# The Art of Fixing Prices: Ways of Price Making and the Problem of Markets in Public Utility Law

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**Note to Berkeley Public Law Workshop Participants:** *This is an early and still incomplete draft. Thank you in advance for any comments, suggestions, or criticisms that you have to offer. Everything is still very much up for grabs. I look forward to seeing you soon. All best, William*

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*It does seem certain that a touch of the motely rests upon the ways of price making.*

*-Walton Hamilton, Price and Price Policies 530 (1938).*

## Introduction

Prices are the lifeblood of markets. They provide vital information about supply and demand, signaling to consumers and producers alike and allowing individual preferences and decisions to come together in market transactions. As every student of economics learns, the price for a particular good or service in a competitive market is determined by the interaction of supply and demand.[1] Prices thus provide a powerful means for coordinating economic activity in a manner that maximizes allocative efficiency.[2] By allowing the decentralized, tacit knowledge of producers and consumers to coalesce and constitute new forms of economic order, the "wisdom of prices," to use an explicitly Hayekian frame, is almost always superior to planning and government intervention as a means of governing economic activity.[3]

To be sure, most economists long ago abandoned the simple notion of price formation that populates introductory economics textbooks. As a distinct sub-field within economics, price theory has waxed and waned over the years, giving way to all manner of concerns with the functioning of imperfectly competitive markets, the influence of industry structure, the role of money, credit, and interest, different

[1] See, for example, Alfred Marshall's iconic graphs showing the interaction of a downward sloping demand curve with an upward sloping supply curve. Alfred Marshall, Principles of Economics (8th ed. 1920). Marshall's efforts to develop a theory of relative prices under a set of highly constrained assumptions was a key part of the foundation for neoclassical price theory. The full neoclassical account of prices was not elaborated and formalized until the middle decades of the twentieth century. See, e.g., Frank Knight; Friedman; Stigler.

[2] See, e.g., Milton Friedman, Price Theory 10-11 (mimeo of lecture notes published in 2008) ("The problem solved by a price system is an extremely complicated one, involving the coordination of the activities of tens and hundreds of millions of people all over the global and their prompt adjustment to ever-changing conditions. The price system is an extremely subtle and complex device for solving this problem. Casual observation of the world leads to an underestimation of the complexity of both the problem and the device used to solve it, because insofar as the price system works, we are hardly conscious of its workings. The complexities are brought to our attention only when something goes wrong.").

[3] Hayek, of course, was quite critical of the neoclassical model of perfect competition. Instead, he emphasized the role of competition and the price system as tools for discovery and knowledge generation. See, e.g., F.A. Hayek, *Competition as a Discovery Procedure*, 5 Q. J. Aust. Econ. 9 (2002) (English trans. of 1968 lecture); F.A. Hayek, *The Use of Knowledge in Society*, 35 Am. Econ. Rev. 519 (1945); F. A. Hayek, *Economics and Knowledge*, 4 Economica 33 (1937). *See also* Richard Bronk, *Hayek on the Wisdom of Prices: A Reassessment*, 6 Erasmus J. Phil. & Econ. 82 (2013).

short- and long-term effects, etc.[4] But prices in most well-developed markets are still assumed, even if only implicitly, to reflect the fundamentals of supply and demand. As such, they are also generally presumed to be fair—a presumption that has long informed and supported various forms of economic regulation. When market distortions or manipulation cause prices to depart from their competitive levels, regulation is sometimes called upon to restore competition and thus allow prices to return to their "natural" levels.

This overly stylized story ignores for the most part the complex ways in which prices are actually made in many markets. It asserts rather than investigates the functioning of particular price mechanisms in particular markets. Like any powerful metaphor, the idea that prices emerge from the interaction of supply and demand (whether represented in the familiar graphs from economic textbooks or conceived as the workings of Adam Smith's invisible hand) has both illuminated and obscured the ways that markets work in the real world.

This Article takes a different approach. It starts with the practice of price making—what Walton Hamilton once referred to as the "ways of price making"—in particular markets.[5] It focuses first and foremost on the instrumentalities of price making; that is, on the tools and techniques that are used to generate prices in specific markets. By investigating these concrete ways of price making, the Article seeks to advance our thinking about how law, technology, and economics come together to fashion markets and some of the concomitant challenges for regulation.

The Article draws on recent work in economic sociology, history of economics, and science and technology studies that takes the building and maintenance of markets—and the tools, techniques, and practices that make this

[4] See, e.g, John Maynard Keynes, The General Theory of Employment, Interest, and Money 292 (1997 [1936]) ("So long as economists are concerned with what is called the Theory of Value, they have been accustomed to teach that prices are governed by the conditions of supply and demand; and, in particular, changes in marginal cost and the elasticity of short-period supply have played a prominent part. But when they pass in volume II, or more often in a separate treatise, to the Theory of Money and Prices, we hear no more of these homely but intelligible concepts and move into a world where prices are governed by the quantity of money, by its income velocity, by the velocity of circulation relative to the volume of transactions, by hoarding, by forced saving, by inflation and deflation *et hoc genus homne*; and little or no attempt is made to relate these vaguer phrases to our former notions of the elasticities of supply and demand."); Frank H. Knight, *Cost of Production and Price Over Long and Short Periods*, 29 J. Pol. Econ. 304, 304 (1921) ("Great difficulties are met with in stating a clear and straightforward exposition of price theory because of the fact that the given conditions or data of the problem are so different according to the length of time which the explanation takes into account. The forces which immediately regulate prices are different from those which ultimately control, and there are degrees or stages in both immediateness and ultimateness.").

[5] See Walton Hamilton, Price and Price Policies (1938).

possible—as key objects of inquiry.[6] It also reaches back to earlier work by legal realists and institutional economists and, in particular, to the work of Walton Hamilton. More than any of his fellow travelers in economics and law, Hamilton, who operated in both worlds, focused on the actual practices of price making in specific industries, and was outspoken in his admonishments of economists and others for their hasty embrace of abstract theory at the expense of the concrete.[7]

Rather than assuming the existence of a price mechanism as the core of any well-functioning market, therefore, this Article asks *how* these mechanisms are constructed and maintained. Doing that requires close attention to the techniques and practices that generate prices and allow markets to function.[8] This was precisely what Hamilton set out to do in his *Price and Price Policies* project in the 1930s and it has been an important subject of more recent work on a range of different markets—from finance to spectrum.[9]

Consistent with these methodological commitments, the Article investigates two particular markets in the United States: natural gas and electricity. It focuses specifically on the new ways of price making that have emerged in these markets over the last several decades as these industries have restructured, with particular attention to the role of price indexes in natural gas markets and market-clearing algorithms in wholesale electricity markets. In both cases, the Article seeks to open up the black box of price making in order to understand how these markets function and the challenges facing regulators charged with their oversight and management.

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[6] See, e.g., Donald Mackenzie, Material Markets; Michel Callon, Laws of the Markets; Trevor Pinch and Richard Swedborg, Living in a Material World: Economic Sociology Meets Science and Technology Studies; Philip Mirowski, Machine Dreams, How Economics Becomes a Cyborg Science; Fabian Muniesa, Market Technologies and the Pragmatics of Prices; Daniel Breslau, What do Market Designers Do When They Design Markets; Breslau, Designing a Market-Like Entity; Mary Morgan.

[7] See Hamilton, Price and Price Policies, supra note __ at 543 ("A vogue among persons who will neither get down to the concrete nor probe beneath the surface is to say that price is made by supply and demand, to dub a truism a natural law, and to let it go at that."). See also Malcolm Rutherford, The Institutionalist Movement in American Economics, 1918-1947: Science and Social Control 81-84 (2011) (discussing Hamilton's study of price and price policies and his broader role in New Deal debates about price control).

[8] See, e.g., Donald MacKenzie, Material Markets: How Economic Agents are Constructed 182 (2009) ("[T]reating 'the market' as a singular entity is mistaken. . . . Of the many markets that are possible, *which* markets we have matters, and that is a question not simply of their overall characteristics but of the details of their design, the technological infrastructures that support them, and the way economic agents in them are constructed: the systematic forms of knowledge those agents deploy; the phenomena to which they pay attention and to which they do not; the ways in which complexities are made simple enough for economic agents to grasp; and so on.").

[9] See, e.g., MacKenzie on Finance; Mirowski and Nik Khan on Spectrum and FCC auctions.

Given this focus, the Article is largely a story about federal efforts to regulate markets, with particular attention to the Federal Energy Regulatory Commission (FERC). But it situates this story in the long history of price making and public utility law. That history is important not only because it continues to inform the basic statutory standard that governs FERC's regulation of these markets, but also because it shapes many of the assumptions that FERC has made (and continues to make) about the operation of markets and the prices that result.

Over the last three decades, as FERC has worked to transform itself into a market oversight and enforcement agency, it has embraced the view that the forces of competition, if sufficiently robust, will generate prices that are "just and reasonable." Making sure that natural gas and electricity markets are competitive, therefore, has come to constitute its primary responsibility. To be sure, FERC is not alone in discharging this responsibility (the Commodity Futures Trading Commission (CFTC) in particular plays an important role in regulating financial derivatives and state and federal antitrust laws have obvious application), but FERC has been the lead agency in overseeing a multi-decade restructuring effort in natural gas and electricity that has resulted in markets of remarkable complexity.[10]

This is very different from what it used to do. For most of its history, stretching back to the 1930s when it was known as the Federal Power Commission, the bulk of its attention was devoted to setting cost-based rates for natural gas pipelines and electric utilities.[11] Its duties were essentially the same as those of state public utility commissions—establishing rates for public utilities under its jurisdiction. With the restructuring of natural gas and electricity in the 1980s and 1990s, however, FERC took on a very different set of responsibilities for managing and overseeing markets. In the early years of restructuring, the Commission generally assumed that the markets emerging in natural gas and electricity were functioning properly and that the prices that resulted were just and reasonable.

[10] See, e.g., GAO, Energy Markets: Additional Actions Would Help Ensure that FERC's Oversight and Enforcement Capability is Comprehensive and Systematic 7-8 (2003) ("The evolution of competitive energy markets is requiring FERC to fundamentally change how it does business. With the shift to market-based prices for natural gas and electricity, FERC has concluded that its approach to ensuring just and reasonable prices has to change: from one of reviewing individual companies' rate requests and supporting cost data to one of proactively monitoring energy markets to ensure that they are working well to produce competitive prices.").

[11] Part II of the Federal Power Act (1935) and the Natural Gas Act (1938) gave the Commission jurisdiction over wholesale sales of gas and electricity in interstate commerce and transmission or transportation in interstate commerce. The statutes were quite similar in their basic design, creating a dual system of regulation under which federal authority would complement rather than displace existing state authority over retail sales and local distribution as well as various upstream activities: generation in electricity and production and gathering of natural gas.

Reading FERC's early restructuring orders, in fact, gives one the sense that the Commission tended to view markets as a more natural state of affairs that would take hold as regulation was relaxed. Competitive markets, in this view, would solve many of the problems that had plagued the cost-of-service regulation of the past. Put simply, the discipline of competition could do a better job at setting "just and reasonable" prices than the discipline of regulation. A "light-handed" approach, to use one of FERC's characterizations of its new oversight responsibilities, was all that was needed to allow these markets to work.[12]

Part of the motivation behind FERC's embrace of the virtues of markets no doubt stemmed from the influence of the sustained and quite powerful economic critique of regulation that had been gathering strength since the early 1970s.[13] Part of it also stemmed from the experience of oil shocks and energy crisis in the 1970s as well as from changes in technology and industry structure that raised questions about whether regulation was appropriate for certain segments of previously regulated industries.[14] As de-regulation rose to the top of the political agenda in the 1980s, natural gas and electricity were viewed as ideal candidates for reform. With some modest help from Congress, FERC used its long-standing statutory authority in creative ways to push forward an ambitious effort to unbundle these industries and allow markets to take hold.

The limits of FERC's embrace of markets became painfully apparent during and after the California energy crisis of 2000-01, which greatly disrupted both natural gas and electricity markets throughout the western United States. Among other things, the crisis illustrated how fragile these new markets were, how relatively easy they were to manipulate, and how much market design and oversight mattered. For its part, FERC recognized that it had been naïve in its assumption at the outset of the crisis that market forces should be allowed to run their course and that light-handed regulation was sufficient.[15] Part of the problem surely stemmed

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[12] See Order 636. See also United Distribution Cos. v. FERC, 83 F.3d 1105, 1122 (1996) (observing that with its natural gas restructuring effort FERC "has gradually withdrawn from direct regulation of certain industry sectors in favor of a policy of 'light-handed regulation' when market forces make that possible").

[13] See Boyd, Public Utility and the Low Carbon Future, supra note __ at 1651-58 (discussing economic critique of public utility regulation).

[14] Id., at 1658-61 (discussing impacts on regulation as a result of energy crisis and exhaustion of economies of scale in power generation).

[15] See, e.g., FERC, Staff White Paper on Anti-Market Manipulation Enforcement Efforts Ten Years After EPAct 2005 at 2 (2016) ("During the Western Energy Crisis, the Commission's enforcement tools lagged behind these market developments, and the [manipulation] schemes exposed a major weakness in the Commission's ability to fulfill its core mission of ensuring just and reasonable rates and protect energy market participants and consumers. Until the Commission enacted the Market Behavior Rules applicable to electric markets and code of conduct applicable to

from the fact that the Commission had limited capabilities and relatively weak enforcement authority to carry out a vigorous oversight role. But there were also deeper conceptual shortcomings that inhibited the Commission from fully appreciating the challenges of market regulation. In both natural gas and electricity, it was clear that FERC had paid too little attention to the role of price formation and, specifically, to the ways in which the actual mechanisms of price formation in these markets—price indexes in natural gas and market clearing algorithms in electricity—could be manipulated.[16] Embracing abstract conceptions of markets and celebrating the forces of competition, FERC failed to give sufficient attention to the concrete ways of price making.

Since the crisis, FERC has worked hard to enhance its market oversight capacities, paying much more attention to price formation, the exercise of market power, and the possibility of manipulation. Congress also stepped in with a suite of new rules to improve the functioning of natural gas and electricity markets and gave significant new enforcement authority to FERC.[17] New codes of conduct, new anti-manipulation rules, improved transparency, and expansive new civil and criminal penalty authority have provided the foundation for a much more robust approach to market oversight and enforcement.

But even with these new authorities, the Commission continues to face significant challenges in overseeing these markets. The proliferation of new physical market products for gas and electricity, growing use of financial derivatives,

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natural gas markets in the aftermath of the Western Energy Crisis, neither the statutes administered by the Commission nor its rules, regulations, or orders contained any explicit prohibition or definition of market manipulation. And in any event, the Commission lacked adequate civil penalty authority to effectively deter and sanction market manipulation, and lacked tools to effectively oversee and surveil potentially problematic conduct occurring in jurisdictional energy markets.").

[16] Not surprisingly, FERC was widely criticized for its handling of the California energy crisis. See., e.g., Gary Taylor et al., Market Power and Market Manipulation in Energy Markets: From the California Crisis to the Present 251 (2015) ("FERC was poorly prepared for the California Crisis. Its approach to constraining market power was woefully antiquated, and it had failed to collect the data necessary to understand what was going on in the markets. The concept of fraud-based manipulation had not even entered the Commission's thinking. It had no workable model of manipulative behavior, no analytic approach for diagnosing it, and no remedial tools to deter it or compensate consumers for any consequential damage."); Jacqueline Lang Weaver, Can Energy Markets Be Trusted? The Effect of the Rise and Fall of Enron on Energy Markets, 4 Houston Bus. & Tax L. J. 1, 80-81 (2004) (observing that FERC did not see a need to intervene in the California crisis initially and that when it did decide to intervene "it found that it lacked the expertise and resources to understand and monitor" the markets): GAO, Energy Markets: Concerted Actions Needed by FERC to Confront Challenges that Impede Effective Oversight 84-86 (2002) (noting that FERC Commissioners recognized the Commission's shortcomings in responding to the crisis). See also Spence, Can Law Manage Competitive Energy Markets.

[17] EPAct 2005.

the emergence of new market operators administering increasingly complex rules, the rise of market hubs and electronic trading platforms, and a diversity of new market participants have raised hard questions about whether FERC has the capacity to regulate these markets effectively.[18] Jurisdictional issues have also hampered FERC's ability to fully police certain cross-market manipulation schemes that implicate the CFTC's authority over futures and derivatives markets.[19] And a fixation on fraud-based approaches to market manipulation (by Congress and FERC) has obscured deeper problems of market design and market power.[20]

The fundamental challenge confronting FERC, however, is not so much a legal or regulatory challenge as it is a problem of knowledge. As this Article shows, FERC's inability to engage in more oversight (and regulation) of price indexes in natural gas and market-clearing algorithms in wholesale electricity markets results in part from (and, at the same time, serves to reinforce) a particular view of markets and what the Commission sometimes refers to as "the forces of competition." Put simply, by viewing these markets through the lens of neoclassical price theory, FERC has allowed the assumptions implicit in abstract models of market competition to hinder its understanding of the concrete realities of these markets. This has translated into a focus on the conduct of market participants rather than the instrumentalities of price formation, and a concomitant reliance on the deterrent effect of large penalties for misconduct as a first line of defense. In the meantime, direct regulation of price indexes and market clearing algorithms has been left to private entities—the price reporting agencies themselves in the case of natural gas price indexes and the various market monitors (and software vendors) in the case of the algorithms that run the wholesale power markets.

In both cases, however, FERC appears to have ample legal authority to engage in more direct oversight of these mechanisms of price formation. Among other things, regulation of price indexes and market clearing algorithms would seem to fit easily within FERC's authority under both the Natural Gas Act and the Federal Power Act to regulate "practices" that directly affect rates.[21] From a broader policy perspective, moreover, there are good arguments for why FERC should

[18] Cf. Julie Cohen, The Regulatory State in the Information Age, 17 Theo. Inq. Law 369 (2016).

[19] See, e.g., Brian Hunter v. FERC, 711 F.3d 155, 160 (D.C. Cir. 2013) (rejecting FERC jurisdiction over manipulation scheme involving natural gas futures contracts).

[20] Spence and Prentice, Transformation of American Energy Markets; Verstein, Benchmark Manipulation.

[21] Natural Gas Act §5(a), 15 U.S.C. 717d(a); Federal Power Act §206(a), 16 U.S.C. §824e(a). Two recent Supreme Court cases, EPSA and Oneok, both address the scope of practices affecting rates. See, e.g., FERC v. Electric Power Supply Association, 577 US __ (2016) slip op at 15 (approving lower court decision that limits FERC's "affecting" jurisdiction to rules of practices that directly affect the wholesale rate); Oneok, Inc. v. Learjet, Inc., 575 U.S. __ (2015) slip op at 4 (discussing FERC's jurisdiction under the Natural Gas Act over practices affecting rates).

regulate these more directly. Price indexes and market-clearing algorithms are critical pieces of the infrastructure on which these markets depend. They are the key instrumentalities or technologies that allow these markets to function. As such, there is a strong public interest in ensuring that they have integrity and are able to perform their services. In a broad sense, they might even be considered as public utilities in their own right.[22] FERC's current posture of leaving their direct regulation to private parties seems problematic.

But more direct regulation by FERC also carries risks. And it is not at all clear how FERC should regulate these instrumentalities. Given their centrality to the markets (the fact that they are deeply embedded in these markets), great care must be taken in devising and implementing any new approach to their regulation. Unintended consequences could easily result from an effort to open up the black boxes of these price indexes and algorithms in the name of enhanced transparency and oversight.[23] Part of their utility, in fact, may stem from the fact that they are not fully understood or transparent. But at a minimum, that fact, along with their fundamental role as instrumentalities or technologies of price making, needs to be acknowledged.

More generally, it is time (well past time in fact) to recognize that abstract conceptions of markets and the forces of competition are not particularly helpful in understanding how markets work in practice.[24] Put another way, the tendency to

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[22] See Boyd, *Public Utility and Low Carbon Future, supra* note __ (arguing for a broader, more normative conception of public utility that is not tied to any particular business model or type of entity).

[23] See, e.g., DOJ comments on transparency in natural gas and electricity proceedings. See also Mark J. Neifer, *Information and Competition in Electric Power Markets: Is Transparency the Holy Grail?*, 35 Energy L. J. 375 (2014).

[24] This basic argument is well rehearsed in the literature on markets and market design in economic sociology, history of economics, and science and technology studies. See, e.g., Mirowski, Callon, MacKenzie, etc. It is worth recalling here that prominent economists in the past have sometimes remarked on the limited attention given to markets in economics. See, e.g., Ronald Coase, The Firm, the Market, and the Law 7 (1988) ("Although economists claim to study the working of the market, in modern economic theory the market itself has an even more shadowy role than the firm."); Douglas North, *Markets and Other Allocation Schemes in History: The Challenge of Karl Polanyi*, 6 J. Eur. Econ. Hist. 703, 710 (1977) ("It is a peculiar fact that the literature on economics . . . contains so little discussion of the central institution that underlies neo-classical economics—the market."). Over the last couple of decades, with the rise of mechanism design, economists have begun to pay much more attention to market design and repair. See, e.g., Philip Mirowski, *Markets Come to Bits: Evolution, Computation, and Markomata in Economic Science*, 63 J. Econ. Beh. & Org. 209, 218 (2007) ("One of the great challenges for intellectual historians of the future will be to explain how it came to be that as professional academic orthodoxy that had eschewed most considerations of the specificity of markets . . . then neatly executed a 180°turn, and managed to convince a broad array of outsiders that they possessed special expertise to construct all manner of actual usable markets, tailor-made for their narrowly specified purposes.").

naturalize markets deflects attention from the specific technologies, practices, institutions, and norms that constitute markets. In the case of natural gas and electricity, this tendency has produced a mistaken view that the indexes and algorithms at the heart of these particular markets are simply facts about these markets rather than constitutive technologies that make them work. In addition, conduct-based approaches, whether enforced by FERC, CFTC, the antitrust laws, or some combination of all of these, reflect a deeply ingrained habit of focusing on market participants rather than the infrastructures or the technologies of price making. Indeed, the very idea of a market participant carries with it a baseline assumption of a pre-existing market—something that is already there rather than something that gets produced and reproduced.

But if we turn this around and start with the infrastructures and devices that are used to build these markets and that allow them to function; that is, if we look not simply at the prices that emerge from markets but at the specific ways of price making, new approaches to oversight and regulation come into focus. To be sure, this Article does not purport to offer a ready-made solution to the challenges confronting FERC in its efforts to regulate natural gas and electricity markets. The goal here is more modest, but also more foundational, in that it seeks first and foremost to develop a different way of seeing these markets—one that brackets our received understandings of what a market is and one that recognizes that markets are shaped not only by norms, rules, and institutions but also by the constitutive role that specific technologies and practices play in making prices. Given the centrality of prices to public utility regulation, together with FERC's ongoing responsibilities in this area, a focus on how prices are in fact made (how they are fixed) in these markets would seem to be an obvious and important place to start.[25]

None of which is intended as criticism of FERC. Since the California crisis, the Commission has worked diligently to meet the challenges of regulating these new markets and it has used its new enforcement authority in an aggressive (some would say too aggressive) fashion to go after market manipulation.[26] Recent settlements secured by the Commission in gas and electricity cases have been in the hundreds of millions of dollars.[27] Conduct-based approaches, combined with significant civil and criminal penalty authority, are far better than what existed

[25] See, e.g., Hope Natural Gas, 320 U.S. 591, 602 (1944) ("Rate making is indeed but one species of price fixing."); Alfred Kahn, 1 The Economics of Regulation: Principles and Institutes 20 (1988) ("Price regulation is the heart of public utility regulation."); William E. Mosher et al., Electrical Utilities: The Crisis in Public Control 34 (1929) ("The control of rates is the crux of the problem of public utility regulation.").

[26] See FERC, Staff White Paper on Anti-Market Manipulation Enforcement Efforts Ten Years After EPAct 2005 (2016) (reviewing manipulation cases and settlements since 2005).

[27] JP Morgan; Barclays; etc.

before (FERC had no regulations on market manipulation and no real penalty authority until after the California energy crisis).

But there remain large blank spots at the heart of FERC's oversight regime that make it challenging for FERC to determine when market prices satisfy the just and reasonable standard. Acknowledging these blank spots and thinking about ways to address the fundamental problem of knowledge at the heart of FERC's regulatory approach to natural gas and electricity markets is surely an important first step for any effort to improve the functioning of these markets and FERC's ability to oversee and regulate them.

To that end, this Article seeks to open up the black box of price making at the heart of these markets. Part of the goal is descriptive. We do not yet have a detailed history and understanding of price making in natural gas and electricity markets, nor do we fully appreciate what we know (and don't know or perhaps can't know) about these markets. This Article thus seeks to add to our overall understanding of natural gas and electricity markets, and the challenge confronting FERC in regulating these markets, by focusing specifically on these ways of price making—how they evolved in the context of restructuring, how they work (and fail to work), how they interact with the basic norms and legal standards of public utility law, and how they are regulated. This requires getting into the technical details of these markets at times, but it is precisely on this more technical terrain of market design where so much of the politics of economic regulation now occurs.[28]

The Article also seeks to engage broader debates about markets, price formation, and economic regulation. Economic sociologists going back to Max Weber have taught us that markets are social structures—that market activity is a form of social action—and that the economy is embedded in norms and institutions.[29] Similarly, institutional economists, legal realists, and their successors have taught us that markets are fundamentally legal entities—shot through with all manner of pre-existing entitlements, rules, and regulations.[30] But markets are more than collections of institutions, norms, rules, and practices. They also include and are structured by a whole host of socio-technical devices embodied in concepts, models, instruments, and technologies of various kinds. Put another way, markets are constituted by specific knowledge practices (material and social) that determine

[28] Cf. Annelise Riles, Collateral Knowledge: Legal Reasoning in Global Financial Markets (2011); Marc K. Landy and Martin Levin, *Creating Competitive Markets: The Politics of Market Design, in* Creating Competitive Markets: The Politics of Regulatory Reform 9-12 (Landy et al eds., 2007) (noting the intense politics and rent seeking directed at various market design processes). Broader literature on rendering technical and anti-politics.

[29] Weber; Polanyi; Swedberg; Granovetter.

[30] Commons; Hamilton; Hale; CLS; Law and society.

how transactions are organized and formatted, how prices are made and disseminated, how economic activity is coordinated. Taking these devices and knowledge practices seriously and understanding their role in making markets work opens up a broad terrain for future research and raises important questions regarding oversight and regulation of markets.

The Article proceeds as follows. Part I provides some brief historical background on the approach to price making in early public utility law, focusing specifically on how medieval conceptions of "just price" came to influence public utility regulation in the United States. The goal here is twofold: to show how market prices were regulated through community norms and sanctions in earlier times and to trace the genealogy of the normative commitment at the heart of public utility law—that of ensuring that just and reasonable prices.

Part II discusses the traditional model of price making in public utility law (utility ratemaking) in more detail, showing how received understandings of just price influenced the traditional model of ratemaking and the corresponding struggle to operationalize the concept of just and reasonable rates. The key takeaway here is that the ways of price making at the heart of public utility regulation for much of the twentieth century all too often devolved into an elaborate, litigation-intensive process (price-by way of litigation as Walton Hamilton put it). Over time, as courts pulled back from policing the methodology of ratemaking, the focus of utility regulation shifted to how competition in certain segments of these regulated industries might be harnessed to ensure that prices would be just and reasonable. This was the primary motivation for natural gas and electricity restructuring in the 1980s and 1990s and it represented a fundamentally new approach to price making in public utility law.

Parts III and IV, which comprise the heart of the Article, investigate the ways of price making in restructured natural gas and electricity markets respectively, focusing specifically on the price indexes and market clearing algorithms at the center of these markets. The central claim here is that FERC's tendency to view these markets in overly abstract terms, its reliance on the so-called forces of competition to discipline prices, and its decision to leave regulation of the actual mechanisms of price making to third parties have created significant epistemic and regulatory challenges for the Commission, raising important questions about its ability to carry out its responsibilities as these markets grow in size and complexity. Finally, Part V draws out some of the more general lessons from these case studies and engages with broader debates (theoretical and methodological) about how to understand and investigate ways of price making and the problem of markets in public utility law and beyond.

## I. Just Price

The classical origins story of public utility regulation claims several lineages: the common law duty to serve incumbent upon innkeepers, ferries, and other so-called common callings;[31] the granting of monopoly privileges and franchises to particular enterprises, often with concomitant powers of eminent domain;[32] and, the medieval conception of "just price." Taken together, these provided both legal and normative justification for the notion that the services provided and the prices charged by certain businesses should be regulated in the public interest.

Of these different influences, the most relevant for this project is the idea of just price. There is a long and somewhat convoluted history here that we can only briefly touch upon. What is most important for this project, however, is not the actual historical meaning of just price, but rather how the concept migrated and mutated across time, and how a particular version of the concept influenced (and continues to influence) public utility regulation in the United States. Indeed, as we will see, vestigial notions of just price exerted a profound influence on utility ratemaking and the valuation of utility assets for decades. And such notions continue to animate the manner in which FERC approaches markets (and the prices that result) in both natural gas and electricity.

### A. *Medieval Markets*

For early twentieth century scholars of medieval economic history, "just price" was one of the defining features of an economic ethic that was qualitatively different from that which would later take hold with the rise of capitalism.[33] Goods

[31] See Charles K. Burdick, The Origin of the Peculiar Duties of the Public Service Companies, 11 Colum. L. Rev. 514, 515 (1911) ("The features which at early common law distinguished those engaged in public or common callings (the original public service companies) from those who were not so engaged, were the peculiar general duties laid upon the persons engaged in common callings to serve all applicants for their services, and to perform such services with care without a special assumpsit to that effect. To these primary duties there are certain corollaries, namely, that the service must be reasonably adequate and rendered upon reasonably terms, and that it must be impartial."). See also Jim Rossi on Duty to Serve.

[32] See Charles K. Burdick, The Origin of the Peculiar Duties of the Public Service Companies Part II, 11 Colum. L. Rev. 616, 638 (1911) (noting that "in the case of a great number of the so-called public service companies of the present day the peculiar duties resting upon them grow out of the exercise public franchises").

[33] Max Weber, General Economic History 358 (Frank Knight trans., 1927) (noting that "medieval economic ethics excluded higgling, overpricing, and free competition, and were based on the principle of just price and the assurance to everyone of a chance to live"); Max Weber, Economy and Society 1188 (Roth and Wittich eds., 1978) (tracing the origins of "just price" to the "primeval ethic of the neighborhood, which knows barter only as the exchange of occasional surpluses or of

and services were held to have an objective value—a just price—that was tied not to what they could fetch in a market but to their cost of production and to the producer's station in life.[34] Considered as a predominantly ethical rather than an economic doctrine, just price served to regulate prices and delineate the boundaries of fair exchange.[35]

By the middle of the twentieth century, new research questioned this earlier understanding of just price. The revisionist interpretation held that the medieval authorities understood the just price in most cases as the market price and that price regulation only applied in specific cases of scarcity of certain essential goods or in the absence of competition.[36] Such a view no doubt received a considerable

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products of one's own labor" and where "one does not haggle for the price, but merely asks for the restitution of one's own cost (including the 'living wage') if an exchange takes place at all"); Werner Sombart __; See also Edgar Salin, Just Price, Encyclopedia of the Social Sciences Vol. VIII (Seligman and Johnson eds., 1932) at 505-06 ("Because the just price was essentially not an economic but an ethical and social concept it did not necessarily coincide with the market price . . . . The social function of the doctrine was to prevent material gain from becoming the sole motive of economic activity, to extend the Christian way of life to the economic sphere and to safeguard the traditional social structure.").

[34] See Baldwin at 7 for a review. See also R.H. Tawney, Religion and the Rise of Capitalism 53 (Verso ed., 2015 [1926]) (discussing the "characteristic doctrine" of just price as one that "insisted on the just price as the safeguard against extortion; . . . [p]rices must be such, and no more than such, as will enable each man to have the necessaries of life suitable for his station").

[35] See, e.g., Salin, supra note __ at 504 ("The just price . . . as a conception and as a doctrine is basically ethical rather than economic."). Various scholars, old and new, have also observed that early governmental price controls were often grounded on notions of "just price." The English Assizes of Bread and Ale and the Statute of Laborers, for example, drew "heavily upon scholastic notions of the just price." See Davis, Medieval Market Morality, supra note __ at 223 ("The most significant national regulations for price control were the assizes of bread and ale, tied to the market price and drawing heavily upon scholastic notions of the just price."); Henry Rottschaefer, *The Field of Governmental Price Control*, 35 Yale L. J. 438, 438 (1926) ("Governmental price regulation was practiced at an early stage in English legal history and constituted an important element in the economic life of the Middle Ages. It was an integral part of a social order strongly influenced by ethical conceptions of a just price capable of the same kind of objective determination as any other ethical standard."); Eugene A. Gilmore, *Governmental Regulation of Prices*, 17 Green Bag 627, 627 (1905) (tracing laws regulating prices in England and the United States back to the doctrine of just price).

[36] See, e.g., John W. Baldwin, *The Medieval Theories of the Just Price* 49 Trans. Am. Phil Soc. 1, 54, 75-80 (New Series 1959) (describing just price of the Canonists and Romanists of the 13th century and of Aquinas and his followers as including the current price determined in competitive conditions as well as the legal price set by the relevant authorities); Raymond De Roover, T*he Concept of the Just Price: Theory and Economic Policy*, 18 J. Econ. Hist. 418, 420-21 (1958) ("[T]he generally accepted definition of the just price is wrong and rests on misinterpretation of the scholastic position on the matter. According to the majority of the doctors, the just price did not correspond to cost of production as determined by the producer's social status, but was simply the current market price, with this important reservation: in cases of collusion or emergency, the public

boost from Joseph Schumpeter who, in his posthumous 1954 *History of Economic Analysis*, traced a direct line from Aristotle to Aquinas and the later Scholastics—all of whom, he argued, equated the just price with the prevailing market price.[37]

To be sure, aspects of this new interpretation likely resulted from a tendency to read history backwards and to impose modern economic concepts and categories on an earlier time. But the new scholarship did engage in considerable detail with primary texts and also recognized that even if the just price was, for the most part, the market price, it was still an "essentially normative" concept.[38] More recent scholarship has sought to recover, at least in part, an ethical, largely non-market conception of just price, noting that writers in the Scholastic tradition used the doctrine primarily in connection with situations involving few buyers and sellers.[39]

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authorities retained the right to interfere and to impose a fair price."); John T. Noonan, The Scholastic Analysis of Usury 86 (1957) ("The just price is the market price.").

[37] Joseph A. Schumpeter, History of Economic Analysis 61 (1954) (arguing that Aristotle understood just prices as "normal competitive prices"); id., at 93 (arguing that Aquinas's notion of just price was "strictly Aristotelian and should be interpreted exactly as we have interpreted Aristotle's"). *But see* M.I. Finney, *Aristotle and Economic Analysis*, 47 Past and Present 3, 12-15 (1970) (criticizing the arguments of Schumpeter and others that Aristotle was engaged in economic analysis aimed at a theory of market prices rather than seeking to develop an understanding of exchange within his notion of justice). Part of the problem, according to Finney, is that Schumpeter and other economists made the mistake of seeking to understand Aristotle through the lens of modern economic institutions and ideas. Id., at 25.

[38] Baldwin, supra note __ at 8; see also id. ("Beginning chiefly with the twelfth and lasting until the sixteenth century the thinkers of the Middle Ages adopted the term *justum pretium*, refined its meaning, and enlarged its importance until the expression became a legal device, a moral imperative, and an economic doctrine.").

[39] See David D. Friedman, *In Defense of Thomas Aquinas and the Just Price*, 12 Hist. of Pol. Econ. 234, 236 (1980) ("Both the writers in the scholastic tradition and Aristotle, their primary source, were largely concerned with exchanges involving small numbers of buyers and sellers. . . . The purpose of the doctrine of just price was to determine the price in such non-competitive situations."); George W. Wilson, *The Economics of the Just Price*, 7 Hist. Pol. Econ. 56, 73 (1975) ("The notion of the just price was rooted in the quest for stability at a time when existing social forms were changing. But it was also a product of low per capita levels of output and, as such, was a social and prescriptive device that attempted to have the needed goods and services produced and distributed in accordance with prevailing views of equity. In the absence of competitive markets, justice in exchange required some special social constraints."); O.F. Hamouda and B.B. Price, *The Justice of the Just Price*, 4 Eur. J. of the Hist. Econ. Thought 191, 208 (1997) (concluding that the medieval schoolmen's "amalgamated discussion of price from an economic and ethical perspective was much deeper than the modern one, in the sense that it rendered contemplation of economic technicalities, which are dear to modern economists, of secondary importance, and reflected on the moral and ethical aspects of market exchange as well as the notion of 'value', issues whose serious discussion today are simply dismissed on economic grounds alone"); Adrian Walsh, *The Morality of the Market and the Medieval Schoolmen*, 3 Pol. Phil. Econ. 241, 247 (2004) ("The theory of the Just Price was an attempt to provide some kind of moral constraints upon the formation of prices."). But see Davis, Medieval Market Morality, supra note __ at 62-63 ("[I]n essence, the just price was

Identifying a single doctrine (or even a coherent notion) of just price that could connect Aristotle's Ethics with the Scholastics and the everyday exchanges of medieval markets is, needless to say, a task of exegesis and historical inquiry that far exceeds the scope and capabilities of the current undertaking. Fortunately, we need not resolve the actual historical meaning and practice of just price during the Middle Ages. Rather, what is most important here is the fact that the *idea* of just price took on a life of its own during the late 19th and early 20th centuries, and exerted an important influence on the concept and practice of public utility regulation with its central normative concern of ensuring that rates would be "just and reasonable." It is, in other words, the received understanding of just price and the way in which it influenced early conceptions of public utility regulation that is most important for this project.

### B. ***Moral Economy***

As a way of regulating prices, just price was grounded in a broader set of customs and norms within particular communities. The idea that the economy constituted a sphere of activity separate from social, political, and ethical relations made little sense. Prices were not simply or exclusively economic phenomena; they had not yet been stripped of social and normative content, but were embedded within more general notions of "moral economy."

As articulated by the British historian Edward Thompson, the notion of moral economy incorporated the idea of just price as a customary practice of establishing fairness in market exchange and regulating the prices of food and other necessities during times of dearth. In particular, Thompson showed how English food riots during the eighteenth century were often framed around notions of a just price—directed at ensuring that fair prices for grain would prevail in times of scarcity or market distortion.[40] Arguing against what he characterized as the

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accepted as the market price that both vendor and purchaser were willing to accept, provided that any deceit, manipulation or coercion has been excised from the deal.").

[40] E. P. Thompson, *The Moral Economy of the English Crowd in the Eighteenth Century*, 50 Past and Present 76, 108 (1971) ("What is remarkable about these 'insurrections' is, first, their discipline, and, second, the fact that they exhibit a pattern of behavior for whose origin we must look back several hundred years: which becomes more, rather than less, sophisticated in the eighteenth century; which repeats itself, seemingly spontaneously, in different parts of the country and after the passage of many quiet years. The central action in this pattern is not the sack of the granaries and the pilfering of grain or flour but the action of 'setting the price.'"). *See also* James Davis, Medieval Market Morality: Life, Law, and Ethics in the English Marketplace, 1200-1500 at 447 (2012) ("The precepts of the moral economy accepted that just prices were those determined by supply and demand and middlemen and bakers had a right to profit. What they did not have a right to do was undertake practices that caused harm to their fellows in the search for the best profits. . . . It was not

"spasmodic" view of food riots and the tendency to relegate the crowd to a marginal, almost Pavlovian role in history (stimulus: hunger → response: food riot),[41] Thompson showed how these various food riots were in fact driven by an older, normative conception of economic exchange and the idea that necessities such as grain had a just price that sometimes departed from prices set in the markets.[42] Riots, and the plausible threat of riots, thus drew on older paternalistic relationships and norms to enforce (to regulate) the price of grain during times of scarcity.[43]

Much of the concern here was with manipulative practices on the part of sellers. The poor were not hostile to competitive markets according to Thompson; indeed, their protests and riots were directed at episodes where markets were not working—where merchants and others seemed to be taking unfair advantage of consumers.[44] The riots targeted these practices and sought to restore prices to what was considered the just or fair price.[45]

Thompson's notion of moral economy, with its grounding in ideas of just price and fairness in exchange, has proved quite wide-ranging in its influence on

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an ideology that was in conflict with the market, but it was a belligerent popular ethic that could not adapt to the new laissez-faire policies of the late eighteenth century that sought to erode traditional paternal notions.").

[41] Thompson, Moral Economy at 76 (discussing the "spasmodic view of popular history" that saw food riots as "compulsive, rather than self-conscious or self-activating . . . simple responses to economic stimuli").

[42] Thompson, Moral Economy at 131-32 ("It is not easy for us to conceive that there may have been a time, within a smaller and more integrated community, when it appeared to be 'unnatural' that any man should profit from the necessities of others, and when it was assumed that, in time of dearth, prices of 'necessities' should remain at a customary level, even though there might be less all around.").

[43] Thompson, Moral Economy at 107-15 (discussing specific food riots and their role in setting the price of grain during times of scarcity); *see also id.*, at 120-26 (discussing how the *threat* of riots also served to regulate the price of necessities).

[44] Thompson, Moral Economy at 112 ("It is the restraint rather than the disorder, which is remarkable; and there can be no doubt that the actions were approved by an overwhelming popular consensus. There is a deeply-felt conviction that prices ought, in times of dearth, to be regulated, and that the profiteer put himself outside of society.")

[45] *See* EP Thompson, Moral Economy Reviewed, 304-05 ("[E]ven the most zealous food rioters . . . were inextricably committed to the market, both as producers and as consumers. How could they have existed for a month or a week without it? . . . It is with the special case of the marketing of necessities in times of dearth that we have been concerned, and the crowd's preferred model was precisely the "open market" in which petty producers freely competed, rather than the closed market when large dealers conducted private bargains over samples in the back parlours of the inns.") *See also* James Davis Medieval Market Morality, 440-47 (discussing Thompson's notions of moral economy and bolstering the argument that the moral economy of the English crowd in the 18th century drew on earlier notions of just price and Medieval market morality).

scholars writing about other times and places.[46] Similar ideas, for example, have been identified as a motive force behind concerns with justice and fairness in contractual exchange prior to the 19th century in the United States and England. Most prominently, Morton Horwitz argued that the "equitable" conception of contract that prevailed in America prior to the commercial transformation of the nineteenth century had a normative grounding in medieval notions of just price.[47] Similarly, P.S. Atiyah identified just price as one of the "relics of medieval thought" that influenced basic understandings of contractual exchange and markets in England during the seventeenth and eighteenth centuries.[48] Like Thompson, Atiyah in particular stressed the role of custom and just price in regulating certain kinds of markets and protecting consumers against the abuses of monopoly.[49] In their attention to what Durkheim called the "morals of contractual relations," these authors embraced a notion of economic activity and markets that was intimately connected to and intertwined with broader notions of justice and social order.[50]

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[46] *See, e.g.*, James C. Scott, The Moral Economy of the Peasant: Rebellion and Subsistence in Southeast Asia 163-65 (1976) (discussing concept of just price as a component of moral consensus regarding fair exchange and as a means of maintaining subsistence among peasant communities in Southeast Asia).

[47] See Morton J. Horwitz, *The Historical Foundations of Modern Contract Law*, 87 Harv. L. Rev. 917, 935 (1974) (characterizing the equitable conception of contract in eighteenth century America as a "remnant of the medieval just price theory of value"). But see A.W.B Simpson, *The Horwitz Thesis and the History of Contracts*, 46 U. Chi. L. Rev. 533, 536-38 (1979) (criticizing Horwitz's invocation of "just price" and his broader equitable conception of contract as overly romantic and out of synch with the prevailing view of just price as the market price). The Horwitz thesis has continued to garner a fair amount of attention and controversy. See, e.g., Robert W. Gordon, *Morton Horwitz and His Critics: A Conflict of Narratives*, 37 Tulsa L. Rev. 915, 918-19 (2002) (summarizing the key points of the dispute between Simpson and Horwitz and referencing James Oldham's conclusion based on a survey of the controversy that the "great majority" of cases supported the Horwitz view).

[48] P.S. Atiyah, The Rise and Fall of Freedom of Contract 61-65 (1979) (discussing medieval notions of just price and their influence on eighteenth century understandings of contractual exchange and markets).

[49] Id., at 65 ("It is enough here to stress that if the older traditions about just prices were now (or perhaps even if they had always been) subject to market influences, it was quite clear that they did presuppose a certain type of market. They presupposed the absence of monopoly. They presupposed that the supply of foodstuffs, especially, should be open and above board; there should be no hoarding, no holding up the public to ransom in times of harvest failure. What was available for sale must indeed be made available, openly, and to customers before dealers. It was thus not so much a free market as a resulted market, and the regulation was largely in the interests of the consumers.").

[50] See Emile Durkheim, Professional Ethics and Civic Morals 211 (trans., Cornelia Brookfield 1957) ("A just contract is not simply any contract that is freely consented to, that is, without explicit coercion; it is a contract by which things and services are exchanged at the true and normal value, in short, at the just value."). For a broader historical investigation of notions of equality in exchange and their connection to ideas of just price, see James Gordley, *Equality in Exchange*, 69 Cal. L. Rev. 1587 (1991). There is, of course, also a vast anthropological literature on norms of exchange and

William Novak's conception of "public economy" and the "well-ordered market" in nineteenth century America evoked similar themes.[51] As Novak demonstrated, economic regulation in America was much older than standard histories suggested and it drew upon a basic commitment to directing economic activity in a manner that would enhance "the people's welfare."[52] Public economy, in his view, underwrote a large body of law and regulation directed at ensuring that markets functioned properly within a "well-regulated society."[53] Like Thompson's moral economy, Novak's public economy was rooted in "a vision of economic relations subject to the larger dictates of community and social mores."[54] But in contrast to Thompson's story, Novak stresses how these commitments to public economy in America were not "extralegal" but rather "firmly rooted in law and legislation."[55]

One does not have to travel far from these conceptions of just price, moral economy, and the public welfare to get to late nineteenth and early twentieth century conceptions of public utility in the United States. With *Munn v. Illinois*, the Supreme Court gave constitutional license to the states to use their police powers to regulate prices charged by "businesses affected with public interest"[56]— setting in motion a train of doctrinal and conceptual developments that culminated in the modern idea of public utility. Throughout the course of this development, price regulation in the public interest drew upon deeper intuitions about just price and fair exchange. As these commitments were absorbed into public utility regulation, they were gradually formalized and subjected to the dictates of

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reciprocity non-Western societies. See, e.g., Marcel Mauss, The Gift: The Form and Reason for Exchange in Archaic Societies (W.D. Halls trans., 1990 [1950]); Marshall Sahlins, Stone Age Economics (1972).

[51] See William J. Novak, The People's Welfare: Law & Regulation in Nineteenth-Century America 83-88 (1996); see also Novak, Social Control of Capitalism.

[52] Novak, The People's Welfare, supra note __ at 88.

[53] Id., at 95-105 (discussing the emergence of public markets in nineteenth century America and their extensive regulation). Although Novak does not identify any specific references to medieval notions of just price in his survey of these early forms of market regulation, his characterization of such regulations seems very much in keeping with the basic idea. See id., at 96 ("American public markets, like their Roman and English predecessors, were created to ensure an adequate supply of wholesome, fairly priced food and provisions accessible to the general population. . . . To leave unregulated something as central to the general welfare as the supply of basic foodstuffs was an abdication of public responsibility. Consequently, nineteenth-century states and municipalities used their police powers to construct regulated marketplaces to protect their populations from high prices, unhealthy goods, unsanitary conditions, fraud and cheating, and the adverse effects of simple profiteering by hucksters, forestallers, middle-men, and other second hand sellers.").

[54] Id., at 112.

[55] Id., at 87.

[56] Munn v. Illinois, 94 U.S. 113 (1877). See also Scheiber; Novak on Munn.

administration and technical expertise—a process that sometimes resulted in great confusion.

But even in the face of such confusion, the strong embrace of fairness as a basis for regulating the provision of essential services signaled a deep-seated conviction regarding the ethical dimensions of economic activity. And while such sentiments may seem antiquated in today's economy, they continue to inform various approaches to regulation, not to mention popular political sentiment. One can, moreover, be sympathetic to a broader, normative conception of economy while recognizing at the same time how limited it is in some circumstances. Moral economy, along with the notion of just price, reflected an approach to prices and price making that, though very different from that prevailing in contemporary markets, continues to exert a profound influence on common conceptions of economic justice and the case for regulation.

### C. *Public Utility*

Nowhere was that case stronger than in early 20th century thinking about public utility regulation in the United States.[57] Major treatises on public utility law and ratemaking, as well as more general statements on governmental price control and the social control of business, all made recourse to notions of just price. The standard account held that public utility regulation, with its basic commitment to fairness and regulation in the public interest, originated in medieval notions of just price. To take one example, Martin Glaeser, a student and colleague of John Commons and the author of several leading statements on public utility regulation, noted in his 1927 treatise that "[a]ll attempts to regulate economic life owed much to the prevalence of an economic idea which may be traced to the Church Fathers, namely, the doctrine of "just price."[58] According to Glaeser, St. Thomas Aquinas

[57] See Baldwin at 7 (discussing this conception of the medieval just price and collecting authorities who embraced this view). Some viewed the idea of just price as a proto-version of the labor theory of value. See, e.g., R.H. Tawney, Religion and the Rise of Capitalism at 48 ("The last of the schoolmen was Karl Marx.")

[58] Martin G. Glaeser, Outlines of Public Utility Economics 157 (1927). See also John Maurice Clark, Social Control of Business 23-25 (1926) (discussing Medieval conception of "just price" as part of the historical development of social control of economic activity); Henry Rottschaefer, *The Field of Governmental Price Control*, 35 Yale L. J. 438, 438 (1926) ("Governmental price regulation was practised at an early stage in English legal history, and constituted an important element in the economic life of the Middle Ages. It was an integral part of a social order strongly influenced by ethical conceptions of a just price capable of the same kind of objective determination as any other ethical standard."). Commons was himself a major figure in the history of public utility law. He drafted Wisconsin's public utility statute of 1907 and spent much of his career exploring the concept and practice of public utility regulation as a core part of his institutionalist approach to economics. {CITES}

and the "Schoolmen" considered the just price to be that "price which will repay the expenses of production."[59] This doctrine of "just price" was, in Glaeser's view, the basic "ethical element" at work in modern day attempts to regulate prices—the "main stem upon which other institutional developments [in public utility regulation] were grafted."[60]

Thus, even though economic historians and others had begun to question the strong version of an ethical, extra-market conception of just price during the middle of the twentieth century, this older understanding had already become embedded in the standard origins story of public utility regulation. As such, the notion of just price found obvious echoes in the basic "just and reasonable" standard that became commonplace in the new public utility legislation of the early twentieth century and the basic understanding of fairness in public utility rates as the balance between ratepayers and investors.[61]

The idea using cost-of-service as a basis for rates likewise drew upon the received understandings of just price as reflecting the costs of production.[62] Putting this into practice, of course, was easier said than done and cost-of-service ratemaking would be subject to a great deal of confusion and controversy for much of the first half of the twentieth century in no small part because of efforts to translate received notions of just price into a working doctrine of "fair value" for utility assets.[63]

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[59] Glaeser, Outlines of Public Utility Economics, supra note __ at 158.

[60] Martin Glaeser, Public Utilities in American Capitalism 197 (1957). See also Emery Troxel, Economics of Public Utilities 4 (1947) ("The 'just' prices of medieval times are prior examples of social controls of business. Like the reasonable prices of public utility service, the just prices were ethically controlled prices; they were measures of what a seller ought to get rather than what the market allowed him to get."). Glaeser's interpretation has proved to be particularly influential on later views. See, e.g., Charles F. Phillips, jr., The Regulation of Public Utilities: Theory and Practice 89-90 (3rd ed. 1993) (citing Glaeser's discussion of "just price" as one of the antecedents of public utility regulation).

[61] See, e.g., James C. Bonbright et al., Principles of Public Utility Rates 180-81 (2nd ed., 1988) (tracing notions of fairness and balance between investors and ratepayers back to medieval conceptions of "just price" as an ethical rather than an economic concept). Bonbright goes on to discuss the "babel of confusion as to what constitutes fairness" in setting rates and notes that "the modern tendency to view fairness criteria of reasonable rates as secondary criteria, to be accepted primarily as constraints on the application of the so-called economic criteria, is a mark of progress in the development of ratemaking policies." Id., at 182.

[62] See, e.g., Paul J. Garfield and Wallace F. Lovejoy, Public Utility Economics 3 (1964) ("The just price was the equivalent of the customary price. It was not competitively determined. Instead, it was a regulated price which permitted the seller to recover production costs plus a margin of profit sufficient only to maintain himself at the customary living standard of his class.").

[63] See infra.

Just price also influenced some of the more theoretical explorations of value undertaken by institutional economists and legal realists concerned with public utility law and ratemaking. John Commons's notion of reasonable value, for example, was rooted in a commitment to older notions of just price and drew directly upon his deep involvement in public utility regulation.[64] For Commons, disparity in bargaining power meant that one could never assume that the prices that emerged out of market transactions reflected the real or true value of what was being exchanged.[65] His theory of reasonable value thus sought to reflect what would have been the price in the absence of any such disparity.[66] Likewise, Robert Lee Hale's efforts to develop what Barbara Fried has referred to as a "rent theory" approach to exchange (and prices) echoed earlier conceptions of just price.[67] Although both of these efforts ultimately failed to get traction in the face of

[64] Commons's view of reasonable value, which, like much of his writing is not easy to follow, is part of his broader theory of social valuation—grounded in notions of fairness and justice, but also of social order. Commons rejected the dualism separating ethics and economics, arguing for an approach that saw individuals not as "atoms of a population, but citizens of a commonwealth kept together by inducements and sanctions of scarcity." (Institutional Economics at 226) see also id., at 225 ("One [theory of the origin of ethics] was the individualistic theory of the maximum of pleasure in a world of abundance, where the individual could not injure others by taking all he wanted. The other was a social theory of conflict of interests in a world of scarcity, where the individual may injure others if he takes all he wants. On the foundation of the latter theory ethics is a historical process developing out of the decisions of economic disputes, and there is no dualism of ethics and economics.").

[65] Id.

[66] For Commons, reasonable value should try as much as possible to accord with what he referred to as real value as opposed to the nominal values that emerge out of market transactions. And here, he makes a direct reference to Aquinas and the notion of just price: "Do we mean by real value that which is fair and reasonable as between all parties because there is no coercion or misrepresentation? If so, then nominal value is the actual price but real value is what ought to have been the price. This was the answer of the theological school whose leader was Thomas Aquinas, and it is the answer of the modern institutionalists." (Institutional Economics at 260). See also Ynge Ramstad, John R. Commons's *Reasonable Value and the Problem of Just Price*, 35 J. Econ. Issues 253, 2454 (2001) (arguing that Commons's theory of reasonable value "can be understood as resolving the long-neglected issue that originally stimulated inquiry into market values—the quest for principles ensuring just prices . . . [and] that at an abstract level, Reasonable Value itself is nothing other than a coherent and pragmatic, albeit secularized, solution to the problem of just price"); Kenneth H. Parsons, *John R. Commons Point of View*, 18 J. Land & Pub. Utility Econ. 245, 258-60 (1942) (discussing Commons theory of reasonable value).

[67] See, e.g., Robert Lee Hale, *Bargaining, Duress, and Economic Liberty*, 43 Colum. L. Rev. 603, 625-26 (1943) ("The fact that transactions do not deviate from normal market values does not necessarily indicate that there is a fair relation between the respective bargaining powers of the parties. The market value of a property or a service is merely a measure of the strength of the bargaining power of the person who owns the one or renders the other, under the particular legal rights with which the law endows him, and the legal restrictions which it places on others. To hold unequal bargaining power economically justified, merely because each party obtains the market value of what he sells, no more and no less, is to beg the question."). See also Barbara Fried, Progressive Assault on Laissez Faire: Robert Lee Hale and the First Law and Economics Movement.

neoclassical economics and its growing formalization during the middle decades of the twentieth century, they demonstrate how a broader understanding of public utility as a normative undertaking shaped the manner in which leading institutional economists and legal realists viewed economic exchange.

## II. Price – By Way of Litigation

The concept of just price found new life in late 19th century America as states began to use their police powers to regulate the prices charged by certain businesses. With *Munn v Illinois*, state legislatures were free to establish rates for those businesses "affected with a public interest."[68] For the next half century, legislatures and courts struggled to define the boundaries of this category. With its 1934 decision in *Nebbia v. New York*, the Supreme Court finally abandoned the effort, holding that there was no closed category of businesses "affected with a public interest" and that legislatures were free to move forward in regulating businesses as long as they had a rational basis for doing so.[69]

In the meantime, a robust body of law had developed around the concept of public utility and the role of public utility commissions (PUCs) in regulating rates charged by these businesses. Indeed, notwithstanding the doomed efforts to define a category of businesses "affected with a public interest," these public utilities had long been viewed as appropriate for price regulation because of their overall importance to the economy and their distinctive economic characteristics. As Felix Frankfurter put it in 1930, "[t]o think of contemporary America without the intricate and pervasive systems which furnish light, heat, power, water, transportation, and communication, is to conjure up another world. The needs thus met are today as truly public services as the traditional governmental functions of police and justice."[70]

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[68] Munn v. Illinois, 94 U.S. 113 (1877). The standard interpretation of *Munn* viewed it as a conservative opinion that limited regulation to only those businesses so "affected with a public interest," thus inhibiting regulation of other businesses. *Id.* at 126. *But see* Novak, *supra* note, at 401–04 for a revisionist view of *Munn* as an expansive and innovative approach to regulation in the public interest. See also Harry N. Scheiber, The Road to Munn: Eminent Domain and the Concept of Public Purpose in the State Courts 330-31 (noting that Munn was not so much a new beginning as it was a culmination of a line of cases exploring the extent to which private property would be subordinated to the public interest).

[69] Nebbia v. New York, 291 U.S. 502, 536 (1934) ("It is clear that there is no closed class or category of businesses affected with a public interest . . . . The phrase 'affected with a public interest' can, in the nature of things, mean no more than that an industry, for adequate reason, is subject to control for the public good."). See also Fried, Progressive Assault on Laissez Faire, supra note __ at 175 ("After *Nebbia*, the Court never again interfered with a legislature's decision about *which* enterprises were regulable.")

[70] FRANKFURTER, *supra* __, at 81.

What was distinctive in an economic sense about these industries were their high fixed-capital requirements, substantial economies of scale, and extensive reliance on a network infrastructure that was expensive to build and maintain.[71] Together, these characteristics facilitated what economists since the late nineteenth century had referred to as "natural monopoly"—the basic idea being that because of declining average costs across the relevant demand curve, the industry was served most cost-effectively by a single firm.[72] As a result, the antitrust laws were not particularly effective in policing the exercise of market power and trying to impose remedies that would restore multifirm competition.[73] Rate regulation thus provided an alternative means of regulating those sectors of the economy that were seemingly beyond the full reach of the antitrust laws.[74]

As a species of common carriers, railroads provided the first major opportunity to experiment with rate regulation.[75] Over time, it became apparent

[71] *See* HUGHES, *supra* __, at 463–65 (summarizing key features of large regional electric power systems that emerged in the United States and other western countries during the half century between 1880 and 1930); JOHN MAURICE CLARK, STUDIES IN THE ECONOMICS OF OVERHEAD COSTS 318–22 (1923) (discussing distinctive economic characteristics of utilities, including large investments in highly specialized assets and substantial "economies of size").

[72] *See* Adam Plaiss, *From Natural Monopoly to Public Utility: Technological Determinism and the Political Economy of Infrastructure in Progressive-Era America*, 57 Tech. & Cult. 806 (2016) (discussing influence of natural monopoly concept on public utility regulation); PAUL J. GARFIELD & WALLACE F. LOVEJOY, PUBLIC UTILITY ECONOMICS 15–19 (1964) (discussing historical understandings of the natural monopoly characteristics of public utilities); *see also* Manuela Mosca, *On the Origins of the Concept of Natural Monopoly: Economies of Scale and Competition*, 15 Eur. J. Hist. Econ. Thought 317 (2008) (tracing history of natural monopoly concept in economics).

[73] *See, e.g.*, Bruce Wyman, *The Law of the Public Callings as a Solution of the Trust Problem*, 17 HARV. L. REV. 156, 163 (1904) (observing that with respect to the "troublesome problem of the public utilities, . . . experience has shown that . . . many of the public works can be conducted with advantage only upon the basis of exclusive franchise" and concluding that "it is necessary for the perpetuity of competitive conditions in general, that, in the particular instances of monopolistic conditions, the state should proceed to establish a legal monopoly and then apply to that situation such strict regulation as the exigency demands"); *see also* STEPHEN BREYER, REGULATION AND ITS REFORM 158 (1982) (describing the classical view of regulation as "an alternative to antitrust, necessary when antitrust cannot successfully maintain a workably competitive marketplace of when such a marketplace is inadequate due to some other serious defect").

[74] Of course, the antitrust laws have long been held to apply to certain forms of anti-competitive behavior engaged in by regulated public utilities. *See, e.g.*, Otter Tail Power Co. v. United States, 410 U.S. 366, 374–75 (1972) (concluding that the Federal Power Act did not immunize Otter Tail power from regulation under the antitrust laws for its refusal to deal with municipal utilities).

[75] *See* John R. Commons, *The Wisconsin Public-Utilities Law*, 36 AM. REV. REVIEWS 221, 221 (1907) [hereinafter Commons, *Wisconsin Public-Utilities Law*] (discussing the importance of the Wisconsin Railroad Law of 1905 in establishing "the principle of regulation through a commission appointed by the Governor" that was subsequently applied in 1907 to "other public utilities");

that natural gas, electricity, and telephone service exhibited similar characteristics. During the late nineteenth- and early twentieth-centuries, local governments struggled with how to regulate these emerging network industries—with some opting for competition among firms for limited municipal franchises and others seeking outright public ownership.[76] State regulation emerged around the turn of the century as a third alternative, gaining momentum with the establishment of state railroad commissions in several states.[77]

Beginning with New York and Wisconsin in 1907, regulation by state commission spread rapidly across the country in a "veritable epidemic of laws."[78] By 1930, every state but Delaware had a public utility statute that charged some type of administrative entity with responsibility for regulating public utilities such

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Dimock, *supra* note __, at 266 ("[T]he regulation of railways . . . furnished the real institutional foundation for both British and American public utility regulation.").

[76] *See* Robert L. Bradley, Jr., *The Origins and Development of Electric Power Regulation, in* THE END OF A NATURAL MONOPOLY: DEREGULATION AND COMPETITION IN THE ELECTRIC POWER INDUSTRY 43, 46–61 (Peter Z. Grossman & Daniel H. Cole eds., 2003) (discussing the municipalization movement at the turn of the century and the move to regulation by state commissions); DANIEL T. RODGERS, ATLANTIC CROSSINGS: SOCIAL POLITICS IN A PROGRESSIVE AGE 130–59 (1998) (discussing the Progressive era movement for municipalization).

[77] *See* Bradley, *supra* note __, at 48–50; Forrest McDonald, *Samuel Insull and the Movement for State Utility Regulatory Commissions*, 32 BUS. HIST. REV. 241, 247–51 (1958). There is a diverse literature on the origins of public utility regulation, with strong competition explanations between those advancing a public interest theory or regulation and those arguing for a public choice, or capture, explanation, which held that regulated entities actively sought regulation and used it for their benefit. *See, e.g.*, George J. Stigler, *The Theory of Economic Regulation*, 2 Bell J. Econ. & Mgmt. Sci. 3, 3 (1971) ("[A]s a rule, regulation is acquired by the industry and is designed and operated primarily for its benefit."); *see also* Jim Rossi, *Public Choice, Energy Regulation and Deregulation*, *in* Research Handbook on Public Choice and Public Law 419, 421–22 (Daniel A. Farber & Anne Joseph O'Connell eds., 2010) (discussing the capture theory of regulation advanced by Stigler and others and its applicability to electricity regulation). *But see* George L. Priest, *The Origins of Utility Regulation and the "Theories of Regulation" Debate*, 36 J.L. & Econ. 289, 323 (1993) ( "The search for a single theory of regulation . . . does not illuminate regulatory behavior. . . . [T]he assertion that an agency has been 'captured' by a utility or is serving that utility's economic interests necessarily is too crude a depiction of the regulatory relationship.").

[78] Mosher, *A Quarter-Century of Regulation*, *supra* __, at 35, 36 (1930); Massachusetts established its own independent Gas and Electric Commission in 1885, more than twenty years before the Wisconsin and New York statutes. *See* MARTIN G. GLAESER, OUTLINES OF PUBLIC UTILITY ECONOMICS 235 (1927) (discussing Massachusetts Gas and Electric Commission established in 1885). *See also* RODGERS, *supra* note __, at 155 (describing spread of public utilities laws during early twentieth century as a "legislative fad"). It is important to recognize, however, that there was considerable diversity regarding jurisdiction and substantive authority to regulate various types of public utilities across the different states. *See generally* William E. Mosher, *Defects of State Regulation of Public Utilities in the United States*, 201 ANNALS AM. ACAD. POL. & SOC. SCI. 105 (1939) [hereinafter Mosher, *Defects of State Regulation*] (discussing the differences among states regarding the regulation of public utilities).

as water, gas, and electricity.[79] These were quintessential Progressive-era laws, built on principles of scientific management and regulation by experts.[80] Statutory mandates were typically broad and open-ended, founded on the goal of ensuring that rates were just, reasonable, and nondiscriminatory in order to strike the appropriate balance between ratepayers and investors.[81] Given the existence of widespread corruption in many municipal governments and constant logrolling in the state legislatures, independent commissions staffed with experts were viewed as the most effective means of achieving this balance and securing the benefits of natural monopoly for consumers.[82]

Widely considered the strongest of the early public utility statutes, the Wisconsin law was drafted by John R. Commons.[83] Key features included mandatory universal service, protected local franchises, delegated powers of

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[79] *See* GARFIELD & LOVEJOY. at 32–33. *But see* Mosher, *Defects of State Regulation*, *supra* note __ (discussing the wide variation among state public utility laws regarding scope and authority of the state commissions).

[80] *See, e.g.*, FINLA G. CRAWFORD ET AL., ELECTRICAL UTILITIES: THE CRISIS IN PUBLIC CONTROL 35 (William E. Mosher ed., 1929) ("When it was inaugurated, commission regulation was hailed as the introduction of 'scientific' methods and as the beginning of an era of control which would be definite, precise and eventually almost automatic.").

[81] *See, e.g.*, Eugene A. Gilmore, *The Wisconsin Public Utilities Act*, 19 THE GREEN BAG 517, 517–18 (1907) ("The object of the [Wisconsin Public Utilities Act] is to secure adequate service from all public utilities under conditions which are fair and reasonable, not only to the public, but also to the corporations concerned . . . ."). See also Federal Power Comm'n v. Hope Natural Gas, 320 U.S. 591. 603 (1944) ("The rate-making process under the [Natural Gas] Act, i.e., the fixing of 'just and reasonable' rates, involves a balancing of the investor and the consumer interests.").

[82] *See* RODGERS, ATLANTIC CROSSINGS, *supra* note __, at 155 ("It was the experience of democratized corruption that ultimately made the expert regulatory commission idea so attractive—beyond its handiness and familiarity, beyond the utility companies' sub-rosa promotion of it, beyond the dynamics of a legislative fad."); John R. Commons, *How Wisconsin Regulates Her Public Utilities*, 42 AM. REV. REVIEWS 215, 215 (1910) [hereinafter Commons, *How Wisconsin Regulates Her Public Utilities*] (noting the "elasticity" or "adjustability" of the Wisconsin law which "[i]nstead of laying down rigid rules, as has been customary, . . . creates a commission and staff of scientific investigators . . . [who] are commanded to 'investigate and ascertain' for each public utility what is the 'reasonable value' of the service which it renders to the public" (internal quotation marks omitted)).

[83] Commons and others viewed public utility as one of the core concerns of institutional economics. *See, e.g.*, JOHN R. COMMONS, LEGAL FOUNDATIONS OF CAPITALISM 327–29 (1924) [hereinafter COMMONS, LEGAL FOUNDATIONS OF CAPITALISM] (discussing broad concept of public utility, its relation to "the public," and its application to particular types of businesses); John R. Commons, *Institutional Economics*, 26 AM. ECON. REV. 237, 242 (1936) ("[I]nstitutional economics is the field of the public interest in private ownership . . . ."). For an earlier statement on institutional economics and its attention to problems of social control in modern industrial society, see Walton H. Hamilton, *The Institutional Approach to Economic Theory*, 9 AM. ECON. REV. 309, 312–14 (1919). *See also* Malcolm Rutherford, *Understanding Institutional Economics: 1918–1929*, 22 J. HIST. ECON. THOUGHT 277, 299 (2000) ("Public utilities, including issues relating to the valuation of utility property and the proper basis for rate regulation, were major areas of institutionalist research.").

eminent domain, a cost-based "used and useful" standard for valuing assets as part of rate base, a uniform system of accounting, commission powers of investigation and adjudication, and, most importantly, a requirement that utility rates be "reasonable and just."[84] With the Wisconsin statute, the notion of just price thus found a new, more secure legal foundation—one that allowed it to reach deep into private enterprise and, by extension, the larger economy.

The new federal public utility statutes of the 1930s—most notably Part II of the Federal Power Act and the Natural Gas Act—used similar language, charging the Federal Power Commission (FPC) with the responsibility to ensure that rates for wholesale sales and transmission in interstate commerce would be "just and reasonable."[85] These statutes were intended to complement state regulation and to fill the gaps that were emerging as interstate transactions grew. Like its state PUC counterparts, the FPC focused on setting cost-based rates and policing against discriminatory behavior in accordance with the just and reasonable standard—a standard that is still in force today though, as we will see, has been adapted to the new realities of restructured natural gas and electricity markets.

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[84] Section 1797m-3, Laws of Wisconsin 1907 at 448 ("The charge made by any public utility . . . shall be reasonable and just, and every unjust and unreasonable charge for such service is prohibited and declared unlawful."). *See also* Commons, *How Wisconsin Regulates Her Public Utilities*, *supra* note __, at 216 (discussing Wisconsin approach to valuation of utility assets, described as "physical valuation," which he defines as "nothing more or less than the cost of construction or reconstruction of the physical property"); Commons, *Wisconsin Public-Utilities Law*, *supra* note __, at 222–24 (discussing key features of the Wisconsin law); George B. Hudnall, *The Public Service Commission Law of Wisconsin*, 4 PROC. AM. POL. SCI. ASS'N. 316 (1907) (elaborating on key features of the Wisconsin law). In a 1923 decision, the Wisconsin Supreme Court, drawing on the work of Robert Lee Hale, interpreted the statute as requiring an approach to rate base valuation that gave controlling weight to the "prudent investment" standard. Waukesha Gas & Elec. Co. v. R.R. Comm'n of Wis., 194 N.W. 846, 854 (1923) ("In determining the present fair value of a public utility operating under our public utility law, it is our view that justice as well as sound economic practice requires that controlling weight should be given in the valuation of the plant of a public utility to the investment cost where the investment has been prudently made."). Hale wrote his dissertation on Wisconsin's approach to valuation and ratemaking. *See* MALCOLM RUTHERFORD, THE INSTITUTIONALIST MOVEMENT IN AMERICAN ECONOMICS, 1918–1947: SCIENCE AND SOCIAL CONTROL 234 (2011). On the importance of a uniform system of accounts as a basis for effective regulation in the Wisconsin law, see CHARLES MCCARTHY, THE WISCONSIN IDEA 192 (1912) ("We cannot attempt to regulate railroads or great public utilities unless our public service is in itself so organized that it has a thorough understanding of the intricate systems of cost accounting and efficiency used by these great economic units."); *see also* Jay H. Price, Jr. et al., *Accounting Uniformity in the Regulated Industries*, 30 LAW & CONTEMP. PROBS. 824, 830–36 (1965) (discussing the history of efforts to establish a uniform system of accounts as a basis for public utility regulation).

[85] See Part II Federal Power Act 1935 (giving FPC jurisdiction over wholesale sales of electricity and transmission in interstate commerce); Natural Gas Act of 1938 (giving FPC jurisdiction over wholesale sales of natural gas and transportation in interstate commerce).

In sum, public utility regulation as it emerged in the first half of the twentieth century, and as exemplified by leading state and federal statutes, could be seen as a grafting of the older normative concerns associated with just price onto more modern concerns with natural monopoly and the regulatory challenges posed by large, capital-intensive network industries. Over time, the more explicitly normative justifications receded in the face of a more robust and explicitly economic rationale for regulation. But the basic commitment to just price—as manifest in the statutory just and reasonable standard—has proven remarkably durable. This part shows how this commitment was operationalized through the traditional model of cost-of-service ratemaking. Specifically, it discusses the challenges confronting ratemaking as a result of the Supreme Court's misguided "fair value" rule as well as subsequent efforts to open up ratemaking in a manner that paved the way for FERC's more recent embrace of markets and the forces of competition as a means to ensure that rates (prices) will satisfy the just and reasonable standard.

### A. Ratemaking

The dominant mechanism for fixing prices under public utility regulation (both federal and state) was the rate case—a hybrid exercise that combined administration with formal adjudication before an Administrative Law Judge, the commission, and, if necessary, the courts to determine the value of various elements used in setting specific rates for a particular utility.[86] These included the value of physical assets (the so-called rate base), the financing charges associated with investments in those assets (the rate of return), operating expenses, taxes, depreciation, and the like. A uniform system of accounts was developed to give the effort more structure and constrain discretion.[87] General legal principles of prudence and reasonableness were used to determine whether certain investments or expenditures could be recovered in rates. And the entire undertaking was guided by the broad statutory command that the resulting rates be "just and reasonable."

But the practice of ratemaking was less straightforward than early proponents likely expected. For their part, Commissions were often badly

[86] In addition to setting rates through a traditional rate case, both the Federal Power Act and the Natural Gas Act allowed (and even encouraged) rates set by contract. Such contracts would then be reviewed by and on file with the Commission. Under the Mobile-Sierra doctrine, rates established through freely negotiated contracts were presumed to be just and reasonable.

[87] See Hamilton, Cost as a Standard for Price, 4 Law & Contemp. Probs. 321, 323 (1937) (discussing powerful role of accounting on determining what counts as cost and thus price). See also Commons, supra.

outmatched by utility lawyers and experts.[88] Highly technical questions about load forecasts, investment plans, asset valuation, financing charges, the prudency of various expenditures, proper accounting techniques, and rate structures often put Commissions and their staff on the defensive as they tried to navigate their way to just and reasonable rates. For much of the first half of the twentieth century, moreover, the courts spent a great deal of time policing the constitutional dimensions of ratemaking methodology, creating an additional layer of concern for Commissions in their efforts to value utility assets.[89]

As a result, the entire ratemaking exercise all too often devolved into an elaborate process of adjudication—what Walton Hamilton characterized as "price by way of litigation."[90] "The invocation of the courts," he argued, "is an extravagant expense to all concerned. It brings into the process of price-making the devices of litigation, contrived for another purpose, alien to the task, and set to a far slower tempo. The introduction of juristic procedures into the process of price-making is an invitation to frustration."[91] In short, progressive era visions of independent commissions staffed by experts and capable of arriving at a scientific determination of rates were a far cry from the reality of rate case adjudications and the inevitable litigation that ensued.

By mid-century, criticisms of the "judicialization" of rate-making were widespread.[92] Rate cases could drag on for months, requiring large expenditures of resources. By the time rates were finally fixed, moreover, they were often already out of synch with current costs and market conditions. In a rapidly evolving

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[88] See, e.g., Hamilton, *Price by Way of Litigation,* 1019 ("It is the utilities which have taken the offensive; the law reports are almost barren of cases brought against commissions by consumers for the reduction of rates. The technical prayer of a taking of property without due process has marked out the lines of litigious combat. An alert group of experts—engineers, accountants, financiers, lawyers—have been omnipresent to commute interests that sought to be vested into legal rights which the Constitution itself must sanction. The commissions, under-staffed and with inadequate access to the facts, have had to accept statement of question and field of battle.").

[89] See Part II.B infra.

[90] See Hamilton, *Price by Way of Litigation*, supra note __. See also Robert Lee Hale, Commissions, Rates, and Policies, 53 Harv. L. Rev. 1103, 1103 (1940) ("But while the statutes require commissions to conform to standards of 'reasonableness,' they fail to indicate what the legislature regards as 'reasonable,' and it is the courts that have provided whatever standards of 'reasonableness' govern commissions.").

[91] Hamilton, *Price by Way of Litigation*, 1034.

[92] See, e.g., Mosher, A Quarter-Century of Regulation, supra ___, at 43 (discussing major functions of commissions to protect the public interest and to adjudicate rate cases and noting that "[t]he judicial function has encroached upon, if it has not practically supplanted, that of public defender"). See also ALFRED E. KAHN, THE ECONOMICS OF REGULATION: PRINCIPLES AND INSTITUTIONS, Vol. 2 at 86–92 (1988 [1971]) (discussing ways in which the increased adjudicatory role of regulatory commissions undermines broader legislative and executive functions).

economy, the standard approach to ratemaking proved to be a grossly inefficient way of fixing prices. Part of the problem, as it turned out, lay with the residual influence of just price and its entanglement with the Supreme Court's concept of "fair value."

### B. Fair Value

Twenty-one years after *Munn*, the Court decided *Smyth v. Ames*, a case that involved the question of how to properly value a railroad's investment in its physical assets (its rate base) without running afoul of Constitutional protections for private property.[93] The resulting rule—that the value of the rate base should be based on the "fair value" of the assets—imbued the notion of just price with powerful Constitutional overtones.[94] It also created massive confusion for much of the next half century.

The severe criticisms leveled by judges, lawyers, and others against the fair value rule are well rehearsed.[95] The rule created, as Justice Frankfurter put it, "a maze of cobwebbery"—the practical import of which was to bring courts deep into the process of ratemaking, forcing them to police the constitutionality of particular choices made regarding the valuation of utility assets.[96] As Robert Lee Hale and others pointed out, setting rates based on the fair value of the assets was hopelessly circular given that the value of the utility's assets depended on the rates that it was allowed to charge.[97]

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[93] Smyth v. Ames, 169 U.S. 466, 546-47 (1898) (holding that "the basis of all calculations as to the reasonableness of the rates to be charged by a corporation maintaining a highway under legislative sanction must be the fair value of the property being used by it for the convenience of the public").

[94] Id.

[95] Writing in dissent in a 1935 case regarding telephone rates, Justice Stone described the effort as "the most speculative undertaking imposed upon [courts] in the entire history of English jurisprudence." West v. Chesapeake & Potomac Tel. Co. of Baltimore, 295 U.S. 662, 689 (1935) (Stone, J., dissenting). The Wisconsin Supreme Court offered a similar lament in a 1923 case on rate base valuation under the Wisconsin public utilities law. *See* Waukesha Gas & Elec. Co. v. R.R. Comm'n, 194 N.W. 846, 850 (1923) (describing the effort to determine "fair value" as "one of the most complex and involved subjects with which courts are called upon to deal"). See also *See* Gerard Henderson, *Railway Valuation and the Courts* (pt. 3), 33 Harv. L. Rev. 1031, 1051 (1920) ("The whole doctrine of *Smyth v. Ames* rests upon a gigantic illusion. The fact which for twenty years the court has been vainly trying to find does not exist. 'Fair value' must be shelved among the great juristic myths of history, with the Law of Nature and the Social Contract. As a practical concept, from which practical conclusions can be drawn, it is valueless.").

[96] Frankfurter, The Public and its Government 104 (1930).

[97] Hale, *The "Physical Value" Fallacy*, *supra* note __, at 716 ("[T]here are authorities who admit that the value depends upon the earnings, but insist that the vicious circle involved (in basing the earnings on the value) can be escaped merely by the simple expedient of measuring the value by replacement cost or some other 'evidence'! Like ostriches, they imagine that by blinking the fact they

Much of the confusion stemmed from the misconceived notion that a utility's assets had a "fair value" that could be discovered or determined through the application of particular valuation techniques. This derived in turn from an uncritical incorporation of received notions of just price combined with an overly "physicalized" conception of property. As one economist writing in 1930 put it:

> Unfortunately the fundamental problem of regulation, at least as far as business aspects are concerned, has been obscured in the entanglements that have arisen around the concept of fair value. We have been side-tracked so beautifully by medieval concepts of a just price and by juristic concepts of property and property values . . . that we have paid little attention to the finances and financial requirements of public service corporations, and to the income which they must offer their investors and prospective investors in order to maintain their credit position in competition with other enterprises.[98]

Instead of focusing on the prudency of specific investments and looking to conditions in the capital markets to determine the rate of return a utility needed to continue as a going concern, the fair value rule forced commissions and courts to engage in detailed exercises directed at the valuation of utility assets so as not to trigger an unconstitutional taking of private property. Only after such an exercise was complete and only on the basis of the fair value of the assets was it permissible to set rates. The overall effect of such a requirement was to make the judiciary the "back-seat drivers of the price fixing machine" that was rate regulation.[99]

### C. End Result

It would take the better part of 50 years for the Supreme Court to clean up the mess it had made in *Smyth v. Ames*. After several false starts, the Court finally succeeded in abandoning the fair value rule in the 1944 *Hope Natural Gas* case,

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can escape its consequences."). *See also* Missouri ex rel. Southwestern Bell Tel. Co. v. Pub. Serv. Comm'n, 262 U.S. 276, 292 (1923) (Brandeis, J., dissenting) ("The rule of *Smyth v. Ames* sets the laborious and baffling task of finding the present value of the utility. It is impossible to find an exchange value for a utility, since utilities, unlike merchandise or land, are not commonly bought and sold in the market. Nor can the present value of the utility be determined by capitalizing its net earnings, since the earnings are determined, in large measure, by the rate which the company will be permitted to charge, and thus, the vicious circle would be encountered.").

[98] D.F. Pegrum, *Legal Versus Economic Principles in Utility Valuation*, 6 J. Land & Pub Utility Econ. 127, 133 (1930).

[99] See Federal Power Comm'n v. Hope Natural Gas, 320 U.S. 591, 652 (1944) (Jackson, j. dissenting).

extricating the courts from reviewing the methodology of ratemaking and relegating them to the more appropriate role of policing the constitutional boundaries of the end result.[100] Writing for the majority, Justice Douglas concluded that

> The fixing of prices, like other applications of the police power, may reduce the value of the property which is being regulated. But the fact that the value is reduced does not mean that the regulation is invalid. It does, however, indicate that 'fair value' is the end process of rate-making not the starting point. . . . The heart of the matter is that rates cannot be made to depend upon 'fair value' when the value of the going enterprise depends on earnings under whatever rates may be anticipated.[101]

With *Hope*, the Court had finally "freed regulation from the obligation to perform the costly and meaningless rituals of *Smyth v. Ames*."[102] Writing in 1948, one prominent scholar of public utility law declared that the decision was "one of the most important pronouncements in the history of American law."[103]

As such, it brought utility rate making into accord with contemporary currents of administrative law. Expert agencies such as the Federal Power

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[100] Fed. Power. Comm'n v. Hope Natural Gas Co., 320 U.S. 591, 602 (1944) ("Under the statutory standard of 'just and reasonable' it is the result reached not the method employed which is controlling. . . . It is not theory but the impact of the rate order which counts. If the total effect of the rate order cannot be said to be unjust and unreasonable, judicial inquiry under the Act is at an end. The fact that the method employed to reach that result may contain infirmities is not then important."). The majority's reasoning in Hope echoed a concurring opinion by Justices Black, Douglass and Murphy two years prior. See Federal Power Comm'n v. Natural Gas Pipeline Co., 315 U.S. 575, 603 (1942) (Black, Douglas, and Murphy, JJ. concurring) ("[T]he value of a going concern in fact depends on earnings under whatever rates may be anticipated. The present fair value rule creates, but offers no solution to, the dilemma that value depends upon the rates fixed and the rates upon value. . . . We know, without attempting any valuation, that if earnings are reduced the value will be less. But that does not stay the hand of the legislature or its administrative agency in making rate reductions. As we have said, rate-making is one species of price-fixing. Price-fixing, like other forms of social legislation, may well diminish the value of the property which is regulated. But that is no obstacle to its validity.").

[101] 320 U.S. at 601.

[102] Robert L. Hale, *Utility Regulation in the Light of the Hope Natural Gas Case*, 44 COLUM. L. REV. 488, 530 (1944). *See also id.* at 496 ("It is to be hoped that the Supreme Court's tardy but conclusive demonstration of the fair value fallacy will lead commissioners and judges of lower courts to appreciate that much that has been hitherto stated in decisions stemming from *Smyth v. Ames* is irrelevant.").

[103] James C. Bonbright, Utility Rate Control Reconsidered in the Light of the Hope Natural Gas Case, 38 Am. Econ. Rev. 465, 465 (1948). *See also id.* ("Unless the Court again reverses itself, no longer will it impose upon legislatures or commissions, state and federal, the severe restrictions upon their power to fix rates that it had previously imposed under its doctrine in Smyth vs. Ames.").

Commission were now viewed as having primary responsibility for fixing prices.[104] There was no single, correct methodology—no one right way—of setting rates, and commissions would receive deference in their choice of methods. For their part, courts would determine whether the "end result" of the ratemaking exercise, taken in its entirety, satisfied the "just and reasonable standard."[105] To be sure, this carried with it a duty to police the constitutional boundaries of the resulting rates—to ensure that they were not so low as to be confiscatory.[106] But in the vast majority of cases, the courts simply deferred to the commissions, no longer twisting themselves into knots trying to make the methods of valuation at the heart of ratemaking comport with received notions of property and its constitutional protections.

Over time, a general view took hold that rate regulation should try to set prices at a level that would mimic the prices expected in a competitive market.[107] The proxy used for this counter-factual exercise was cost-of-service. Just and reasonable rates, therefore, were implicitly judged against a baseline of competitive markets and the neoclassical assumption that prices in such markets reflected marginal costs. In a first-best world, the forces of competition would ensure that prices were just and reasonable. But in industries where this was not feasible, due to the presence of natural monopoly characteristics or other barriers, price regulation should strive as much as possible to set rates at levels expected to prevail in a competitive market. Viewed in retrospect, the entire exercise seemed oddly circular: because competitive markets cannot work as intended in these industries, rate regulation is necessary, but in setting rates, every effort should be made to

[104] Douglas, who authored the majority opinion in Hope, had already made a strong statement to this effect in his concurring opinion in the earlier Pipeline Case. See 315 U.S. 575, 608 (Douglas J., concurring) (concluding that "the problem of ratemaking is for the administrative experts not the courts").

[105] Hope, 320 U.S. at 602 ("If the total effect of the rate order cannot be said to be unjust and unreasonable, judicial inquiry under the Act is at an end. The fact that the method employed to reach that result may contain infirmities is not then important.").

[106] See, e.g., Duquesne Light Co. v. Barasch, 488 U.S. 299, (1989) ("Today we reaffirm these teachings of *Hope Natural Gas:* '[I]t is not theory but the impact of the rate order which counts. If the total effect of the rate order cannot be said to be unreasonable, judicial inquiry ... is at an end. The fact that the method employed to reach that result may contain infirmities is not then important.' This language, of course, does not dispense with all of the constitutional difficulties when a utility raises a claim that the rate which it is permitted to charge is so low as to be confiscatory: whether a particular rate is "unjust" or "unreasonable" will depend to some extent on what is a fair rate of return given the risks under a particular rate-setting system, and on the amount of capital upon which the investors are entitled to earn that return. At the margins, these questions have constitutional overtones.") (citations omitted).

[107] Cites

mimic the outcome of a competitive market.[108] In the end, most commissions simply embraced a version of cost-of-service ratemaking that was tied to prudent investments and expenditures as well as a rate of return necessary to continue accessing the capital markets.

More important for the subject of this Article, *Hope's* focus on the end result paved the way for later moves to a system of market based rates in both natural gas and electricity. As part of its restructuring efforts, as we will see, FERC developed a system of blanket marketing certificates and market-based rate authority to give jurisdictional sellers of natural gas and electricity permission to transact freely in the markets. Market screens were used to determine whether those applying for market-based rate authority had the ability to exercise market power and distort prices. By insulating markets ex ante from sellers with market power, FERC assumed that the forces of competition would operate without interference. Viewed in the context of *Hope*, the effort constituted a new method of setting rates that would mobilize the forces of competition to ensure that the resulting prices (the end result) would satisfy the statutory just and reasonable standard.[109]

With restructuring and the move to market-based rates, FERC thus embraced the notion that prices formed in competitive markets were just and reasonable. The old approach to price making embodied in the utility rate case (price—by way of litigation) would be replaced at least in part by new ways of price making that depended much more fundamentally on markets (and what FERC often referred to as "the forces of competition") to ensure that prices were just and reasonable. In making this move, FERC unwittingly resurrected an earlier understanding of just price as that which prevailed in open and competitive markets. Only in cases of market power would FERC need to step in and assert its authority to fix prices. Otherwise, light-handed regulation would suffice. As we will see, this proved far more challenging than FERC expected at the outset of restructuring.

[108] Never mind, moreover, that the entire exercise depended upon an underdeveloped view of the ways of price making in actual markets. 1950s was ironically the heyday of recognition that most prices in most markets were administered.

[109] To date, The Ninth Circuit and the DC Circuit have agreed with FERC and upheld its argument that market-based rates satisfy the just and reasonable standard. But the Supreme Court has yet to weigh in on the question. See Morgan Stanley. See also Spence and Prentice, Transformation of American Energy Markets, supra note __ at 197-200 (surveying doctrinal landscape regarding question whether market based rates satisfy the just and reasonable standard).

## III. Price – By Way of Index

FERC launched its first major restructuring effort in the mid-1980s, focusing on the natural gas industry. Taking its cues from Congress, the Commission sought to unbundle the natural gas pipeline business, separating gas sales from gas transportation and establishing an open-access transportation regime that would provide the foundation for competitive natural gas markets. It would take the better part of a decade to complete the effort and, by virtually all accounts, restructuring has been quite successful in creating robust markets and lowering prices. But there have been challenges, and FERC continues to struggle, as this part will demonstrate, with the ways of price making that operate at the heart of U.S. natural gas markets.

The natural gas industry in the United States is a vast network of continental scope that involves thousands of different entities providing a vital service to millions of end users across the country. Viewed as a single, integrated supply chain, the industry includes 555,364 active wells,[110] 11,565 miles of gathering lines,[111] 297,409 miles of transmission pipelines, an extensive network of storage facilities, and some 2,190,825 miles of local distribution lines.[112] Since 2005, with the substantial increase in unconventional shale gas production, natural gas prices have declined dramatically, leading to large increases in the use of natural gas across all of the major consuming segments: industrial, commercial, residential, and electricity generation.[113]

[110] U.S. Energy Information Administration, Number of Producing Gas Wells, https://www.eia.gov/dnav/ng/NG_PROD_WELLS_S1_A.htm. These numbers include gas and gas condensate wells.

[111] Pipeline and Hazardous Materials Safety Administration, Annual Report Mileage for Natural Gas Transmission & Gathering, January 3 2017, http://www.phmsa.dot.gov/pipeline/library/data-stats/annual-report-mileage-for-natural-gas-transmission-and-gathering-systems

[112] Pipeline and Hazardous Materials Safety Administration, Annual Report Mileage for Natural Gas Transmission & Gathering, January 3 2017, http://www.phmsa.dot.gov/pipeline/library/data-stats/annual-report-mileage-for-gas-distribution-systems The LDC amount includes an estimated mileage for service lines.

[113] See Paul Joskow, Natural Gas: From Shortages to Abundance in the United States, 103 Am. Econ. Rev. 338 (2013). One indicator of the growing importance of natural gas in the United States: in 2016, for the first time, natural gas provided a larger share of electric power generation than coal. See U.S. Energy Information Administration, Short-Term Energy Outlook (January 2017), available at: http://www.eia.gov/outlooks/steo/pdf/steo_full.pdf ("In 2016, annual U.S. electricity generation from natural gas surpassed generation from coal-fired power plants, the first time this has happened based on data going back to 1949. Natural gas supplied an estimated 34% of total U.S. electricity generation in 2016 compared with 30% for coal.").

On average, a molecule of natural gas produced in the United States is sold 2.4 times before being consumed.[114] Natural gas is traded throughout the country at dozens of active trading hubs, and since the early 1990s a deep and liquid market for futures contracts and other financial derivatives has emerged. Price discovery in a market of such complexity and scope is quite challenging. No one really knows the total value of the U.S. natural gas market—a problem that FERC and others have pointed to repeatedly in their efforts to enhance market transparency.[115]

Because of the complexity of the market and the challenges of price discovery, much of the natural gas sold in the United States is tied in one way or another to one of a handful of price indexes. As noted above, these price indexes are published by private price reporting agencies such as Platts, a division of publishing giant McGraw-Hill, and Natural Gas Intelligence.[116] In the United States today, there are ten or so index publishers, which publish dozens of indexes for the different trading hubs and market centers across the country.

These indexes emerged during the 1980s, as new wholesale markets for natural gas took shape in the wake of efforts by Congress and FERC to restructure the industry.[117] During this time, FERC paid almost no attention to these price indexes, assuming that they were natural features of an emerging market. Price indexes, in other words, were viewed as reflections of the market (facts about the market) rather than as constitutive technologies that played a fundamental role in making these markets. With the California crisis of 2000-01, which involved, among other things, extensive manipulation of natural gas price indexes, FERC began to recognize the importance of focusing more attention on the critical role of price indexes.

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[114] See Cornerstone Research, Characteristics of U.S. Natural Gas Transactions: Insights from FERC Form 551 Submissions as of May 16, 2016 at 1 (2016) (reporting that, based on the volume of transactions analyzed, "on average, a molecule of natural gas was traded through approximately 2.4 transactions from production to consumption").

[115] See, e.g., Transparency Provisions of Section 23 of the Natural Gas Act, Order 704, 73 Fed. Reg. 1014, 1014 (Jan 4., 2008) ("Currently, because of the way transactions take place in the natural gas industry, there is no way to estimate even in the broadest terms the overall size of the natural gas market or its breakdown by types of contract provision, including pricing and term (e.g., spot or for delivery farther in the future. As noted by the price index developer Platts, the question of what is the total size of the traded market has 'hung over the gas market for years.'").

[116] Platts has been publishing industry and price information for oil and natural gas since the early twentieth century. The company takes its name from its founder, Warren Cummings Platt, a one-time reporter for the Cleveland Plain-Dealer who had the foresight and good luck to get into the oil reporting business during the early twentieth century.

[117] See Carver; Harpole.

But FERC has struggled since the California crisis to come up with a coherent approach to price indexes. Although it has new codes of conduct for market participants, express prohibitions on market manipulation, stronger enforcement authority, and new transparency rules at its disposal, it has been unable to fashion a stable approach to the indexes themselves. This stems in part from the unwillingness of the index publishers to make their underlying data available for audit and verification (and their claim of First Amendment protections over the confidentiality of that data whenever challenged).[118] It also stems from long-standing jurisdictional issues—namely, the fact that in the wake of restructuring FERC has jurisdiction over a modest subset of wholesale natural gas sales.[119] But it also reflects the limits embedded in how FERC (and Congress) have tended to "see" these markets and their corresponding conceptions of what constitutes a proper object of regulation.

As a result, primary responsibility for regulating (governing) these indexes continues to rest with the index publishers themselves. Although FERC has made several efforts since the early 2000s to exert more oversight over the price indexes and to gain better visibility of the market as a whole, its efforts to date have fallen short. In 2015, in fact, FERC terminated its most recent effort to enhance the transparency of natural gas markets after concluding, at the urging of index publishers and other market participants, that the additional information and oversight it was seeking would not improve the overall transparency of the markets and might have anti-competitive effects.[120]

This part describes these efforts and explains why FERC has had such difficulty regulating price indexes and generating better information about the natural gas market as a whole. It starts with a brief general discussion of indexes and benchmarks before describing in more detail how natural gas price indexes are constructed and the roles they play in the markets. It then discusses how these indexes emerged in the context of restructuring and their extensive manipulation during the California energy crisis. Finally, it discusses FERC's ongoing efforts to fashion a coherent approach to oversight and regulation of price indexes and natural gas markets more generally.

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[118] Cite disputes between price reporting agencies and CFTC/FERC enforcement over claims of first amendment protections for underlying data. See also discussion infra.

[119] NGPA and Wellhead Decontrol Act limited FERC jurisdiction over wholesale sales of natural gas to non-first sales – basically sales by the affiliates and subsidiaries of jurisdictional pipelines.

[120] See FERC, Order Terminating Proceeding: Enhanced Natural Gas Market Transparency, 153 FERC ¶ 61,174 (2015). See also discussion Part III.D infra.

### A. Indexes and Benchmarks

A price index, as the name suggests, is a composite number meant to reflect the average value of a set of individual prices.[121] Simple price indexes have been used for centuries, but the modern theory of index numbers and the widespread use of price indexes in commerce, economics, and statistics are products of the twentieth century.[122] For the most part, these efforts focused on the construction of broad indexes, such as the Consumer Price Index or the Dow Jones Industrial Average, meant to track changes in prices of a basket of different commodities for the purpose of evaluating economic conditions and trends.[123]

Price indexes are also used extensively in particular industries as instruments for price discovery and as benchmarks for transactions.[124] The history of these kinds of indexes is less well known, in part because these indexes have typically grown out of efforts by market participants, business reporters, and industry analysts to solve practical problems of pricing posed by certain types of markets. These price indexes, moreover, have often been taken for granted, viewed as a natural part of the market landscape. For a long time, they were all but invisible.

But in the wake of various high-profile manipulation cases, price indexes and benchmarks have become more visible. The most famous example of such an index today is LIBOR—the London Interbank Offered Rate—that provides a

[121] Here is how Irving Fisher described an index number: "If we look at prices as starting at any time from the same point, they seem to scatter or disperse like the fragments of a busting shell. But, just as there is a definite center of gravity of the shell fragments, as they move, so is there a definite average movement of the scattering prices. This average is the 'index number'. Moreover, just as the center of gravity is often convenient to use in physics instead of a list of the individual shell fragments, so the average of the price movements, called their index number, is often convenient to use in economics." Irving Fisher, The Making of Index Numbers 2-3 (1922). Fisher goes on to note that an index number can be applied to comparisons across space and other non-price quantities. Id., at 3.

[122] See, e.g., Irving Fisher, The Making of Index Numbers 458-60 (1922) (observing that "index numbers are a very recent contrivance . . . their current use did not begin till 1869 at the earliest, and not in a general way till after 1900. In fact, it may be said that their use is only seriously beginning today." See also Wesley Mitchell, The Making and Using of Index Numbers, Bureau of Labor Statistics Bulletin No. 656 at 7-10 (1938) (discussing history of index numbers); John Maynard Keynes, Index Numbers in The Collected Writings of John Maynard Keynes, Vo. XI (Moggridge ed., 1983).

[123] See, e.g., Marshall Reinsdorf and Jack Triplett, Ninety Years of Professional Thinking About the Consumer Price Index in Price Index Concepts and Measurement (Diewert et al. eds., 2009); H. Spencer Banzaf, The *Form and Function of Price Indexes: A Historical Accounting*, 36 Hist. Pol. Econ. 589 (2004);

[124] See Rauterberg and Verstein, Index Theory supra note __.

benchmark rate for short-term loans between many of the world's largest banks. LIBOR, which is actually a set of numbers tied to particular currencies for particular periods of time, affects more than $300 *trillion* of securities and loans globally. It has been called the most important number in the world.[125] And it was the target of an extensive manipulation scheme during and after the financial crisis of 2008.[126]

Needless to say, price indexes perform vital services. They allow for price discovery, imposing order and coherence on a mass of individual transactions and making markets visible. They also reduce the costs associated with contracting by providing a simple benchmark that can serve as a price term. In effect, they operate as key technologies for making prices—part of the basic infrastructure supporting markets and, by extension, the global economy. Given their importance, it is remarkable how little we know about them—how they are made, how they are used, and how they can be manipulated.[127]

Various types of price indexes and benchmarks have been used in the oil and gas industry since the early twentieth century. The oil markets, in particular, grew up on the basis of a system of posted prices for crude oil at particular locations and, more recently, have come to depend upon a handful of global benchmarks for various grades of crude oil (e.g., West Texas Intermediate, Brent, Dubai).[128] In natural gas, use of price indexes was less widespread in the early twentieth century in part because the markets were much less mature than those for oil and because of a more extensive regulatory scheme. In the 1940s, for example, the Federal Power Commission actually prohibited the use of price indexes in natural gas

[125] See, Donald J. MacKenzie, *What's in a Number?* 30 London Rev. Books 11, 11 (25 September 2008) ("Judged by the amount of money directly dependent on it, the British Bankers' Association's London Interbank Offered Rate matters more than another set of numbers in the world. Libor anchors contracts amounting to some $300 trillion, the equivalent of $45,000 for every human being on the planet. It's a critical part of the infrastructure of financial markets but, like plumbing, doesn't usually get noticed.").

[126] See, e.g., Philip Ashton and Brett Christopher, *On Arbitration, Arbitrage and Arbitrariness in Financial Markets and Their Governance: Unpacking LIBOR and the LIBOR Scandal*, 44 Econ. & Soc. 188, 197-204 (2015) (recounting LIBOR manipulation Donald Mackenzie, Material Markets: How Economic Agents are Constructed 80-83 (2009) (discussing how LIBOR is constructed). There are also a handful of popular newspaper and book-length accounts of the LIBOR manipulation scheme. See, e.g., Liam Vaughn and Gavin Finch, The Fix: How Bankers Lied, Cheated, and Colluded to Rig the World's Most Important Number (2017).

[127] Very few legal academics have investigated price indexes. *See, e.g.*, Andrew Verstein, *Benchmark Manipulation*, 56 B. C. L. Rev. 215 (2015); Gabriel Rauterberg and Andrew Verstein, *Index Theory: The Law, Promise and Failure of Financial Indices*, 30 Yale J. Reg. 101 (2013).

[128] See, e.g., Bassam Fattouh, An Anatomy of the Crude Oil Pricing System 30-35 (Oxford Institute for Energy Studies, 2011) (discussing role of price reporting agencies and price indexes in oil markets).

contracts, and from the mid-1950s to the early 1980s, price indexes were non-existent due to direct regulation of wellhead sales of natural gas.[129] Beginning in the 1980s, however, as wellhead sales were deregulated, prices indexes emerged as important features of natural gas markets.[130]

Since that time, price indexes have become central to U.S. natural gas markets. The objective of these indexes is to provide an accurate representation of fixed-price transactions at particular geographic locations.[131] Today, price indexes are published for more than one hundred locations around the country,[132] and typically distinguish between daily, weekly, and monthly delivery terms.[133] Although as many as ten different entities publish natural gas price indexes of one sort or another, two index publishers—Platts and Natural Gas Intelligence (NGI)—are by far the most important.[134]

While the details involved in calculating price indexes vary by publisher (and are not fully known), Platts' publicly available information on its methodology offers a reasonable framework for understanding the basic approach.[135] Index

[129] See Craig Carver, Natural Gas Price Indexes, supra note __ at 10.02 (descriving early history).

[130] The first price index for natural gas was published in 1983 in the Natural Gas Market Newsletter. See John A. Harpole, *Natural Gas Price Indexes: Fact, Fiction, or Failure?*, 49 RMMLF_INST 14, 14.05 (2003).

[131] Platts, *Natural Gas Methodology and Specifications Guide North American Natural Gas* 1 (January 2017) http://www.platts.com/methodology-specifications/natural-gas.

[132] Platts, *S&P Global Platts & Intercontental Exchange to Improve Natural Gas Price Transparency and Bolster North America Benchmarks: Anonymized ICE Data to further underpin Platts Natural Gas indices* (Nov. 21, 2016) http://www.platts.com/pressreleases/2016/112116/no; http://www.naturalgasintel.com/about. Platts publishes prices for 109 daily locations and 90 monthly locations for natural gas. *Id.* NGI reports at over 100 locations across the United States and Canada, NGI, NGI Corporate, http://www.naturalgasintel.com/about.

[133] Platts, *Natural Gas Methodology and Specifications Guide North American Natural Gas* 3 (January 2017) http://www.platts.com/methodology-specifications/natural-gas.

[134] Platts has been used as a pricing reference for energy contracts since 1928 and launched its first US gas spot price index in 1988. Platts, *A Historical Perspective*, 1 Platts, *About PLATTS 100th Year Anniversary*. NGI has published Daily and Weekly natural gas price indices since 1988 and 1993, respectively. Natural Gas Intelligence, NGI Corporate, http://www.naturalgasintel.com/about. As of June 2004, ten separate index developers had submitted one or more statements to FERC discussing their index Policy Statement Standards. These price index developers include: Arugus Media, Inc., Bloomberg L.P., Btu/Dtata Transmission Network, Dow Jones and Company, Energy Intelligence Group, Intelligence Press, Inc. (NGI), Intercontinental Exchange, Inc. (ICE), IO Energy LLC, Platts, and Powerdex, Inc. *Price Discovery in Natural Gas and Electric Markets,* Federal Energy Regulatory Commission, 109 FERC P 61,184 (2004).

[135] Platts, *Natural Gas Methodology and Specifications Guide North American Natural Gas* (January 2017) http://www.platts.com/methodology-specifications/natural-gas. Reporting companies should report each bilateral, arm's length transaction between non-affiliated companies in the physical markets at all trading locations and not simply a subset if the transactions. Id. at 2.

publishers operate on the basis of long-standing relationships with market participants who voluntarily report their transactions to the publishers, often by phone.[136] Platts' daily indexes, for example are based on reports of fixed-price physical deals completed before 1pm Central Time for next-day delivery to pipelines in North America.[137] Its monthly index is based on fixed-price physical deals negotiated on any of the last five business days for each month—what is known as "bidweek"—and negotiated for next-month delivery.[138]

After collecting the transaction data, the publisher sorts the data and performs various tests to analyze its quality.[139] Anomalous trades are identified and overall liquidity is evaluated at each trading location before constructing and publishing an index.[140] Throughout the process, there is ample room for the exercise of discretion and judgment on the part of those responsible for constructing the indexes—a point that has been made with respect to other indexes as well and one that argues strongly against the view that these are merely technical exercises.[141] From their relationships with market participants to their evaluation and weighting of individual transactions to their decision whether to go forward and publish an index on the basis of limited data, the people in charge of constructing these indexes hold enormous power in their hands. [142] They can literally move markets.

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[136] The publishers provide standardized spreadsheets and market participants are responsible for entering relevant transaction data and submitting the spreadsheet via email by a specified deadline. Methodology at 3. The reporting organizations are expected to have a central contact located in the organization's back office, lacking a commercial interest in the price index, to handle data submission. Platts Methodology at 2.

[137] Platts, *Natural Gas Methodology and Specifications Guide North American Natural Gas* 3 (January 2017) http://www.platts.com/methodology-specifications/natural-gas.

[138] Unlike the daily index, the Platts monthly index includes physical-basis deals for certain trading locations, or transactions where the price of the contract is tied to the settlement value of the NYMEX Henry Hub contract. To be included in the index formation process, the physical-basis transactions must have been negotiated on any bidweek day prior to and including the day the near-month NYMEX gas futures contract settles and the price must be set by the final settlement value of the NYMEX at the Henry Hub. Methodology at 3. Platts uses physical-basis deals to calculate the index price for "points east of the Rocky Mountains, except in the Permian Basin region at Waha, El Paso Natural Gas Co., Permian Basin and Transwestern Pipeline Co., Permian Basin. Id. Physical-basis transactions are so common along the East Coast and Gulf of Mexico that monthly indices in these regions depend almost entirely on physical basis transactions. Testimony of Hon. Joseph T. Kelliher, Energy Speculation: Is Greater Regulation Necessary to Stop Price Manipulation?, December 12, 2007 at 8.

[139] Methodology at 5.

[140] Id. at 5-6. After the relevant data has been analyzed, the publisher produces the final index along with relevant raw data, such as total volume and number of transactions at each trading point, to subscribers of its service. Id.

[141] See LIBOR example. Five guys in a room in south London.

[142] Id. at 5.

It would be difficult to overstate the importance of these indexes to natural gas markets. They serve as benchmarks for a whole range of transactions and investment decisions across the industry.[143] Virtually all forward contracts for physical gas are tied to an index.[144] Most local distribution companies in the United States, for example, price their long-term natural gas purchases at index, in part because such a price is deemed to be prudent by the public utility commissions that regulate these transactions. Other contracts with various end users—industrial facilities, power plants, commercial operations—include pricing terms tied to one or another index. Financial basis contracts are also often settled against an identified price index. Futures and other derivative contracts likewise use price indexes as benchmarks for settlement. Natural gas producers utilize price indexes to book the value of future reserves. Royalty payments to mineral rights holders and others are typically tied to price indexes. And investment decisions regarding exploration and development are often made on the basis of price indexes. In short, natural gas price indexes play a huge role in the industry, affecting many billions of dollars in transactions and capital investment decisions.[145] Maintaining confidence in the integrity of these indexes, therefore, is critical to ensuring that natural gas markets continue to function smoothly.

### B. Natural Gas Restructuring

In order to fully understand the role of price indexes in natural gas markets, and the challenges that they pose for FERC, it is important to situate them within the broader effort to restructure the industry. Natural gas price indexes are, in many ways, a product of restructuring and the move to markets over the last several decades. Decisions made by Congress and FERC, as part of the restructuring process, moreover, have had a significant impact on how they are used (and abused) and how they are regulated (or not).

FERC took its first steps toward restructuring the interstate pipeline industry starting in the 1980s in response to Congress's efforts to deregulate wellhead sales of natural gas and create a competitive market.[146] In a series of

[143] See Verstein, Benchmark Manipulation, supra note __ (discussing how benchmarks of various types are "hardwired" into legal relationships).

[144] Some spot market contracts are also tied to a price index.

[145] As one close observer of the industry noted in the wake of the crisis, "[n]atural gas price indexes are the Achilles Heel of a multi-billion dollar a week industry." See Harpole, supra note __ at 14.01.

[146] Congress began the process of deregulating wellhead sales of natural gas in 1978 with the Natural Gas Policy Act (NGPA). See Natural Gas Policy Act of 1978 Pub. L. 95-621, 92 Stat. 3351

Orders culminating most prominently in its landmark Order 636 issued in 1992, FERC used its authority under the Natural Gas Act to unbundle the pipeline business and create an open access regime for interstate transportation of natural gas.[147] Going forward, pipelines would act as common carriers, providing transportation capacity to their own marketing affiliates, third-party shippers, and others on the same rates, terms, and conditions.[148] This would provide the necessary foundation for a truly competitive natural gas market.

In contrast to the cost-of-service model of the past, competition and market forces would ensure that prices for jurisdictional sales of natural gas comported with the statutory just and reasonable standard.[149] FERC would withdraw from direct regulation in favor of a posture of "light-handed regulation" when it judged that market forces were sufficiently robust to allow competition—rather than regulation—to set prices. In its own words, the Commission determined that prices for jurisdictional sales of natural gas "will be limited by a just and reasonable ceiling which is set by a competitive natural gas market."[150]

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(1978). The legislation was enacted largely in response to the Supreme Court's disastrous 1954 decision, *Phillips Petroleum Co. v. Wisconsin*, which forced FERC's predecessor (the Federal Power Commission) to regulate wellhead sales of natural gas on a cost-of-service basis. See 347 U.S. 672, 677 (1954) (holding that wellhead sales of natural gas in interstate commerce are sales for resale and thus subject to Federal Power Commission jurisdiction under the Natural Gas Act). See *Regulation of Natural Gas Pipelines After Partial Wellhead Decontrol*, Order No. 436, 50 Fed. Reg. 42,408, 42,411 (Oct. 18, 1985) ("In essence, sections 601 and 602 effected a phased partial reversal of the Supreme Court's 1954 decision in the *Phillips* case. . . . These statutory changes reflect a Congressional determination that producers of natural gas do not have 'natural' monopoly power. In other words, the statute reflects the workably competitive nature of the production industry."). Congress finished the job in 1989 with the Wellhead Decontrol Act, which removed price regulation for most wholesale sales of natural gas. See Natural Gas Wellhead Decontrol Act of 1989, Pub L. 101-60, 103 Stat. 157 (1989). Going forward, FERC's jurisdiction over wholesale sales of natural gas was limited to sales of domestic gas by pipelines, local distribution companies, or their affiliates.

[147] See *Pipeline Service Obligations and Revisions to Regulations Governing Self-Implementing Transportation; and Regulation of Natural Gas Pipelines After Partial Wellhead Decontrol*, Order No. 636, 57 Fed. Reg. 13267 (April 16, 1992). The key features of Order 636 were upheld by the D.C. Circuit in 1996. See United Distribution Cos. v. FERC, 88 F.3d 1105, 1191 (D.C. Cir. 1996) ("In its broad contours and in most of its specifics, we uphold Order No. 636.").

[148] 57 Fed. Reg. at 13270 ("In brief, this rule requires pipelines to unbundle (i.e., separate) their sales services from their transportation services . . . and to provide all transportation services on a basis that is equal in quality for all gas supplies whether purchased from the pipeline or from any other gas supplier.").

[149] Id., at 13297 ("[T]he Commission is instituting light-handed regulation, relying upon market forces at the wellhead or in the field to constrain unbundled pipeline sale for resale gas prices within the NGA's 'just and reasonable' standard.").

[150] Id.

Although Order 636 discussed the importance of promoting market centers and pooling areas, it said nothing about price indexes.[151] Throughout its restructuring effort, in fact, FERC never focused on price indexes in any serious way. In its first major restructuring order, Order 436 issued in 1985, the Commission emphasized the importance of "[a]ccurate, responsive price signals" in allowing markets to develop.[152] The Commission also pointed to the "explosive growth" of the spot market over "a few short years" and identified the role of trade publications in "following prices and market developments" as evidence of healthy and maturing market.[153] But neither Order 436 nor any of FERC's other restructuring orders identified price indexes as objects of inquiry or concern.

In effect, FERC seemed to assume that price indexes, like market centers and pooling areas, were natural features of the emerging landscape of natural gas markets. Price indexes, in other words, were viewed as evidence of the continuing maturity and health of these markets rather than as something that could be manipulated. This largely passive view of such a critical instrument of price making would prove to be naïve—a product of an overly simplistic, naturalized understanding of markets compounded by a lack of critical information about market conditions and the behavior of key market participants. Indeed, as we will see, it would take a full-blown crisis involving extensive manipulation of price indexes for FERC to begin taking them seriously as tools for price formation and as potential objects of regulation. But even in the wake of such a crisis, FERC has struggled (and continues to struggle) to get a handle on how price indexes operate and whether they should be regulated.

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[151] See id., at 13289 to 13290 (discussing market centers and pooling areas).

[152] See Order 436, 50 Fed. Reg. at 42414. FERC went on to note that such price signals are "not a matter for mere academic concern but a matter of commercial life and death for the production industry." Id.

[153] Id., at 42420. See also id. at 42412 (observing that the natural gas industry in the United States was marked by a "highly competitive and rapidly growing spot market, with a thriving infrastructure of brokers and marketers, electronic information exchange services, and trade publications tracking price and market movements."). Between 1982 and 1987, for example, the Energy Information Administration (EIA) estimated that spot market volumes traded in the U.S. grew from 0.22 trillion cubic feet to 7.22 trillion cubic feet, growing from less than a *de minimis* percentage of deliveries in 1981 to more than 55% in 1987. See Michael J. Doane and Daniel F. Spulber, Open Access and the Evolution of the U.S. Spot Market for Natural Gas, 37 J. Law & Econ. 477, 485 (1994) (citing EIA figures). Given this dramatic growth in the spot market for natural gas, the New York Mercantile Exchange (NYMEX) opened up a natural gas futures market in April 1990. Id.

### C. Manipulation and Crisis

Index manipulation is relatively easy to understand, but difficult to detect. In its most basic form, a market participant reports false information to the index publisher, thus skewing the index in a manner that will benefit the market participant's position in a connected transaction or market. But indexes can also be manipulated through means other than false reporting: trading strategies and selective reporting of information, for example, can move an index even though neither involves misrepresentation. Depending on the volume of transactions tied to any particular index, small changes in a price index can result in large impacts. The LIBOR manipulation scandal that first came to light in 2012, for example, affected trillions of dollars in consumer loans, currency exchanges, and a whole host of other transactions tied to the index. Likewise, even a very small increase in the wholesale natural gas price as a result of an index manipulation scheme would ripple through the markets affecting billions of dollars in natural gas transactions and investment decisions.

Market participants and others have long been aware of the possibility of index manipulation. One close observer of the use of price indexes in the petroleum industry during the 1950s, for example, described the obvious incentives for manipulation:

> It would appear on the surface at least that there might be some opportunities in a price mechanism such as this [Platt's *Oilgram*] for price rigging by those interested in keeping prices low. Assuming that contract prices are based on the low of the Oilgram, the Journal, or any other price reporting medium, there is no question but that net buyers might gain from a decrease in the low quotation. If the net buyer were to unload an occasional cargo at a price below the low, he would, by so doing, establish a new low and if he were then to offset that sale by buying something in excess of the amount sold, he would enjoy a net gain on the combination of transactions.[154]

The author goes on to note, however, that "[w]hile this is possible in the abstract it would be difficult to effect, even assuming a company might be interested in attempting it."[155] This was because "any such attempt would be perfectly apparent

[154] Ralph Cassady, jr., Price Making and Price Behavior in the Petroleum Industry 149 (1954).
[155] Id.

to the price-reporting experts" and other market participants would no longer trade with the would-be manipulator.[156]

During the 1980s and 1990s, as it worked to restructure the natural gas industry, FERC seemed unaware of the possibility of price index manipulation. As noted above, none of FERC's major restructuring orders discussed price indexes and there was almost no commentary at the time on potential problems with these indexes.[157] The working assumption seemed to be that these price indexes were a reflection of healthy, well-functioning markets.

All of this changed with the California energy crisis. Subsequent investigations by FERC and others revealed that false reporting to natural gas price indexes during the crisis was, in FERC's words, "epidemic."[158] In addition, some traders engaged in extensive "churning" (rapid buying and selling of natural gas at a particular location) to create the illusion of market activity and drive indexes higher.[159] Together, these activities resulted in significant increases in spot gas prices, in published price indexes, and in electricity prices—all of which translated into billions of dollars in excessive payments by California consumers of natural gas and electricity.[160]

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[156] Id. at 149-50. Price index manipulation has been the subject of antitrust litigation for decades. See, e.g., U.S. v. Socony-Vacuum Oil co., 310 U.S. 150 (1940). Oneok litigation. Recent litigation on broiler chicken price indexes. Etc.

[157] A survey of legal periodicals has found only one detailed treatment on natural gas price indices prior to the California Energy Crisis of 2000-01: a 1996 article by a practicing oil and gas lawyer from Denver, Colorado that addressed the use natural gas price indices as a basis for sales and royalty payments. See Craig R. Carver, Natural Gas Price Indices: Do They Provide a Sound Basis for Sales and Royalty Payments?, 42 RMMLF Inst. 10 (1996).

[158] See FERC, Final Report on Price Manipulation in Western Markets, Docket PA02-2-000 [hereinafter Final Report] at ES-6 (2003) ("Market participants provided false reports of natural gas prices and trade volumes to industry publications. These publications used the reports to compile price indices, and false reporting became epidemic. . . . The false reporting included fabricating trades, inflating the volume of trades, and adjusting the price of trades. . . . Many traders acknowledged that false reporting was done openly in the industry.").

[159] Final Report at II-59 (concluding that churning strategy of Reliant at Topock in Southern California "had the effect of moving the entire market price of natural gas by an average of some $8.54/MMBtu for December 2000 and by an average of $1.91/MMBTu over the 8-month period that it churned"). See also id. at II-30 to II-31 (describing how Reliant's churning raised index prices).

[160] See Final Report at II-59 to II-60 (estimating that as a result of Reliant's churning activities, SoCalGas customers "paid excessive gas costs in the neighborhood of $650 million for December 2000 and about $1.15 billion for the 8-month period" that Reliant churned and that these excessive gas prices in turn inflated electric clearing prices by about $1.6 billion).

During the investigation, five companies admitted that their employees provided false data to price index publishers.[161] But FERC staff also found that index manipulation was common throughout the industry, extending far beyond these five companies.[162] And the behavior went on for years.[163] According to FERC, it was common knowledge in the industry that most market participants engaged in false reporting to price indexes: "because everyone knew that everyone else was manipulating the indices by reporting false prices and volumes, it was somehow acceptable and even necessary for this to take place."[164] Incredibly, one argument advanced in defense of the price indexes maintained that because the manipulations went in both directions, they would be "offsetting" and the resulting indices could be considered accurate.[165] Needless to say, FERC staff were not persuaded.[166]

Part of the problem stemmed from the fact that most of the major natural gas trading companies "had no formal process for reporting trade data to the publishers of the price indices; the process was left to the trading desks and to the traders themselves."[167] Nobody was paying attention. No systems of quality control had been established. Conflicts of interest were endemic. Some of this, not surprisingly, was easy to fix, and natural gas trading companies responded quickly by adopting improved practices, internal controls and audits, and improved oversight.[168]

More fundamental was the fact that FERC had no regulations expressly prohibiting any of these activities.[169] Indeed, as FERC concluded in its final report on the western energy crisis, none of these activities violated the Commission's regulations because those regulations did not contain explicit guidelines or

[161] Final Report at III-4 (listing Dynegy, AEP, Williams, CMS, and El Paso as the five companies).

[162] Final Report at III-29 (noting that "the industry lacked systematic reporting procedures and internal verification processes" and that "the price manipulation goes beyond the five companies that have admitted to such behavior").

[163] Final Report at III-37 (concluding that "systematic attempts to manipulate the published price indices by various significant market participants occurred for at least 4 years").

[164] Final Report at III-15.

[165] Final Report at III-16.

[166] As the report concluded: "Staff does not find this argument to be persuasive." Id.

[167] Final Report at III-29.

[168] Final Report at III-38 to III-43 (discussing efforts by natural gas trading companies to reform their price reporting activities).

[169] FERC also had very limited penalty authority, a holdover from its days as a cost-of-service regulator.

prohibitions for trading gas or reporting to indexes.[170] Moreover, the Commission had limited ability to force market participants and/or price index publishers to disclose specific information. Nor did it really seem to understand how these indexes were constructed and the roles they played in the markets. This would not be so easy to fix.

In sum, the California crisis revealed that price indexes were hardly the simple reflections of the market that FERC and others had assumed they were (to the extent that they even thought about them) before the crisis. In fact, they were key instruments of price making and, as a result, ideal targets for manipulation. But recognizing their constitutive role in making prices and, by extension, their potential for manipulation was only a first step. Determining how, if at all, to regulate these price indexes would prove (and continues to prove) quite challenging for FERC.

### D. Regulation and Oversight

Much of the post-crisis analysis and calls for reform at FERC have focused on improving transparency in price indexes and ensuring that market participants adhere to basic standards in their reporting. FERC clearly recognizes the importance of price formation and the role of price indexes in ensuring the integrity of natural gas markets and it has pursued multiple efforts to ensure the credibility of these indexes and to generate a more complete picture of the natural gas markets.

But important challenges continue to confront FERC in its efforts to develop a coherent approach to price indexes. Perhaps most importantly, the index publishers themselves, although they have reformed their internal practices and have endeavored to be more transparent, are not subject to FERC jurisdiction and have been unwilling to allow the data underlying their price indexes to be audited and verified. As FERC staff observed in their initial report on the western energy crisis:

> At this point in time, no independent entity, such as this Commission, can verify the published price data. This is due, in part, to the reporting firms' status as non-jurisdictional entities as well as their legitimate desire to protect the confidentiality of their

[170] See, e.g., Final Report at II-61 ("Reliant's churning did not violate Section 284.402 of the Commission's regulations because those regulations contain no explicit guidelines or prohibitions for trading gas.").

> sources. Without knowing the source of the raw data, there cannot be any independent verification of the price data published by any reporting firm.[171]

In fact, Platts and other price reporting agencies have long maintained a position of confidentiality for their sources, making it very difficult for FERC or other regulators to police the integrity of the published indices.[172]

Because of this, FERC staff concluded in the wake of the California crisis that the price reporting process was "fundamentally flawed because the Trade Press data are still not subject to independent verification."[173] "[A]s long as the companies publishing the indices continue to refuse to disclose the actual calculations of the published price indices," FERC staff continued, "the information chain cannot be audited and the Commission cannot verify the accuracy of the published price indices."[174] Their recommendation to the FERC Commissioners was unequivocal: "only price indices calculated from actual trades that can be verified by the Commission should be used as the basis for any Commission approved sales of natural gas or electricity."[175]

Starting in 2003, FERC took its first steps toward improving transparency and promoting confidence in natural gas price indexes. Based on a series of

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[171] FERC, Initial Report on Company-Specific Separate Proceedings and Generic Reevaluations; Published Natural Gas Price Data; and Enron Trading Strategies, Docket No. PA02-2-000 at 4 (2002).

[172] In the mid-1990s, for example, in response to an inquiry into the methodology used to establish price indexes, price reporting agencies such as NGI and Platts opposed any effort to review the underlying data and methods used to construct the price indexes. NGI: "The key to NGI's price survey of the natural gas market is our pledge of confidentiality which is printed as part of our pricing methodology. . . . Because of the confidentiality requirements, once the aggregation process is complete, NGI destroys the written notes it has used that identify individual price quotes and the names of those submitting them. Since confidentiality is the basis on which the survey operates, it would be impossible to keep verifiable records of our price quotes and still remain in business. Therefore, no true audit of our activities can be made." And here is Platts: "We would oppose any attempt . . . to review the raw data that we use to compile our prices. In principle, that data is no different from a reporter's notes used to write a story, which clearly we would not turn over voluntarily to any outside party." Quoted in Carver, *Natural Gas Price Indices, supra* note __.

[173] Final Report at III-48. See also id. at III-48 to III-49 ("In order for the published indices to be reliable, there must be a way to audit the entire information chain. The chain consists of (1) the actual trades, (2) the data provided by the companies to the reporting firms, (3) the data used by the reporting firms to calculate the indices, and (4) the method for calculating the indices.").

[174] Final Report at III-49.

[175] Final Report at III-49.

technical conferences investigating price formation issues,[176] FERC issued its first policy statement on price indexes that included, among other things, recommended standards for index publishers and market participants.[177] Building on this, FERC then issued regulations that established a new mandatory code of conduct for those making jurisdictional sales of natural gas that directly addressed reporting to gas index publishers as well as other activities, such as churning or "wash trades," that could distort prices.[178]

As the Commission pointed out, its new code of conduct was directed at "behavior undertaken without an appropriate commercial underpinning for the purposes of distorting prices that would otherwise occur in the competitive market."[179] The regulations accordingly "prohibit[ed] market-based rate sellers from taking actions without a legitimate business purpose that are intended to or foreseeably could interfere with the prices that would be set by competitive forces."[180] Only those "[b]ehaviors and transactions with economic substance in which a seller offers or provides service to a willing buyer where value is exchanged for value will be recognized as reflecting a legitimate business purpose consistent with just and reasonable rates."[181] The ambiguities embedded in some of these terms ("appropriate commercial underpinning," "economic substance," "value for value," "legitimate business purpose") were palpable and raised serious concerns among market participants about whether and when certain behaviors crossed the line.[182]

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[176] Cites. FERC also encouraged the industry to articulate a set of "best practices" for price indexes that resulted in a 2003 white paper by the Committee of Chief Risk Officers on Best Practices for Energy Price Indices.

[177] FERC, *Policy Statement on Natural Gas and Electric Price Indices*, 9-11 (2003). The minimum standards for index publishers included: (1) adoption and public dissemination of a code of conduct disclosing how the developer will obtain, treat, and maintain price data; (2) maximization of the amount of information collected, including complete transaction data that is tailored for each pricing location; (3) verification of collected data through identification of counter parties and investigation into and elimination of matching errors; (4) an annual independent audit; and (5) reasonable access to price reports by any interested customer, including the Commission. Id. Reporting standards included: (1) adoption of an employee code of conduct; (2) reporting of trade data through a department that is independent of the trading; (3) reporting of each bilateral, arms-length transaction with a non-affiliated company (subject to a confidentiality agreement with the developer); (4) an error resolution process; (5) data retention for three years; and (6) independent audit of data gathering and submission process. *Id.* at 11-12.

[178] *Amendments to Blanket Sales Certificates*, Order No. 644, 68 Fed. Reg. 66,323 (Nov. 26, 2003).

[179] 68 Fed. Reg. at 66,328.

[180] Id.

[181] Id.

[182] Cite comments.

Somewhat surprisingly, the new code of conduct did not require jurisdictional sellers to report their transactions to price indexes.[183] But any jurisdictional seller that did report was required to "provide accurate and factual information and not knowingly submit false or misleading information or omit material information to any [index] publisher."[184] In response to concerns that this would chill reporting, FERC established safe harbor protections for inadvertent mistakes in reporting.[185]

Congress also added new provisions to the Natural Gas Act in 2005 that specifically addressed market manipulation, transparency, and price indexes. New section 4A of the Natural Gas Act, for example, imported the basic securities fraud framework to prohibit market manipulation in natural gas markets.[186] New section 23 directed the Commission "to facilitate price transparency in markets for the sale or transportation of physical natural gas in interstate commerce" and provided that the Commission may obtain "information about the availability and prices of natural gas sold at wholesale and in interstate commerce" from "any market participant."[187] In carrying out its new responsibilities under this provision, FERC was required to consider the degree of price transparency provided by existing price index publishers and to rely on such indexes to the maximum extent possible.[188] But if the Commission determined that the existing indexes were not adequately providing for price discovery or market transparency, it could establish its own electronic information system.[189]

[183] 68 Fed. Reg. at 66,332 ("At this time, we are not mandating reporting.").

[184] 68 Fed. Reg. at 66,331.

[185] Id.

[186] EPAct § 315; Natural Gas Act §4A, Prohibition on Market Manipulation, 15 U.S.C. § 717f ("It shall be unlawful for any entity, directly or indirectly, to use or employ, in connection with the purchase or sale of natural gas or the purchase or sale of transportation services subject to the jurisdiction of the Commission, any manipulative or deceptive device or contrivance (as those terms are used in section 10(b) of the Securities Exchange Act of 1934 (15 U.S.C. §78j(b)) in contravention of such rules and regulations as the Commission may prescribe as necessary in the public interest or for the protection of natural gas ratepayers."). FERC adopted regulations on market manipulation in 2006. See *Prohibition on Energy Market Manipulation*, Order No. 670, 71 Fed. Reg. 4244 (Jan 26, 2006). But see Spence and Prentice, supra note __ at 133 (arguing that "by focusing on fraud and deceit, the securities regulation model misses ways in which sellers of energy in physical markets can exercise market power at the expense of buyers, even in the absence of fraudulent or deceptive conduct").

[187] EPAct 2005 § 316; Natural Gas Act § 23, 15 U.S.C. § 717t-2

[188] Id.

[189] Id.

Pursuant to this new authority, FERC issued a pair of regulations in 2008 intended to provide more visibility into the workings of the natural gas market.[190] The first, Order 704, required "market participants" to file annual reports on their wholesale transactions of physical natural gas.[191] The objective was to require both jurisdictional and non-jurisdictional sellers to report their volumes of annual sales and whether they reported to price index publishers.[192] The language the Commission used in proposing the new rule is worth quoting:

> The Commission's market-oriented policies for the wholesale electric and natural gas industries require that interested persons have broad confidence that reported market prices accurately reflect the interplay of legitimate market forces. Without confidence in the basic processes of price formation, market participants cannot have faith in the value of their transactions, the public cannot believe that the prices they see are fair, and it is more difficult for the Commission to ensure that jurisdictional prices are "just and reasonable."[193]

With the information available as a result of this new reporting requirement, FERC concluded that the final rule would "permit an annual estimate of (a) the size of the physical domestic natural gas market, (b) the use of index pricing in that market, (c) the size of the fixed-price trading market that produces price indices from the subset reported to the index publishers, and (d) the relative size of the major traders."[194] Taken together, such information would provide much needed visibility into what was still an opaque market.

In its companion order (Order 720), FERC required intra-state pipelines to submit information about the volume of natural gas shipped on their systems (their flow data).[195] The goal here was similar to that behind Order 704—to get a better

[190] See *Transparency Provisions of Section 23 of the Natural Gas Act*, Order No. 704, 73 Fed. Reg. 1014 (Jan 4, 2008); *Pipeline Posting Requirements Under Section 23 of the Natural Gas Act*, Order No. 720, 73 Fed. Reg. 73,494 (Dec. 2, 2008).

[191] Order 704, 73 Fed. Reg. 1014, supra note __.

[192] 73 Fed. Reg. at 1020 (defining a market participant subject to the annual reporting requirement as "any buyer or seller that engaged in wholesale, physical natural gas transactions in the previous calendar year" and detailing the reporting requirements, including total volume of transactions, volume that was reportable to price indexes, and volume that was actually reported to the indexes).

[193] *Transparency Provisions of Section 23 of the Natural Gas Act*; *Transparency Provisions of the Energy Policy Act*, NOPR, 72 Fed. Reg. 20,791, 20792 (April 26, 2007).

[194] Order 704, 73 Fed. Reg. at 1016.

[195] Order 720, 73 Fed. Reg. 73,494, supra note __.

picture of the overall natural gas market.[196] And FERC used the same jurisdictional hook—"market participants"—as justification for its imposition of reporting requirements on intra-state pipelines. In this case, however, the Fifth Circuit held that FERC had over-reached, stretching the meaning of "market participants" beyond what was permissible under the statute, and thus could not subject intra-state pipelines to the new reporting requirements.[197] Despite the fact that the inter- and intra-state pipelines were all part of one inter-connected system, FERC would be unable, without additional authority from Congress, to get even basic flow data from the large intra-state pipelines operating in Texas and other large gas producing states. This left the Commission to focus on securing more detailed transactional data on natural gas sales as a means to enhance its visibility into the market.

To that end, FERC's most recent effort to improve transparency came in a 2012 proposal to require more detailed and more frequent reporting on natural gas transactions by jurisdictional sellers.[198] According to FERC, the aggregated information that it was receiving under Order 704 was inadequate because it did not include specific details on price, counterparty, or the price index, if any, to which the seller had reported its transactions. [199] Reporting only on an annual basis also made it impossible to assess market conditions in a timely manner. In its new proposal, the Commission asserted that more regular and more detailed reporting would "facilitate price transparency in the natural gas market by enabling buyers and sellers of natural gas to better understand the trading and prices that contribute to the daily and monthly indices."[200] This would in turn help to ensure that prices in the natural gas markets were the "result of fundamental supply and demand forces and not the result of manipulation or other abusive market conduct."[201]

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[196] Order 720, 73 Fed. Reg. at 73,494 ("The postings required here will increase price transparency in the interstate natural gas markets by providing information about the supply and demand fundamentals that underlie those markets.").

[197] See Texas Pipeline Assoc. v. FERC, 661 F.3d 258, 263 (2011) (concluding that "the NGA unambiguously precludes FERC from issuing the Posting Rule so as to require wholly intrastate pipelines to disclose and disseminate capacity and scheduling information").

[198] FERC, *Enhanced Natural Gas Market Transparency*, Notice of Inquiry, 141 FERC ¶ 61,124 (2012). The proposal would require more detailed information about transactions, include data on prices and counterparties, and would also move to quarterly rather than annual reporting.

[199] Id., at 9 ("[T]he information that is currently available does not provide full market visibility or price transparency. Much of the data that is currently available is aggregated and does not provide transaction-specific details.").

[200] Id., at 11.

[201] Id., at 11-12. ("Market participants lack a complete understanding of the actions that produce the prices that are reported to the indices. Increased confidence in these indices requires greater transparency to assure prices are a result of fundamental supply and demand forces and not the result of manipulation or other abusive market conduct.")

The responses to FERC's new proposal were almost uniformly negative. Because of jurisdictional limits, the new information, commenters argued, would not be representative of the market as a whole.[202] In addition, public dissemination of detailed information on specific transactions might have anticompetitive effects.[203] For its part, Platts argued that the information FERC was seeking from market participants and price reporting agencies was akin to the information that would be provided by the "electronic information system" identified in Section 23 of the Natural Gas Act.[204] As a result, Platts continued, FERC would have to make a threshold determination of why the existing price publishers were not "adequately providing price discovery or market transparency" before requiring this additional reporting.[205]

But this argument simply begs the question of how FERC is supposed to evaluate the markets in order to make such a determination of adequacy if it cannot see what is actually going on in the markets. And because Platts and other price index publishers have continued to assert First Amendment protections over the data they use to construct their price indexes, FERC has been unable to see what is actually going on in the markets. Nonetheless, FERC terminated this new proceeding in 2015, leaving it to rely upon the limited reporting required under Order 704.[206] In retrospect and notwithstanding a substantial effort stretching over more than a decade, FERC has made very little progress in improving the overall transparency of the natural gas markets and getting a better handle on the crucial role that price indexes play in those markets.

All of which has left FERC to fall back on its market manipulation rules and enhanced penalty authority to deter conduct aimed at manipulating these price indexes. Over the last decade, the Commission has used this authority vigorously, litigating or securing settlements in five separate cases involving natural gas price index manipulation.[207] But there are limits to such an approach, given the opacity of the indexes themselves and the fact that index manipulation does not always

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[202] See, e.g., Comments of American Forest & Paper Association, Inc. at 8-9, *Enhanced Natural Gas Market Transparency*, Docket No. RM13-1-000 (February 12, 2013).

[203] See Comments of U.S. Department of Justice at 1-2, Enhanced Natural Gas Market Transparency, Docket No. RM13-1-000 (February 1, 2013).

[204] See Comments of Platts, *Enhanced Natural Gas Market Transparency*, Docket No. RM13-1-000 (February 1, 2013).

[205] Id.

[206] FERC, *Enhanced Natural Gas Market Transparency: Order Terminating Proceeding*, 153 FERC ¶ 61,174 (2015).

[207] See FERC, Staff White Paper on Anti-Market Manipulation Enforcement Efforts Tern Years After EPAct 2005 at 21-23 (2016) (describing five separate cases involving natural gas price index manipulation since 2005). Note also CFTC cases.

involve overt fraudulent activity such as misreporting. Moreover, without full visibility into the indexes themselves, including at a minimum how they are calculated and the underlying data used in such calculations, it is difficult for FERC to accurately assess how well its current anti-manipulation rules are working to deter index manipulation.

And there is some urgency here. Based on the information that FERC does collect as well reports in the trade press, the volume of transactions being reported to the index publishers is declining, while the volume of gas sold in the United States that is tied to the indexes is increasing.[208] While it is hard to know the precise reasons for this, some have pointed to the perception of increased regulatory risk for misreporting, despite FERC's efforts to create safe harbors and clear guidelines. Others have suggested that market participants may be losing confidence in the integrity of the indexes. Whatever the reason, ongoing decline in the volume of transactions used to support the indexes will further undermine confidence in the indexes themselves and, in turn, will hamper the functioning of natural gas markets.[209] Declining liquidity could also exacerbate the potential for manipulation by giving those entities that continue to report more influence over the index. While this may not seem to matter as much in the current environment of low natural gas prices, no one wants to see a return to the market disruptions of the past and index manipulation is problematic (and illegal) in any price environment.

Although FERC surely recognizes this, the Commission has so far been unable or unwilling to impose more oversight on the indexes to ensure that they have integrity and enjoy the full confidence of market participants. As noted in the introduction to this Article, however, FERC appears to have ample legal authority to do so given that the index publishers are quite clearly engaged in "practices" that directly affect jurisdictional rates.[210] Even if the First Amendment protections claimed by the index publishers inhibit FERC from getting direct access to their underlying data and calculations (a question that has yet to be tested fully in

[208] See, e.g., Cornerstone Research, Characteristics of U.S. Natural Gas Transactions: Insights from FERC Form 552 Submissions 10 (May 2016) (reporting that in 2015 the volume of transactions reported to the indexes continued to decline while the volume of transactions dependent upon the indexes continued to increase); Alexander Osipovich, *U.S. Gas Reporting Drop Raises Questions About Indexes*, __ Energy Risk __ (2015) (noting that price reporting agencies "are constructing their indexes based on a shrinking proportion of reported trades, yet the share of deals linked to their price assessments is growing"). See also trade press reports from 2015 indicating dramatic decline in reporting to indexes at Houston Ship Channel.

[209] See Osipovich, supra note __.

[210] See Natural Gas Act § 5(a), 15 U.S.C. § 717d(a).

court[211]), FERC could likely require independent audit and verification of such indexes. It could also use its section 23 authority to require all market participants in wholesale natural gas markets (not simply jurisdictional sellers) to disclose specific transactional data to FERC, including the identity of the indexes to which such transactions are reported, as a basis for supporting such audits. Finally, FERC could take the more radical step of creating its own electronic information system for price reporting (a public price index) to support these markets if it determined that the existing indexes were inadequate—a determination that could, in theory, be based on the general lack of transparency regarding the price indexes and the ongoing decline in reported transactions.

To be sure, none of these approaches would be easy to implement and all of them likely have shortcomings. But the current situation seems untenable, and it is clear that FERC needs a fresh approach to the persistent knowledge problem that it confronts in trying to ensure the integrity and functioning of natural gas markets. If natural gas prices are to be trusted and deemed to satisfy the just and reasonable standard, we need to understand how they are made. Doing that requires focusing directly on the indexes as the key instrumentalities of price making in these markets rather than solely on the conduct of market participants.

## IV. Price – By Way of Algorithm

[This part is quite preliminary and still under development.]

Following its successful effort to restructure the natural gas industry, FERC embarked on the far more ambitious task of restructuring the electricity sector. Starting in the mid-1990s, the Commission used its authority under the Federal Power Act to unbundle the industry and create an open access regime for transmission that would in turn provide the foundation for competitive wholesale power markets.[212] Today, organized wholesale power markets operate across much of the country, including the mid-Atlantic, Northeast, Midwest, California, and Texas (which is regulated wholly by the state of Texas).[213] This part focuses on

[211] In several cases involving investigations by FERC and CFTC of natural gas price index manipulation, courts have rejected assertions of the reporter's privilege by index publishers. See, e.g., U.S. CFTC v. McGraw-Hill Cos., 507 F. Supp. 2d 45 (D.D.C. 2007) (holding that need for trading data reported to price index publisher by company under investigation overrode reporter's privilege); In re Natural Gas Commodities Litigation, 235 F.R.D. 241 (S.D.N.Y. 2006) (finding that qualified reporter's privilege did not protect trade data reported in natural gas industry publications from disclosure). The question whether courts would find similarly in the absence of a specific investigation has not been litigated.

[212] See Orders 888, 889, 2000.

[213] See https://www.ferc.gov/industries/electric/indus-act/rto.asp for a map of wholesale power markets in the United States.

these organized electricity markets—those that are run by independent system operators (ISOs) and regional transmission organizations (RTOs). It focuses specifically on the algorithms and auction structures at the center of these markets and the challenges that these ways of price making pose to FERC's ability to ensure that the resulting prices are just and reasonable.

The U.S. electric power system has been described as the most complex machine ever built.[214] Organized into three major grids, or interconnects, (Eastern, Western, and Texas[215]) it joins a diverse array of generation assets with high-voltage transmission lines, local distribution systems, and, increasingly, active demand-side and distributed resources to deliver a highly reliable service to millions of households and businesses in a manner that must precisely balance generation (supply) and load (demand) in real-time.

Viewed as a whole, the electric power system is a complex, highly interdependent network that operates on multiple time scales, ranging from milliseconds to years.[216] Because electricity cannot be stored on any significant scale, cannot be directed (as in the case of classic switched networks), and because generation and load must be balanced in real time, sophisticated systems operation capabilities are necessary to ensure continuous delivery of reliable electric service.[217] The electric power industry has been described, in this respect, as the ultimate just-in-time system.[218]

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[214] *See* MIT, THE FUTURE OF THE ELECTRIC GRID 1 (2011) ("Hailed as the 'supreme engineering achievement of the 20th century' by the National Academy of Engineering, the U.S. electric power grid serves more than 143 million residential, commercial, and industrial customers through more than 6 million miles of transmission and distribution lines owned by more than 3,000 highly diverse investor-owned, government-owned, and cooperative enterprises.") (citations omitted); S. Massoud Amin, *Securing the Electricity Grid*, 40 THE BRIDGE 1, 14 (2010) (describing the North American power system as the largest and most complex machine in the world); PHILLIP F. SCHEWE, THE GRID: A JOURNEY THROUGH THE HEART OF OUR ELECTRIFIED WORLD 1 (2007) ("Taken in its entirety, the grid is a machine, the most complex machine ever made."); *see also* THOMAS P. HUGHES, NETWORKS OF POWER: ELECTRIFICATION IN WESTERN SOCIETY, 1880–1930, at 1 (1983) ("Of the great construction projects of the last century, none has been more impressive in its technical, economic, and scientific aspects, none has been more influential in its social effects, and none has engaged more thoroughly our constructive instincts and capabilities than the electric power system.").

[215] *See* MIT, *supra* note __, at 3 (describing the three major interconnects that make up the U.S. electric power system).

[216] *See* ALEXANDRA VON MEIER, ELECTRIC POWER SYSTEMS: A CONCEPTUAL INTRODUCTION 260–68 (2006) (discussing balancing requirements at multiple scales necessary to coordinate generation and load in electric power systems).

[217] Electricity is often mischaracterized as the flow of electrons. In fact, it is electric current that flows through the grid at roughly the speed of light. The electrons in the transmission and distribution wires simply oscillate in place (in Alternating Current (AC) systems), "shoved" back and forth in the direction of the electric field. The energy that is transmitted across the system occurs via the propagation of an electromagnetic wave. *See id.* at 8 ("Conceptually, it is important to

These facts make it difficult to design well-functioning markets for electricity, which require carefully designed dispatch algorithms and auctions and are distinctly vulnerable to the exercise of market power.[219] Although bilateral contracting for electricity has long been a common feature of the U.S. electricity system, the new organized wholesale power markets had to be designed from the ground up and require central systems operators to match supply and demand and ensure overall grid reliability.

During the late 1990s and early 2000s, several new organized wholesale electricity markets took shape around the county. Some of these (notably the markets run by PJM in the mid-Atlantic region, the New York market run by the New York Independent System Operator (NY ISO), and the New England market run by the New England Independent System Operator (NE ISO)), emerged out of the tight power pools that had existed in those regions for decades. The new market in California, by contrast, was mandated by the state's 1996 electricity restructuring legislation (AB 1890), and the new market in the Midwest (MISO) emerged out of voluntary cooperation between neighboring utilities in the region. Because of the structure of federalism in the Federal Power Act, moreover, a number of states in the Southeast and the West chose not to participate in the new wholesale markets, staying instead with the traditional, cost-of-service model of regulation.[220]

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recognize that what is traveling at this high speed is the *pulse* or *signal* of the current, not the individual electrons."). For a good overview of the distinctive features of electric power systems and their implications for the current grid, see Brief Amicus Curiae of Electrical Engineers, Energy Economists and Physicists in Support of Respondents at 2, 6–9, New York v. FERC, 535 U.S. 1 (2001) (No. 00-568).

[218] *See* Paul L. Joskow, *Creating a Smarter U.S. Electricity Grid*, 26 J. ECON. PERSP. 29, 33 (2012) ("Electricity is the ultimate 'just-in-time' manufacturing process, where supply must be produced to meet demand in real time.").

[219] *See* VON MEIER, *supra* note __, at 295 ("The extreme inelasticity of demand and supply as the system nears its limits makes it vulnerable to the withholding of even small amounts of generation capacity."); Lave et al., *supra* note __, at 17–18 (discussing the vulnerabilities of restructured markets to withholding and market manipulation); Frank A. Wolak, *Regulating Competition in Wholesale Electricity Supply*, *in* ECONOMIC REGULATION AND ITS REFORM: WHAT HAVE WE LEARNED? (Nancy L. Rose ed., forthcoming July 2014) (manuscript at 1), *available at* http://www.nber.org/chapters/c12567.pdf ("[T]he probability of a costly market failure in the electricity supply industry, often due to the exercise of unilateral market power, appears to be significantly higher than in other formerly regulated industries."); Richard O'Neill and Udi Helman, *Regulatory Reform of the U.S. Wholesale Electricity Markets, in* Creating Competitive Markets: The Politics of Regulatory Reform 141 (Land et al. eds., 2007) ("There was not much question that in the transition from the era of monopoly regulation, the new electricity markets could be particularly prone to generation market power.").

[220] Roughly a third of states, mostly in the Southeast and West, have opted to stay with the traditional cost-of-service model of electricity regulation. See Boyd, *Public Utility and the Low Carbon Future, supra* note __ (describing three models of electricity regulation in operation across the country); Boyd and Carlson, *Accidents of Federalism, supra* note __ (discussing how these three models

Although the details of market design and the specific rules governing these new wholesale markets varied, they did share some common features. All of them were based on a specific auction design—the so-called single- or uniform-price auction. All of them make use of a series of optimization algorithms that trace their roots back to post-WWII advances in linear programming and the efforts to solve the optimal power flow problem that is at the heart of power system engineering. All of these markets are also governed by non-profit, member based Independent System Operators (ISOs) or Regional Transmission Organizations (RTOs) that are themselves regulated as public utilities by FERC. And all of them rely upon independent market monitors as the first line of defense against market manipulation and gaming.

For its part, FERC has pursued an "open architecture" approach to the RTO and ISO markets, articulating general governance principles and approving tariffs, but leaving the design and development of the markets to the operators. Aside from a few technical conferences on software needs in these markets and some remarks in various rulemakings about software constraints, moreover, the Commission has not focused in any detail on the algorithms and software used to run these markets. As in natural gas, the Commission has not focused in any detail on the actual mechanisms of price formation, and it has generally assumed that robust competition in these markets will result in just and reasonable prices.[221]

[This part will ….]

### A. Auctions and Algorithms

The organized wholesale electricity markets in the United States are structured around a series of auctions that are themselves embedded in a set of algorithms that match the results of the auctions to the physical constraints of the grid. In effect, these markets are a complex mix of software and hardware that combine specific auction designs, subject to various market rules, with algorithms dedicated to optimizing power flow on the grid. The overall goal is to ensure economic or least-cost dispatch of electric generating units subject to grid constraints (what is sometimes known as security

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emerged somewhat accidentally from restructuring because of the particular structure of federalism at the heart of the Federal Power Act).

[221] See, e.g., FERC v. EPSA, 577 U.S. __ slip op at 4 (2016) ("In this new world [of competitive wholesale power markets], FERC often forgoes the cost-based rate-setting traditionally used to prevent monopolistic pricing. The Commission instead undertakes to ensure "just and reasonable" wholesale rates by enhancing competition—attempting, as we recently explained, 'to break down regulatory and economic barriers that hinder a free market in wholesale electricity'." (citing Morgan Stanley 554 US 527, 536)).

constrained economic dispatch) based on the results of a sequence of day-ahead and real-time auctions. The algorithms at the center of these markets ultimately determine the prices that result, influencing hundreds of millions of dollars in financial transactions every day.[222]

At the most basic level, the systems operation requirements in these markets are the same as those confronting traditional vertically integrated utilities. In both cases, systems operators dispatch generation units on the basis of cost subject to the physical requirements of the grid and the need to balance generation (supply) and load (demand) in real time. The main difference between the two models is that the inputs into the unit commitment and dispatch algorithms in the markets are submitted by independent generators and load serving entities and are ultimately matched or cleared through a specific auction structure. Systems operators in the wholesale electricity markets, in other words, have much less control over generation and thus face a more complex set of challenges in coordinating and managing the system than their counterparts in vertically integrated utilities. They also typically manage systems that are much larger in scope than those managed by individual utilities.

In the early days of electricity, the systems control challenge was modest, with small, local power plants serving a small number of end users.[223] During the 1920s and 1930s, however, as regional power networks expanded in scale and scope, the need for more formal control systems became more apparent, and system operators developed specialized slide rules, analog computers, and network analyzers to manage these networks.[224] Starting in the 1950s, early digital computers were used to analyze regional power networks.[225] And by the early 1960s, engineers formalized for the first time the problem of optimal power flow for regional electricity systems.[226]

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[222] See National Academies of Science, Analytic Research Foundations for the Next-Generation Electric Grid 62 (2016) ("Because these algorithms sit at the center of wholesale electricity markets, the influence financial transactions of hundreds of millions of dollars daily.")

[223] See Thomas P. Hughes, Networks of Power: Electrification in Western Society, 1880-1930 at 366 (1983) (discussing early direct-current and small local systems).

[224] See id. at 372-75 (discussing early approaches to systems operation and control in U.S. regional power networks during the 1920s and 1930s). See also Mary B. Cain et al., History of Optimal Power Flow and Formulations, Optimal Power Flow Paper 1, at 11 (FERC, 2013) (discussing early efforts to "solve" the optimal power flow problem using engineering judgment, rules of thumb, specially-developed slide rules, and analog network analyzers).

[225] See, e.g., Rodney J. Brown and William F. Tinney, *Digital Solutions for Large Power Networks*, 76 Trans. Am. Inst. Elec. Eng. 347 (1957) (discussing early use of digital computers to solving power network problems).

[226] See Cain et al., Optimal Power Flow and Formulations, supra note __ at 7 ("The optimal power flow problem was first formulated in the 1960s, but has proven to be a very difficult problem to solve."). See also J Carpentier, *Optimal Power Flows*, 1 Elc. Power & Energy Systems 3, 3 (1979) ("The trouble [with the prior approach of simple economic dispatch] started around 1961 when the use of networks close to their limits led to a fear of line overloadings; security constraints had to be

Efforts to "solve" the optimal flow problem have proceeded apace, drawing upon increasingly powerful optimization tools made available by advances in linear and non-linear programming during the post-WWII period.[227] Since the 1960s, utility system operators have made use of various commercial algorithms and digital computers to manage their systems in accordance with the requirements of optimal power flow.[228] During this time, refinements of the algorithms, better software, and increases in computational capacity have translated into massive improvements in overall performance. From the late 1980s to the early 2000s, for example, the speed of IBM's CPLEX algorithm (a commercial optimization algorithm used by several electricity markets) increased by some six orders of magnitude as a result of the combined effects of algorithmic and machine improvements.[229]

This remarkable increase in performance provided much of the necessary technical foundation for the development of wholesale electricity markets during the 1990s and 2000s. Indeed, it is fair to say that these markets were not really feasible prior to this time—that is, they could not be developed until software and computational capacity had achieved a sufficient state of development. All of these markets, moreover,

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introduced and optimal power flows were rapidly born. . . . [I]t appeared necessary to consider all the variables defining the state of the system and to solve the economic dispatch and the load flow problems at the same time. An optimal power flow may thus be defined as the determination of the complete state of a power system corresponding to the best operation within security constraints. Best operation usually means least fuel costs: security may range from the generation feasibility up to very sophisticated constraints, so that the optimization problem may become huge.").

[227] Cain et al.; Hunneault; Happ. Much of this work derived from the seminal contributions of George Dantzig to the field of linear programming starting in the late 1940s. In particular, Dantizig's development of the simplex algorithm at RAND in the late 1940s would prove to be enormously influential and important in solving optimization problems, including optimal power flow in electric power networks. See George B. Dantzig, *Origins of the Simplex Method, in* A History of Scientific Computing (S Nash ed., 1990); Dorfman, etc. In reflecting on the history of linear programming near the end of his life, George Dantzig described the field this way: "Linear programming can be viewed as part of a great revolutionary development which has given mankind the ability to state general goals and to lay out a path of detailed decisions to take in order to 'best' achieve its goals when faced with practical solutions of great complexity. Our tools for doing this are ways to formulate real-world problems in detailed mathematical terms (models), techniques for solving the models (algorithms), and engines for executing the steps of algorithms (computers and software)." George B. Dantzig, *Linear Programming*, 50 Op. Res. 42, 42 (2002).

[228] Hunneault; Can et al.

[229] Robert E. Bixby, *A Brief History of Linear and Mixed-Integer Programming Computation*, 2012 Documenta Mathematica 107, 113-14 (2007) (reporting total improvement factor of 5,280,000 for IBM CPLEX linear programming code between 1988 and 2002). The CPLEX algorithm is itself based on the simplex algorithm developed by George Dantzig in the late 1940s.

are still "software constrained," and small increases in the efficiency of these algorithms translate into billions of dollars in annual savings.[230]

Better algorithms and improved software for systems operation, however, were only a necessary first step in creating these markets. The markets themselves also had to be designed, which entailed all manner of choices regarding bidding, pricing, and settlement rules; the sequence of different markets for capacity, energy, and ancillary services; the locational effects of congestion; the value of flexible resources and so-called fast-ramping capacity; and, more recently, the integration of intermittent renewable resources and various demand-side and distributed resources. Needless to say, such an exercise represented far more than a simple withdrawal of regulation.

Indeed, the task of designing and building these new electricity markets, like other market design efforts that were underway during the 1990s, reflected and drew upon the growing enthusiasm for mechanism design within economics.[231] As the name

[230] See Cain et al., History of Optimal Power Flow and Formulations, supra note __ at 4 ("Small increases in efficiency of dispatch are measured in billions of dollars per year. Since the usual cost of purchasing and installing new software for an existing ISO market is less than $10 million, the potential benefit/cost ratios of better software are in the range of 10 to 1000."). See also id. ("The heart of economically efficient and reliable Independent System Operator (ISO) power markets is the alternating current optimal power (ACOPF) problem. The problem is complex economically, electrically and computationally. Economically, an efficient market equilibrium requires multi-part nonlinear pricing. Electrically, the power flow is alternating current (AC), which introduces additional nonlinearities. Computationally, the optimization has nonconvexities, including both binary variables and continuous functions, which makes the problem difficult to solve. . . . Even 50 years after the problem was first formulated, we still lack a fast and robust solution technique for the full ACOPF. . . . While superior to their predecessors, today's approximation techniques may unnecessarily cost tens of billions of dollars per year. They may also result in environmental harm from unnecessary emissions and wasted energy.").

[231] Mechanism design traces its roots to post-WWII developments in game theory, experimental economics, and the Hayekian emphasis on communication and information in market systems. *See, e.g.*, *Roger B. Myerson, Perspectives on Mechanism Design in Economic Theory*, 98 Am. Econ. Rev. 586, 602 (2008) ("Mechanism design and other areas of game theory have contributed to a fundamental change in the scope of economics. Once the scope of economics was defined by the allocation of material goods, but now economists study all kinds of questions about incentives in social institutions."); Alvin E. Roth, *The Economists as Engineer: Game Theory, Experimentation, and Computation as Tools for Design Economics*, 70 Econometrica 1341, 1341 (2002) ("[I]n the 1990s, economists, particularly game theorists, started to play a very substantial role in design, especially in the design of markets. These developments suggest the shape of an emerging field of design economics, the part of economics intended to further the design and maintenance of markets and other economic institutions."); Leonard Hurwicz, *The Design of Mechanisms for Resource Allocation*, 63 Am. Econ. Rev. 1, 27 (1973) (observing that "economic analysis has broken out of its traditional limits in at least two important ways: (1) devising specific new institutions; and (2) exploring the constraints and tradeoffs to which the design of mechanisms is subject."). See also Philip Mirowski, *Markets Come to Bits, supra* note __ at 213-14 (discussing the emergence of mechanism design within economics). One indicator of the growing importance of the field of mechanism design within

suggests, mechanism design involved a reframing of the task of economics from investigation and analysis of economic processes and mechanisms to one of active design of such mechanisms as a means of maximizing certain social objectives.[232] Economists, in this view, operated more as architects or engineers than as social scientists.[233]

Along with the FCC auctions for spectrum, the design of new markets for electricity provided an important opportunity for this emerging field of mechanism design. Much of the initial attention focused on questions of auction design for the day-ahead and real-time electricity markets, with two main alternatives under consideration: (1) a single-clearing price auction or (2) a pay-as-bid auction.[234] Under a single-clearing price design, offers to sell electricity and bids to buy electricity are stacked from lowest to highest price relative to the specific quantity to be sold or bought. The intersection of these supply and demand curves determine the clearing price. Successful offers (those below the clearing price) and successful bids (those above the clearing price) all receive the clearing price regardless of the actual price of their offer or bid. Under pay-as bid, as the name suggests, successful offers and bids receive or pay the price that they offer or bid. Although each design had its respective champions during the restructuring debates (as discussed below), all of the markets in the United States chose a single-clearing price design on the theory that this would provide incentives for generators to offer their generation at their marginal costs in order to ensure that they would clear the market and be dispatched. As we will see, however, the single clearing price design does have certain vulnerabilities in times of scarcity (when generation is constrained) that can lead to opportunities for gaming and manipulation and very high clearing prices.

[note other key market design choices]

All of these market design choices, moreover, have to be embedded in the optimization algorithms that govern the system. Because the power system operates as

economics is the fact that the 2007 Nobel Prize was awarded to Leonid Hurwicz, Eric Maskin, and Roger B. Meyerson for their foundational work on mechanism design theory.

[232] See Philip Mirowski and Edward Nik-Khah, *Command Performance: Exploring What STS Thinks it Takes to Build a Market, in* Living in a Material World: Economic Sociology Meets Science and Technology Studies 91 (Pinch and Swedberg eds., 2008) ("Where economists once placidly contemplated markets from without, situated in a space detached from their subject matter, so to speak, instead they are now mush less disciplined about their doctrines concerning the nature of economic agency and much more inclined to be found down in the trenches with other participants, engaged in making markets.").

[233] See Roth, *Economist as Engineer, supra* note __. *See also* Robert Wilson, *Architecture of Power Markets*, 70 Econometrica 1299, 1299-1300 (2002) (discussing role of "economics as an engineering discipline capable of providing guidance on details of market design" in context of electricity markets and more generally). A Professor at Stanford Business School, Wilson was deeply involved in the design of the California electricity market during the 1990s.

[234] Note vast literature on auction theory, different auction designs, and discussions during electricity restructuring on the merits of the two alternatives.

one big machine, auctions for electricity operate differently than those for spectrum and other goods and services. The optimization algorithms always get the last word, and in most markets this has translated into a system of locational prices that vary depending on congestion constraints. [elaborate]

Different optimization algorithms are also necessary for the day-ahead and real-time electricity markets, given that the system constraints vary depending on whether one is committing and scheduling generation units for the next day (the day-ahead market) or dispatching units in real time (the real-time market). These differences also create additional complexities in the markets and have been the subject of recent concerns and market manipulation cases (discussed below) regarding the use of so-called virtual bidding to arbitrage between the two markets.

Because each of the RTOs and ISOs have their own specific rules and market designs, they each use customized software packages to manage their markets. Currently, there are a handful of software vendors that provide the tools that run the organized wholesale power markets (Gorubi, IBM, Seimens, and GE/Alstom are the major players). Notwithstanding their foundational importance to these markets (and the prices that result), these vendors (and the tools they provide) are almost entirely insulated from ongoing discussions about oversight and regulation of the wholesale electricity markets.

Viewed from the outside, the overall complexity of these markets is staggering, requiring highly specialized support structures and personnel to make them work. To take one example, in PJM, which is the largest wholesale power market in the United States serving more than 50 million people, the systems operation challenge must contend with daily market volume that includes offers from over 1,600 generators, 20,000 demand bids, 60,000 virtual bids and offers, 9,500 different pricing nodes, 20,000 different transmission elements, and some 6,000 different transmission contingencies that must be modeled.[235] Designing a mechanism that can manage the physical, economic, and computational complexity of such a system is a socio-technical achievement of the first order. Designing an effective regime for oversight and regulation of such a system may well be beyond the capabilities of any institution.

### B. Electricity Restructuring

[This part will briefly describe the history of electricity restructuring and the development of the "organized" wholesale power markets managed by Regional Transmission Organizations and Independent System Operators. In doing so, it will focus on the development of particular market designs and the infrastructures

[235] See Ward, Unit Commitment in PJM Markets, @ FERC 2011.

(including especially the market clearing algorithms) at the heart of these markets. This history is not well known. It will focus specifically on the wholesale power market in California (the first major restructuring effort), as a set-up for the discussion that follows in the next part on the manipulation of the California electricity markets in 2000-01 and the crisis that ensued.]

### C. Manipulation and Crisis

[This part will describe the specific manipulations of the California electricity market during the crisis of 2000-01. The gaming and manipulation that was apparent in California was in part the result of bad market design, but it was also a product of efforts to take advantage of the physical constraints of the grid as embedded in the market clearing algorithms. As with natural gas, FERC was woefully unprepared for the gaming and manipulation that occurred—a fact that stemmed in part from the Commission's overly simplistic conception of markets and failure to pay close attention to the ways of price making at the heart of these markets.]

### D. Regulation and Oversight

[This part will focus on FERC's efforts in the wake of the California crisis to improve its market oversight and enforcement capabilities—discussing the additional regulations and authorities it has deployed and its ongoing efforts to gain better visibility into issues of price formation and the potential for manipulation. Here too FERC seems to be focused more on conduct and behavior than the actual ways of price-making at the heart of these markets. In the meantime, the algorithms that power these markets are treated as proprietary black boxes. FERC is not policing them. The RTOs and ISOs cannot really police them. The "independent market monitors" are not policing them.]

## V. The Art of Fixing Prices

[This part will draw out the broader lessons from the previous discussion of natural gas and electricity markets and situate them in the context of the long history of price making and public utility law. The following are some tentative thoughts along these lines:

- The price system, Justice Douglas famously wrote in the Socony-Vacuum Oil case, is the "central nervous system of the economy."[236] Efforts to manipulate prices interfere with this system and threaten the foundation of competitive markets. Protecting the ways of price making that operate in competitive markets should thus be a central concern of economic regulation.

- The economic critique of traditional public utility regulation depends fundamentally on the possibility that markets can be designed and overseen in a manner that will allow prices to form under competitive conditions. In the context of natural gas and electricity markets, FERC has assumed that market forces and the discipline of competition will work to keep prices low—that the market price is, in effect, the just price. Public utility regulation as practiced by FERC now involves making sure that markets are generating just and reasonable prices. Contrary to assumptions sometimes made about de-regulation and restructuring, this has proved to be much more challenging than traditional cost-of-service regulation.

- Indeed, FERC has learned the hard way that market forces cannot always be trusted to operate in a free and open manner. The California energy crisis demonstrated that it must be vigilant to protect against gaming and manipulation—that markets are fragile, that market design matters, and that the ways of price making at the heart of these markets can be objects of manipulation.

- But the Commission has struggled to understand and surveil these ways of price making. It has tended to assume that the market is the price maker and has been unable or unwilling to look inside these markets and investigate the actual instrumentalities or devices of price making that make them work. FERC has devoted significant attention to the conduct of market participants and it has developed elaborate rules for these markets (especially in electricity), but it has so far not taken on the instrumentalities of price making themselves.

- The challenges that FERC faces in overseeing and regulating these markets are similar in some ways to challenges facing other regulatory agencies in the so-called information age.[237] Understanding market-clearing algorithms and the ways in which they can be gamed is a very different task than ensuring a proper accounting has been made to determine cost-of-service.

[236] Socony-Vacuum, 310 U.S. 150, 224 n. 59 (1940).
[237] See, e.g., Julie E. Cohen, The Regulatory State in the Information Age, supra note __.

There are hard questions here about accountability. Can FERC really claim to understand how these markets function and can it in turn claim to be discharging its responsibilities if it continues to treat these indexes and algorithms as black boxes?

- It is relatively easy to see and acknowledge that market design is a political exercise as much as a technical exercise and is, therefore, subject to rent seeking just like any other form of regulation.[238] Standard public choice approaches need to be complemented (or perhaps extended) with more attention to the technical aspects of market design. As markets become more sophisticated, more complex, and more automated, the technical details of market design will matter even more—at the same time that they will become more opaque.

- The standard economic conception of markets is incomplete and overly abstract when it comes to understanding the ways in which actual markets work and how prices are formed in practice. By the same token, the legal realist insight that all markets are in fact legal entities—that there is no such thing as a "free market"—only gets us so far. This Article has embraced the notion that we also need to look at the materiality of markets and market practices. That is, we need to investigate the techniques and practices that allow these markets to function. We need to recognize that market actors and market participants are intimately bound up with these techniques. And we need to acknowledge that regulation ignores these techniques (or assumes them away) at its peril. Put another way, the varied and variable ways of price making within particular markets need to be taken on their own terms. We need more concrete histories of how actual markets work to complement our already well-developed intellectual histories of how they should work in the abstract.[239] This was the point made by Walton Hamilton more than 75 years ago in his work of "ways of price making," and it is no less relevant today than it was then.

**Conclusion**

[238] See, e.g., Landy et al, Creating Competitive Markets, supra note __.

[239] Cf. Michel Callon, Economic Markets as Calculative Devices at 1240 (observing that abstract conceptions of "the market" have made concrete markets invisible and seldom studied).