8, Lawrence Berkeley National Laboratory, May 2017, <http://ipu.msu.edu/wp-content/uploads/2017/09/LBL-FEUR-Regulation-and-Incentives-2017.pdf>.

¹⁸ Ian Alexander and Chris Shugart, “Risk, Volatility and Smoothing: Regulatory Options for Controlling Prices.” World Bank and European Bank for Reconstruction and Development (1999), 11. For additional information on FERC’s energy offer cap regulation, see: <https://www.ferc.gov/industries/electric/indus-act/rto/energy-price-formation.asp>.

¹⁹ Edward L. Glaeser and Andrei Shleifer, “A Reason for Quantity Regulation,” *American Economic Review* 91, no. 2 (2001): 431-435; Mannix 2012; Dudley and Brito 2012.

²⁰ John Bauer, “The Concepts of Capital and Income in the Regulation of Utilities,” *The Accounting Review* 12, no. 1 (1937): 22-29; Transportation Research Board 2015, 23.

²¹ Fredric C. Menz, “Green Electricity Policies in the United States: Case Study,” *Energy Policy* 33, no. 18 (2005): 2398-2410.

is often applied to electricity generation but can also affect other producers. For example, the Environmental Protection Agency (EPA) implements the Renewable Fuel Standard (RFS) program, which mandates refiners or importers of gasoline and diesel fuel to use an increasing volume of renewable fuel to displace petroleum-based fuel.²² Portfolio standards can also target outputs—such as setting a goal for the number of mortgages generated for consumers purchasing units deemed “affordable housing.”²³

Rationing and quotas are regulatory forms that limit the number or monetary value of goods or services purchased or produced. They are often imposed to limit the quantity of international imports or exports of specific goods throughout a specified timeframe. For instance, an import quota can restrict foreign competition in an effort to boost domestic production.²⁴ In other circumstances, the government might establish quotas to limit the production of certain goods to reduce negative externalities.²⁵ The National Oceanic and Atmospheric Administration issues hundreds of rules each year to set annual catch limits for different fish species to prevent overfishing.²⁶

C. Entry & Exit

In addition to controlling prices or quantities to manage market power, governments also use economic regulation to control entry & exit of participants in a market.²⁷ These regulatory forms include: 1) certificate of need, 2) licensing, 3) rivalrous/exclusive permits, 4) certification, and 5) antitrust. The first four forms create entry barriers, ostensibly to protect health, safety, or common environmental resources, but which help market incumbents enforce and maintain market power.²⁸ Antitrust policy, on the other hand, aims to restrain the creation of market power that might hamper fair competition in a market.

Certificate-of-need regulation requires entities to obtain approval from the government prior to the acquisition, expansion, or creation of facilities or equipment.²⁹ The government determines whether the action in question fulfills a “need” for a specified community.³⁰ Certificate-of-need regulation is

²² U.S. Environmental Protection Agency (EPA), “Overview for Renewable Fuel Standard,” June 07, 2017, accessed November 15, 2018, <https://www.epa.gov/renewable-fuel-standard-program/overview-renewable-fuel-standard>.

²³ Federal Housing Finance Agency, “2018-2020 Enterprise Housing Goals,” accessed November 16, 2018, <https://www.fhfa.gov/SupervisionRegulation/Rules/Pages/2018-2020-Enterprise-Housing-Goals.aspx>.

²⁴ Don Clark, “Nontariff Measures and U.S. Imports From Western Hemisphere Developing Countries,” *Social and Economic Studies* 48, no. 3 (1999): 137-152.

²⁵ Austan Goolsbee, Steven D. Levitt, and Chad Syverson, *Microeconomics* (New York, NY: Worth Publishers Macmillan Learning, 2016).

²⁶ Federal Register, “Fisheries of the Northeastern United States; Golden Tilefish Fishery; 2019 Specifications,” *Federal Register* October 26, 2018, accessed November 10, 2018, <https://www.federalregister.gov/d/2018-23431>.

²⁷ Simeon Djankov et al., “The Regulation of Entry,” *The Quarterly Journal of Economics* 117, no. 1 (2002): 1-37.

²⁸ Goolsbee et al. 2016.

²⁹ Our sample of regulations affecting agriculture in the U.S. (detailed in Chapter 3) did not include any of these forms of regulation.

³⁰ Jon M. Ford and David L. Kaserman, “Certificate-of-Need Regulation and Entry: Evidence from the Dialysis Industry,” *Southern Economic Journal* 59, no. 4 (1993): 783-791.

commonly employed at the state level to regulate healthcare facilities. New York enacted the first certificate-of-need program in 1964, and other states followed.³¹ By the 1980s, all states except Louisiana had implemented some form of certificate of need regulations, requiring government approval before a facility could expand, offer additional services, or purchase certain equipment.³² Proponents originally advanced the use of certificate-of-need regulation as a way to reduce costs and increase quality—stating that underutilized facilities would result in increased medical costs borne by patients.³³ Nonetheless, a growing body of evidence suggests that this form of regulation is not effective in achieving its desired outcomes and may even result in higher costs and limit access to care—even for those living in rural areas.³⁴ Notably, this form of regulation was not observed in the sample of agricultural regulations examined in this study.

Licensing regulations require government approval to practice a profession or operate a business. A license is typically granted to individuals or facilities. For example, states may require occupational licenses for individuals to legally operate a particular business (i.e., to practice medicine), but regulators can also specify particular services that can be provided within a profession. The Department of Health and Human Services (HHS) regulates the kinds of services that different medical professionals can provide; EPA licensing requirements regulate “any person who applies or supervises the use of restricted use pesticides;”³⁵ and USDA regulates the types of establishments allowed to produce biological products intended for the treatment of animals under the Virus-Serum-Toxin Act by granting licenses to qualified establishments.³⁶

Rivalrous/exclusive permits are similar to licensing with one important exception: the allocation of a permit to one party precludes another party from obtaining the same permit.³⁷ Examples of this form include FCC licenses for broadcast spectrum use or Federal Aviation Administration (FAA) regulation of runway slots for airplanes.³⁸

³¹ Matthew D. Mitchell, “Certificate-of-Need Laws: Are They Achieving Their Goals?” George Mason University, Mercatus Center, working paper April 2017, <https://www.mercatus.org/system/files/mercatus-mitchell-con-qa-mop-v1.pdf>.

³² Matthew D. Mitchell and Christopher Koopman, “40 Years of Certificate-of-Need Laws Across America,” Mercatus Center, April 19, 2018, <https://www.mercatus.org/publication/40-years-certificate-need-laws-across-america>.

³³ Daniel Sherman, *The Effect of State Certificate-of-need Laws on Hospital Costs: An Economic Policy Analysis* (Washington, D.C.: Bureau of Economics, Federal Trade Commission, 1988), <https://www.ftc.gov/reports/effect-state-certificate-need-laws-hospital-costs-economic-policy-analysis>.

³⁴ Mitchell 2017.

³⁵ EPA, “How to Get Certified as a Pesticide Applicator,” November 15, 2018, accessed May 06, 2019, <https://www.epa.gov/pesticide-worker-safety/how-get-certified-pesticide-applicator>.

³⁶ Animal and Plant Health Inspection Service, U.S. Department of Agriculture (APHIS), “Veterinary Biologics,” accessed November 10, 2018, <https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/veterinary-biologics>.

³⁷ Djankov et al. 2002.

³⁸ FAA, “Slot Administration,” last modified October 16, 2018, https://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/systemops/slot_administration/.

Certification is a form of regulation that requires products or services to be routinely certified—usually via on-site inspection by regulators or approved third parties—prior to entering the market.³⁹ For instance, USDA’s Food Safety and Inspection Service inspects all poultry and raw meat (including imported products) sold in interstate commerce⁴⁰ while USDA’s Animal and Plant Health Inspection Service (APHIS) certifies that plants have been treated for quarantine pests prior to interstate movement.⁴¹

Finally, antitrust regulations seek to promote competition in markets—oftentimes by restricting collusion, the creation of cartels, or mergers that would create substantial market power.⁴² In the U.S., the Federal Trade Commission (FTC) and Department of Justice (DOJ) Antitrust Division are the federal antitrust regulatory agencies; examples of this form include regulations under the Hart-Scott-Rodino Antitrust Improvements Act, which require companies to submit a detailed filing with FTC and DOJ before being allowed to proceed with large mergers and acquisitions.^{43, 44} Examples of antitrust relevant to agriculture include many of USDA’s regulations implementing industry-specific rules intended to promote competition and fair trade practices in the livestock, meat, and poultry markets under the Packers and Stockyards Act.⁴⁵ For example, USDA’s Grain Inspection, Packers and Stockyards Administration (GIPSA) regulates trade practices to ensure that they do not restrict or limit competition between packers and dealers.⁴⁶

D. Service Quality

The final category of economic regulation includes regulatory forms that affect service quality: 1) product identity or grades, and 2) quality levels. These regulations attempt to ensure the quality of the goods and services provided. Product identity or grades are regulatory forms that categorize products into official grades or classes recognized by regulators based on measurable attributes. For example, USDA establishes grade standards for fruits, which are used to determine how they can be labeled and

³⁹ Peter Drahos, *Regulatory Theory: Foundations and Applications* (Canberra: ANU Press, 2017), 734.

⁴⁰ Food Safety and Inspection Service, U.S. Department of Agriculture (FSIS), “Inspection & Grading of Meat and Poultry: What Are the Differences?,” accessed May 06, 2019, https://www.fsis.usda.gov/wps/portal/food-safety-education/get-answers/food-safety-fact-sheets/production-and-inspection/inspection-and-grading-of-meat-and-poultry-what-are-the-differences_/inspection-and-grading-differences.

⁴¹ Animal and Plant Health Inspection Service, U.S. Department of Agriculture (APHIS), “FRSMP Frequently Asked Questions for Importers,” accessed May 06, 2019, https://www.aphis.usda.gov/aphis/ourfocus/planthealth/plant-pest-and-disease-programs/frsmp/ct_importers_faqs.

⁴² W. Kip Viscusi, Joseph E. Harrington Jr., and John M. Vernon, *Economics of Regulation and Antitrust* 4th. Ed. (Cambridge, MA; MIT Press, 2018), 69-75.

⁴³ Public law 94-435.

⁴⁴ Federal Trade Commission, “Premerger Notification Program,” last modified April 04, 2019, <https://www.ftc.gov/enforcement/premerger-notification-program>.

⁴⁵ National Agricultural Law Center, “Packers and Stockyards Overview,” accessed April 15, 2019, <https://nationalaglawcenter.org/overview/packers-and-stockyards/>.

⁴⁶ AMS, “Packers & Stockyards Division,” accessed April 15, 2019, <https://www.gipsa.usda.gov/psp/psp.aspx>.

their eligibility to be sold in markets.⁴⁷ An alternative to regulating the measureable attributes of a particular good, is regulating quality levels—which specify a level or standard of service defined by regulators.⁴⁸ One example is FCC regulation of local exchange telephone company service quality which outlines company performance with respect to responsiveness to network failures and other customer complaints.⁴⁹

III. Social Regulation

Social regulation includes policy instruments that aim to address public health, safety, and environmental concerns by intervening in markets more indirectly than economic regulation. These forms tend to address market failures such as information asymmetries and externalities by clarifying property rights, reducing risks, and disclosing information. Command-and-control regulations, market-based regulations, and information-based regulations are the most common forms of social regulation. Command-and-control regulations and market-based regulations tend to address externalities, whereas information-based regulations aim to reduce information asymmetries. The key distinction between command-and-control and market-based regulations is the degree of government intervention and the degree to which incentives are relied on to drive outcomes. Figure 2 presents an overview of our classification of second- and third-tier forms of social regulation.

A. Command-and-Control

Command-and-control regulations include forms that set standards or limits on what is allowable (or not allowable) with varying levels of specificity regarding how a regulated entity can comply with the requirement.⁵⁰ These forms include: 1) monitoring, reporting, and verification requirements, 2) means-based standards, 3) performance standards, 4) permitting, 5) pre-market notice, 6) pre-market/pre-manufacture approval, and 7) prohibitions.

Monitoring, reporting, and verification require regulated entities to periodically maintain and/or share data with regulators. Monitoring includes either direct measures (e.g., tons of methane emitted) or proxy measures (e.g., number of cattle processed) for an outcome of interest to a regulator. Reporting is the administrative process wherein a regulated entity aggregates the data, informs the regulator how it derived the data, and oftentimes forwards the data to the regulator (i.e., the regulated entity incurs some cost in the form of paperwork and/or reporting requirements); this process normally involves a

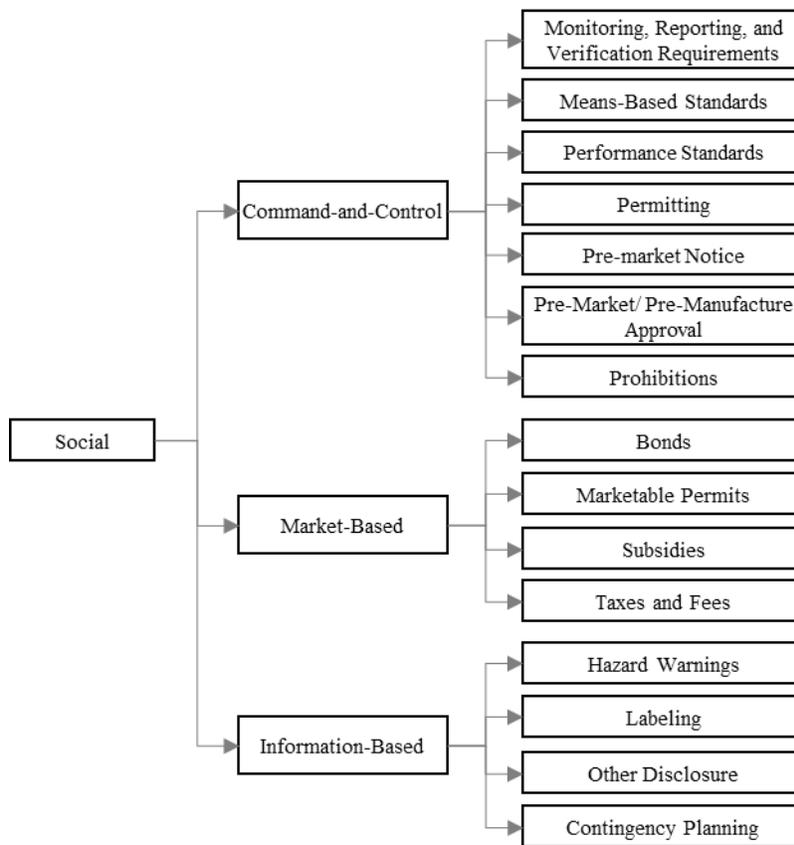
⁴⁷ Food and Nutrition Service, U.S. Department of Agriculture (FNS), “Specifications & U.S. Grade Standards,” accessed April 15, 2019, <https://www.fns.usda.gov/fdd/specifications-us-grade-standards>.

⁴⁸ Our sample of regulations affecting agriculture in the U.S. (detailed in Chapter 3) did not include any of these forms of regulation.

⁴⁹ Marcelo Resende and Luís Otávio Façanha, “Price-cap Regulation and Service-quality in Telecommunications: An Empirical Study,” *Information Economics and Policy* 17, no. 1 (2005): 1-12.

⁵⁰ Christopher Carrigan and Elise Harrington, “Choices in Regulatory Program Design and Enforcement,” Penn Program on Regulation, June 2015, <https://www.law.upenn.edu/live/files/4706-carriganharrington-ppr-researchpaper062015pdf>.

Figure 2: Forms of Social Regulations



standardized procedure specified by regulation. Finally, verification involves detecting errors in reporting and is oftentimes performed by a third party.⁵¹ For example, EPA’s National Pollutant Discharge Elimination System (NPDES) requires regulated entities to electronically report data relevant to EPA’s implementation of the Clean Water Act (CWA);⁵² the Food and Drug Administration (FDA) requires regulated entities that manufacture or process human food for consumption to conduct monitoring, reporting, and verification of various practices under its Preventive Controls for Human Food regulations (e.g., food allergen controls, sanitation controls).⁵³

Means-based standards specify technologies to be used, or that prescribe detailed procedures, methods, and practices to be employed by regulated entities.⁵⁴ For example, the Food and Drug Administration’s (FDA) current good manufacturing practice regulations for animal food specify measures and test

⁵¹ Valentin Bellassen et al., “Monitoring, reporting and verifying emissions in the climate economy.” *Nature Climate Change* 5, no. 4 (2015): 319-328.

⁵² EPA, “NPDES EReporting,” last modified January 10, 2018, <https://www.epa.gov/compliance/npdes-ereporting>.

⁵³ U.S. Food & Drug Administration (FDA), “Key Facts about Preventive Controls for Human Food,” accessed May 6, 2019, <https://www.fda.gov/files/food/published/Key-Facts-about-Preventive-Controls-for-Human-Food.pdf>.

⁵⁴ Cary Coglianese, “The Limits of Performance-Based Regulation” *University of Michigan Journal of Law Reform* 50, no. 3 (2017): 525-563.

methods to limit contamination.⁵⁵ Means-based standards also often include regulatory requirements specifying the design features of a particular object.⁵⁶

Performance standards specify a desired outcome (e.g., emissions level) but grant a measure of flexibility to the regulated entity regarding how to achieve the outcome. This approach is less prescriptive than means-based standards.⁵⁷ For example, under the Clean Air Act (CAA), EPA sets pollutant emissions or concentration levels without mandating the use of a particular technology. Of course, regulators can specify performance standards with differing levels of stringency; for instance, performance standards that can only realistically be achieved by using a particular technology might act as a *de facto* means-based standard since the regulated entity is not actually given increased flexibility in achieving the outcome.⁵⁸

Permitting is a regulatory form wherein a regulator grants permission to do something that would otherwise be prohibited.⁵⁹ It is usually used to address externalities. For example, under the National Pollutant Discharge Elimination System (NPDES), EPA issues permits to approve exceptions to prohibitions against discharging “pollutants” through a “point source” into a “water of the United States” under the Clean Water Act.⁶⁰

Pre-market notice and pre-market/pre-manufacture approval regulations impose conditions that business entities must meet prior to introducing their products to market. Pre-market notice requires regulated entities to notify regulators prior to introducing products into the market but does not require the regulator’s approval. In contrast, pre-market/pre-manufacture approval regulations are generally considered more stringent since they require regulatory approval—more closely approximating a precautionary approach— prior to introducing products into the market.⁶¹ For example, section 5 of the Toxic Substances Control Act (TSCA) requires regulated entities to provide EPA with a pre-manufacture notice at least 90 days prior to the manufacture of certain chemicals (pre-market notice), whereas FDA requires certain medical devices to undergo evaluation of product safety and effectiveness before

⁵⁵ Code of Federal Regulations, Title 21, Part 507, “Current Good Manufacturing Practice, Hazard Analysis, and Risk-Based Preventive Controls for Food for Animals.”

⁵⁶ Carrigan and Harrington 2015.

⁵⁷ Cary Coglianese, Jennifer Nash, and Todd Olmstead, “Performance-Based Regulation: Prospects and Limitations in Health, Safety, and Environmental Protection,” *Administrative Law Review* 55, no. 4 (2003): 705-729.

⁵⁸ *Ibid.*

⁵⁹ Eric Biber and J.B. Ruhl, “The Permit Power Revisited: The Theory and Practice of Regulatory Permits in the Administrative State,” *Duke Law Journal* 133 (2014): 13-121; Biber and Ruhl “Designing Regulatory Permits” ACUS Final Report, 2015, <https://www.acus.gov/report/licensing-and-permitting-final-report>.

⁶⁰ EPA, “NPDES Permit Basics,” last modified July 25, 2018, <https://www.epa.gov/npdes/npdes-permit-basics>.

⁶¹ Ed Soule, “The Precautionary Principle and the Regulation of U.S. Food and Drug Safety,” *The Journal of Medicine and Philosophy* 9, no. 3 (2004): 333-350.

allowing them to be sold in the market and APHIS requires commercial entities to receive approval prior to introducing genetically engineered products into the environment (pre-market approval).⁶²

Another form of command-and-control regulation is a prohibition. This form bans the use of a product or act without exception (i.e., the regulator will not issue a permit under any circumstance). For example, dichlorodiphenyltrichloroethane (DDT) was a commonly used pesticide until EPA prohibited its use in 1972—thus requiring businesses to find other pesticides or pest-control methods.⁶³ Another example are the regulations implementing the Horse Protection Act which prohibit the use of chains, boots, or action devices on horses at horse shows, exhibitions, or auctions.⁶⁴

B. Market-based

In contrast to command-and-control regulations, market-based regulations rely on market signals instead of specified commands to achieve regulatory goals.⁶⁵ A normative goal of market-based regulation is to leverage market forces (e.g., price signals) to increase the efficiency of policy interventions intended to ameliorate market failures.⁶⁶ These regulations usually provide material incentives to encourage or discourage certain behaviors of regulated entities; this approach is also referred to as incentive-based regulation. Market-based regulations include: 1) bonds, 2) marketable permits, 3) subsidies, and 4) taxes and fees.

Bonds require companies to set aside an amount deemed by regulators to be commensurate with the risk introduced by a firm's economic activity.⁶⁷ This form of regulation is meant to internalize the social costs of potential externalities into a firm's resource allocation decisions.⁶⁸ For example, the Farm Service Agency requires grain and rice warehouse operators to post bonds as a financial assurance to the agency as a condition of receiving a license or authorization under United States Warehouse Act.⁶⁹

⁶² EPA, "Filing a Pre-manufacture Notice with EPA," last modified October 24, 2018, <https://www.epa.gov/reviewing-new-chemicals-under-toxic-substances-control-act-tsca/filing-pre-manufacture-notice-epa>; Center for Devices and Radiological Health, "Premarket Approval (PMA)," accessed April 15, 2019, <https://www.fda.gov/medicaldevices/deviceregulationandguidance/howtomarketyourdevice/premarketsubmissions/premarketapprovalpma/>; Tadlock Cowan and Kristina Alexander, *Deregulating Genetically Engineered Alfalfa and Sugar Beets: Legal and Administrative Responses* (Washington, DC: Library of Congress, 2012).

⁶³ National Pesticide Information Center, "DDT: General Fact Sheet," National Pesticide Information Center, 1999, <http://npic.orst.edu/factsheets/ddtgen.pdf>.

⁶⁴ APHIS, "Horse Protection Act," accessed April 15, 2019, <https://www.aphis.usda.gov/aphis/ourfocus/animalwelfare/hpa>.

⁶⁵ Carrigan and Harrington 2015, 8.

⁶⁶ Winston 2006.

⁶⁷ Carrigan and Harrington 2015, 16.

⁶⁸ Jason F. Shogren, Joseph A. Herriges, and Ramu Govindasamy, "Limits to Environmental Bonds," *Ecological Economics* 8, no. 2 (1993): 109-133.

⁶⁹ Farm Service Agency, U.S. Department of Agriculture (FSA), "WA-402: Licensing Agreement for Grain and Rice Warehouse Operators," accessed April 15, 2019, <https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdfiles/Comm-Operations/pdf/WA402.pdf>.

Another example of this regulatory form is the U.S. Department of Energy’s bonding requirements for natural gas producers, which requires producers to “post bonds that can be used to pay for [future] claims made against the company.”⁷⁰

Another market-based instrument—generally used to reduce externalities in an environmental context—is marketable permits. These are permits or allowances (e.g., the amount of greenhouse gas emissions allowed for a year, or the amount of lead per unit of gasoline refined) which regulated entities can trade with other private parties.⁷¹ This approach has been implemented in the U.S. for different purposes, including the early EPA trading programs for air emissions from stationary sources under the CAA in the late 1970s, the lead trading program for gasoline in 1980s, and the acid rain program for sulfur dioxide (SO₂) emissions from the electric industry in the 1990s.⁷²

Subsidies are payments the government makes to individuals, businesses, or other entities to incentivize certain behaviors. For instance, in the agriculture sector, farmers often receive subsidies for engaging in environmentally-sensitive farming protection practices through USDA’s conservation programs.⁷³

Finally, taxes and fees generally refer to environmental—or Pigovian—taxes on market activities that generate negative externalities (e.g., a penalty imposed on polluters in proportion to the amount of pollution they discharge). The taxes and fees are set to internalize the externalities by offsetting the difference between the private and social cost of production.⁷⁴ A carbon tax is one example of this approach.⁷⁵

C. Information-based

Information-based regulation requires regulated entities to disclose information to the public—particularly in cases where one party in a transaction has more information about the product or service in question than the other party.⁷⁶ Oftentimes these regulatory forms are used to increase the provision

⁷⁰ Lucas W. Davis, “Bonding Requirements for U.S. Natural Gas Producers,” *Review of Environmental Economics and Policy* 9, no. 1 (2015): 128-144.

⁷¹ Administrative Conference of the United States (ACUS), “Administrative Conference Recommendation 2017-4: Marketable Permits,” ACUS, December 2017, <https://www.acus.gov/sites/default/files/documents/Recommendation%202017-4%20%28Marketable%20Permits%29.pdf>.

⁷² A. Denny Ellerman and David Harrison, Jr., “Emissions Trading in the U.S.: Experience, Lessons, and Considerations for Greenhouse Gases,” Pew Center on Global Climate Change Report, May 2003, http://web.mit.edu/globalchange/www/PewCtr_MIT_Rpt_Ellerman.pdf.

⁷³ NRCS, “Natural Resources Conservation Service,” accessed April 15, 2019, <https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/>.

⁷⁴ Drahos 2017, 729.

⁷⁵ Gilbert E. Metcalf and David A. Weisbach, “The Design of a Carbon Tax,” *Harvard Environmental Law Review* 33, no. 2 (2009): 499-556.

⁷⁶ Carrigan and Harrington 2015, 22.

of information with the goal of increasing market efficiency.⁷⁷ Such regulations include: 1) hazard warnings, 2) labeling, 3) other disclosure, and 4) contingency planning.

Regulatory agencies can mandate the use of hazard warnings to disclose information about dangers and threats related to a particular substance or process. This form often requires entities to use recognizable symbols (e.g., skull and crossbones) to make consumers or workers more aware of various risks associated with products or work environments.⁷⁸ For instance, the Occupational Health and Safety Administration's (OSHA) Hazard Communication Final Rule establishes regulations requiring chemical manufacturers and importers to provide hazard information to employers and workers,⁷⁹ while EPA's Agricultural Worker Protection Standard requires regulated entities "notify workers about pesticide-treated areas so they can avoid inadvertent exposures."⁸⁰

Labeling is another form of regulation that requires regulated entities to include certain information on products sold to consumers. For example, the Nutrition Labeling and Education Act requires foods to be labeled for certain nutritional content, calories, etc. Another example is USDA's regulation requiring foods to be labeled as to country of origin.⁸¹

Regulations may also include other disclosures; these forms generally require public disclosures of information, but the purpose is not as well-specified as either hazard warnings or labeling. For example, the Toxics Release Inventory—created pursuant to section 313 of the Emergency Planning and Community Right-to-Know Act (EPCRA)—requires facilities to disclose data to the public related to toxic chemical releases and prevention activities at both industrial and federal facilities.⁸²

A final form of information-based regulation is contingency planning. This typically requires regulated entities to identify potential hazards related to their operations, construct plans for risk mitigation, and make the contingency plan available to the public. Also referred to as management-based regulation, contingency planning requires firms to design their own risk-management plans but does not mandate

⁷⁷ Todd J. Zywicki, "Market-Reinforcing versus Market-Replacing Consumer Finance Regulation," in *Reframing Financial Regulation*, edited by Hester Peirse and Benjamin Klutsey (Arlington, VA: Mecatus Center, 2016); George A. Akerlof, "The Market for "Lemons": Qualitative Uncertainty and Market Mechanisms," *The Quarterly Journal of Economics* 84, no. 3 (1970): 488-500; Stephen Breyer, *Regulation and Its Reform* (Cambridge, MA: Harvard University Press, 1982).

⁷⁸ W. Kip Viscusi, Wesley Alexander Magat, and Joel Huber, "Informational Regulation of Consumer Health Risks: An Empirical Evaluation of Hazard Warnings," *RAND Journal of Economics* 17, no. 3, (1986): 351-365.

⁷⁹ U.S. Department of Labor, "OSHA Fact Sheet: Hazard Communication Standard Final Rule," accessed April 16, 2019, <https://www.osha.gov/dsg/hazcom/HCSFactsheet.html>.

⁸⁰ EPA, "Agricultural Worker Protection Standard (WPS)," last modified January 30, 2019, <https://www.epa.gov/pesticide-worker-safety/agricultural-worker-protection-standard-wps>.

⁸¹ AMS, "Country of Origin Labeling (COOL)," accessed April 16, 2019, <https://www.ams.usda.gov/rules-regulations/cool>.

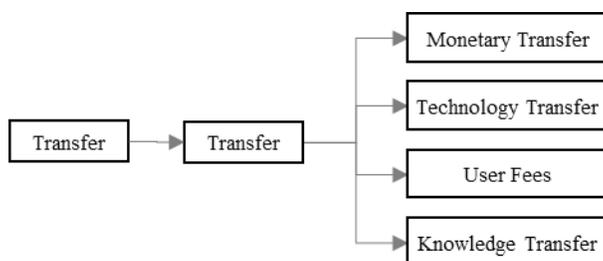
⁸² EPA, "Toxics Release Inventory (TRI) Program," last modified May 03, 2019, <https://www.epa.gov/toxics-release-inventory-tri-program>.

implementation of specific procedures.⁸³ One example of contingency planning are the regulations that implement the Bureau of Safety and Environmental Enforcement’s Safety and Environmental Management Systems.⁸⁴ Another example are the regulations implementing the Federal Select Agent Program—jointly administered by the Centers for Disease Control and APHIS—requiring certain entities handling biologic agents to “have a written contingency plan for unexpected shipments...of select agents and toxins.”⁸⁵

IV. Transfer Regulation

Transfer regulations establish entitlements that channel resources (e.g., money, knowledge) to beneficiaries with redistributive implications. Regulations of this form are distinguishable from other shifts in resources, such as subsidies, because they target a public goal instead of motivating behavior or attempting to correct market failures.⁸⁶ Four forms qualifying as transfers are: 1) monetary transfer, 2) technology transfer, 3) user fees, and 4) knowledge transfer. Figure 3 presents an overview of our typology of second- and third-tier forms of transfer regulation.

Figure 3: Forms of Transfer Regulation



A. Monetary Transfer

These regulations channel government funds to beneficiaries who are entitled based on certain criteria. For instance, this includes regulations that implement disaster assistance payments and income support payments to farmers. The Noninsured Crop Disaster Assistance Program is an example of a monetary transfer program in the agriculture sector. While there may be other policy reasons for these (including distributional effects), OMB Circular A-4 indicates that from a social welfare economics perspective,

⁸³ Carrigan and Harrington 2015.

⁸⁴ Bureau of Safety and Environmental Enforcement, “Safety and Environmental Management Systems (SEMS) Fact Sheet,” accessed April 16, 2019, <https://www.bsee.gov/site-page/fact-sheet>.

⁸⁵ Centers for Disease Control and Prevention (CDC) and Animal and Plant Health Inspection Service (APHIS), “Federal Select Agent Program,” accessed April 17, 2019, <https://www.selectagents.gov/>; 7 CFR 331.11.

⁸⁶ Eric A. Posner, “Transfer Regulations and Cost-Effectiveness Analysis.” *Duke Law Journal* 53, no. 1 (2003): 1067-1110; Philip Saunders, Judith Markland, and Benjamin Wurzbarger, “Transfer Payments and Inflation,” *Proceedings of the Academy of Political Science* 33, no. 3 (1979): 68-81; David Levi-Faur, “The Welfare State: A Regulatory Perspective,” *Public Administration* 92, no. 3 (2014): 599-614.

monetary transfers do not generate changes in aggregate social welfare (i.e., a \$1 million benefit to farmers is also a \$1 million cost to taxpayers).⁸⁷

B. Technology Transfer

Technology transfer refers to the transfer of existing or newly developed technology by government to private sector entities generally through patenting or licensing—which can be either exclusive or non-exclusive. The purpose of such transfers is to encourage adoption of successful innovations resulting from government research and development units. For instance, USDA’s Agricultural Research Service (ARS) contains an Office of Technology Transfer that licenses ARS technologies to the private sector and academia.⁸⁸

C. User Fees

Regulatory forms classified as user fees involve the provision of services by the government or government authorized entities in exchange for payment. User fees are distinguishable from general taxes because the latter do not confer or guarantee a specific government benefit or public good. They also differ from taxes and fees that are designed to reduce externalities (e.g., a carbon tax). Tax scholars often refer to user fees as falling in the category of “benefit taxes.”⁸⁹ One common example of user fees includes the use of tolls to allow users to access particular highways; another would be the requirement for the public to pay a user fee to visit a national park. USDA’s APHIS “charges user fees to recover the costs of conducting agriculture quarantine inspections at U.S. ports of entry.”⁹⁰

It is worth noting that regulatory user fees are not restricted only to fees collected at the time of a specific service. For instance, the U.S. Government Accountability Office (GAO) notes that regulatory user fees might also be collected from “an entire industry at regular intervals as prescribed by...regulation.”⁹¹

For example, research and promotion boards for individual agricultural industries overseen by the Agricultural Marketing Service conduct research and promotion activities to maintain and expand

⁸⁷ The United States Office of Management and Budget (2003). OMB also notes that these transfers “may impose real costs on society to the extent that they cause people to change behavior, either by directly prohibiting or mandating certain activities, or, more often, by altering prices;” Anthony E. Boardman, et al., *Cost-Benefit Analysis: Concepts and Practice*, 5th Edition (Cambridge University Press, 2018); Posner 2003.

⁸⁸ ARS, “Office of Technology Transfer,” accessed April 16, 2019, <https://www.ars.usda.gov/office-of-technology-transfer/>.

⁸⁹ David G. Duff, “Benefit Taxes and User Fees in Theory and Practice.” *The University of Toronto Law Journal* 54, no. 4 (2004): 391-447.

⁹⁰ APHIS, “APHIS User Fees,” accessed April 15, 2019, https://www.aphis.usda.gov/aphis/ourfocus/business-services/User_Fees/APHIS_User_Fees.

⁹¹ U.S. Government Accountability Office (GAO), “Federal User Fees: Key Considerations for Designing and Implementing Regulatory Fees,” GAO, September 16, 2015, <https://www.gao.gov/products/GAO-15-718>.

markets by collecting specified annual assessments from farmers, ranchers, and agricultural businesses in the relevant industries.⁹²

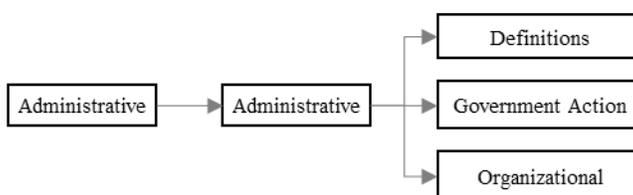
D. Knowledge Transfer

This form of regulation requires the government to disseminate technical knowledge (e.g., soil survey results) at no direct cost to recipients. Government can share information such as weather-related data or respond to a specific request under the Freedom to Information Act. For instance, the Natural Resources Conservation Service (NRCS) is responsible for coordinating with state-level agriculture agencies to provide the public with data produced by the National Cooperative Soil Survey, which includes soil maps and data for over 95 percent of U.S. counties.⁹³

V. Administrative Regulation

Administrative regulations require action on the part of a government agency but do not, themselves, impose any requirements on entities from the public (i.e., in essence, the regulated entity is the government itself rather than the public). These regulations often describe definitions of general terms used in subsequent regulations, specify the administrative procedures a government entity must follow, or prescribe organizational structure or membership of a government entity. Administrative regulations are often standalone parts of the CFR that are not accompanied by text referencing additional regulatory forms (i.e., they do not contain text describing a regulatory form used to implement a requirement). As shown in Figure 4 our taxonomy does not distinguish a second tier for administrative regulation, but does have three third-tier forms.

Figure 4: Forms of Administrative Regulations



A. Definition

Regulatory text often defines the meaning of general terms employed by relevant regulations. In the U.S., these definitions are often included as a distinct part in the *Code of Federal Regulations* (CFR); therefore, it is included as a separate category. For example, 50 CFR 1 under General Provisions issued by the Fish and Wildlife Service (FWS) defines the term “Service” (referring to FWS) which is then used in 50 CFR 3 in text prohibiting discrimination by contractors “upon any land under the control...of

⁹² AMS, “Research & Promotion,” accessed April 17, 2019, <https://www.ams.usda.gov/rules-regulations/research-promotion>.

⁹³ NRCS, “Web Soil Survey Home,” accessed April 17, 2019, <https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>.

the Service.”⁹⁴ It is worth noting that not all definitions sections in the CFR fit the narrow definition of administrative forms—that they “do not impose *any* requirements on entities from the public.” For instance, definitions may, themselves, list which entities will be regulated or even how a government agency will regulate (i.e., what forms of regulation will apply).⁹⁵

B. Government Action

These rules establish procedure, specify processes, or describe entitlements that apply to agencies or government personnel. For instance, Title 5 of CFR on the Office of Personnel Management includes several rules related to civil service or internal administrative process with which government agencies must comply. Such rules are classified as government action because they are internal to the agency; there is no specific requirement for the public.

C. Organizational

Certain administrative regulations specify the organizational structure and functions of a government agency or a government authorized entity. For example, 7 CFR 2 specifies delegations of authority by the Secretary of Agriculture and general officers to various agencies and offices in USDA. Similarly, 29 CFR 4002 establishes the location, board structure, meeting requirements, and emergency procedures of the Pension Benefit Guaranty Corporation—a self-funded entity created by the Employee Retirement Income Security Act of 1974.

VI. Voluntary vs. Mandatory Regulation

We also classified each of the different forms in the taxonomy as either mandatory or voluntary. Depending on the regulatory context, regulators may opt for either a voluntary or mandatory regulatory approach; by definition, voluntary approaches impose less stringent requirements on regulated entities.⁹⁶ Typically, command-and-control regulations are mandatory, and a violation would lead to penalties or sanctions (e.g., fines). In contrast, subsidy and transfer programs tend to be voluntary, as participants have the freedom to choose whether to enroll. Nevertheless, regulators sometimes use voluntary approaches to address issues traditionally addressed by mandatory regulations. For instance, the ENERGY STAR program is a voluntary labeling scheme launched by EPA to improve energy efficiency through labels containing information on a product’s average energy consumption.⁹⁷ Although participation is not mandatory, companies receive a benefit when they can market their products as ENERGY STAR certified.

⁹⁴ See Chapter 3 of this report for a detailed description of our coding strategy for definitions.

⁹⁵ See Appendix C: Coding Q&A, Q1 of this report.

⁹⁶ Kathleen Segerson, “Mandatory versus Voluntary Approaches to Food Safety” *Agribusiness* 15, no. 1 (1999): 53-70.

⁹⁷ Energy Star, “ENERGY STAR Overview,” accessed April 15, 2019, <https://www.energystar.gov/about>.

VII. Conclusion

This taxonomy is the first comprehensive typology of regulation, by form (i.e., policy instrument) that can be applied to regulations across policy areas. Our approach addresses several shortcomings of existing taxonomies, which may not be generalizable across issue areas, are too theoretical to apply directly to empirical research, or involve a limited range of policy instruments. We expect the taxonomy to help better understand the relationship between regulatory activity and public outcomes. The remainder of this report applies this taxonomy to regulations affecting the agriculture sector.

Appendix: Taxonomy of Regulatory Forms

First Tier	Second Tier	Third Tier	Definition	Example
Economic	Price	Benchmarking (or yardstick regulation)	A limit placed on prices by reference to benchmarks, such as prevailing wage or prices within an area or product segment.	Prevailing wage provisions for agricultural employers under the Fair Labor Standards Act; Centers for Medicare and Medicaid Services' pharmaceuticals and medical services.
		Price ceiling/floor	A price control on the highest/lowest price that can be charged for a product.	Federal Milk Marketing Orders; Rent control.
		Rate of return	A form of price setting regulation where governments determine the fair rate of return allowed to be charged by a monopoly.	The Federal Communication Commission's (FCC) rate of return for local exchange carrier to determine common line rates.
		Revenue cap	A limit on the amount of total revenue received by a company operating within an industry; this generally applies to utility companies who are monopolists.	The Federal Energy Regulatory Commission's regulations related to energy offer caps.
	Quantity	Obligation to serve	A regulation requiring companies to make their services/products available to the general public at rates determined to be "reasonable."	Regulations under the Communications Act of 1934, telephone companies; rail and bus services.
		Portfolio standards	A regulation that requires the increased production of energy from renewable energy sources.	Renewable portfolio standards; renewable fuel standards.
		Rationing and quotas	A regulation that limits the number, or monetary value, of goods: it generally applies to limits in international imports or exports during a particular time period and occasionally to limits in interstate commerce; and it also includes catch limits in fishing and hunting.	U.S. tariff rate quotas for imports; peanut marketing quotas (7CFR 729).
	Entry & Exit	Certificate of need	A requirement before proposed acquisitions, expansions, or creation of facilities to affirm that the plan fulfills the needs of a community as decided by a government entity.	State-level requirements for approval before providing medical services.
		Licensing	A license granted by the government is required to legally practice a profession, operate a business, or produce and market specific products.	EPA licensing requirements for pesticide applicators (40 CFR 152); The Department of Health and Human Services' requirements regarding the services that different medical professionals can provide; occupational licensing (often at the state level).

First Tier	Second Tier	Third Tier	Definition	Example
		Rivalrous/exclusive permits	Permission is required to enter the market, and allocation to one party precludes other party.	Broadcast spectrum license; airline landing slots.
		Certification	A requirement that products be routinely approved before introduction to the market.	Inspection of eggs; USDA certification and inspection of meat products (7 CFR 57).
		Antitrust	A regulation that promotes fair competition (restrict collusion/cartels).	Regulations under the Hart-Scott-Rodino Antitrust Improvements Act (16 CFR 801, 802); regulations implementing the Packers and Stockyards Act (9 CFR 201.70).
	Service Quality	Product Identity or Grades	Products categorized into official grades/classes recognized by the government based on measurable attributes.	USDA Agricultural Marketing Service's Grades & Standards for fruits or beef.
		Quality levels	Level/Standard of service is defined by regulators in case of price cap regulation.	FCC regulation of local exchange companies.
Social	Command-and-Control	Monitoring, reporting and verification (MRV) requirement	Requirements that specifically require reporting data to the government and often involves substantial recordkeeping by businesses.	Electronic reporting of National Pollutant Discharge Elimination System (NPDES) (40 CFR 127); the Food and Drug Administration's (FDA) requirements related to Preventive Controls for Human Food.
		Performance standards	"A performance standard specifies the outcome required but leaves the concrete measures to achieve that outcome up to the discretion of the regulated entity." ^a This includes technology-based performance standards.	The Environmental Protection Agency's (EPA) performance standards; FDA's performance standards for growing, harvesting, packing and holding of produce for human consumption.
		Means-based standards	A requirement that specifies technologies that must be used, or prescribes specific procedures, methods, and practices that must be performed. It is also known as prescriptive standards, specification standards, design standards, or technology-based standards. ^b	CPSC's animal testing policy; requiring Vehicle-to-vehicle communications (V2V) in highly automated vehicles; the Animal and Plant Health Inspection Service's viruses, serums, toxins, and analogous products regulations (e.g., 9 CFR 109).
		Permitting	"An administrative agency's statutorily authorized, discretionary, judicially reviewable, granting of permission to do that which would otherwise be statutorily prohibited". ^c Usually for environmental protection; can include conditions for operation.	National Pollutant Discharge Elimination System (NPDES).

First Tier	Second Tier	Third Tier	Definition	Example
		Pre-market notice	A requirement to notify a regulator prior to manufacture but not to receive approval prior to introduction into the market.	Regulations under the Toxic Substances Control Act; EPA notification requirements for concentrated aquatic animal production (40 CFR 451).
		Pre-market/pre-manufacture approval	A requirement to receive regulatory approval prior to initiating the manufacture or marketing of a product.	FDA's approval of medical devices or drugs required prior to sale; EPA's pesticide registration requirements (40 CFR 152).
		Prohibitions	The official or legal prohibition of a product or an act, without exceptions (i.e. no permits accepted).	EPA's ban of the pesticide DDT; acts prohibited on a National Wildlife Refuge.
	Market-based	Bonds	A requirement for regulated entities to post a bond prior to engaging in any activity that might cause negative impacts. ^d	Bonding requirements for natural gas production and cottonseed warehouses.
		Marketable permits	Tradable allowances or permits. Mostly used in an environmental context.	Marketable permits applied to fisheries; SO ₂ ; lead (carbon).
		Subsidies	Benefits given to an individual, business or institution to incentivize certain behavior (changes resource allocation vs. transfer which is intended to change resource distribution).	USDA's conservation programs.
		Taxes and fees	Fees on polluters that penalize them in proportion to the amount they discharge.	Carbon taxes.
	Information-based	Hazard warnings	A requirement to disclose information concerning the hazards and identities of a subject. Often involves the requirement to use recognizable symbols (e.g. skull and crossbones).	The Occupational Safety and Health Administration's Hazard Communication Final Rule, requiring information disclosure on hazardous chemicals to employees; EPA's Worker Protection Act regulations.
		Labeling	A requirement for labels that bear certain information on products sold.	Nutrition Labeling and Education Act (NLEA), nutrition labelling for foods; Country of Origin Labeling (COOL); Appliance & vehicle efficiency stickers, pesticide labels.
		Other disclosure	Information disclosure requirements other than labeling or hazard warnings. Distinguished from other information disclosures because the intended recipient is not directly affected either as a consumer or worker.	Toxics Release Inventory; Community Right-to-Know; EPA's procedures and requirements for plant incorporated pesticides.

First Tier	Second Tier	Third Tier	Definition	Example
		Contingency planning	A requirement for regulated entities to engage in planning and data gathering to realize regulatory goals, which typically includes identifying the hazards in operations and actions to take to mitigate the risks while it does not require any specific outcomes or actions. ^e	Safety and Environmental Management System (SEMS) rules (oil and gas development); EPA's Chemical Accident Prevention Provisions (40 CFR 68).
Transfer	Transfer	Monetary transfer	Includes income support/payments to farmers/businesses. Distinguished from "subsidies" because it targets a need versus motivating a behavior.	Dairy Disaster Assistance Payment Program; Food Stamps (7 CFR 786).
		Technology transfer	Technologies transferred from the government to a private sector partner, generally through patenting and licensing (including exclusive and non-exclusive licensing).	USDA Agricultural Research Service's technology transfer programs.
		User fees	A payment is required in exchange for certain services.	Peanut Board fees in exchange for marketing/research.
		Knowledge transfer	A regulation that requires agencies to share certain information (e.g. manuals, data, survey results) with the public for free, usually upon request.	Regulations on soil surveys (7 CFR 611); snow surveys and water supply forecasts (7 CFR 612).
Administrative	Administrative	Definitions	A CFR part that only contains definitions of terms.	The Fish and Wildlife Service's definitions under General Provisions (50 CFR 1).
		Government action	A regulation that requires government agencies to take certain actions or comply with certain standards without any requirements for the public.	Regulations requiring Natural Resources Conservation Service to collect, provide and interpret data on water supply forecasts (7 CFR 612).
		Organizational	A CFR part that only describes the organization and functions of an institution.	Regulations on the administrative structure and functions of Farm Service Agency state and county committees (7 CFR 7).

- ^a Cary Coglianese, Jennifer Nash, and Todd Olmstead, “Performance-Based Regulation: Prospects and Limitations in Health, Safety and Environmental Protection,” *Administrative Law Review* 55, no. 4 (2003): 705-729.
- ^b Coglianese 2017.
- ^c Biber and Ruhl 2015.
- ^d Carrigan and Harrington 2015.
- ^e *Ibid.*