BOOK REVIEWS

Imperfect Markets and Imperfect Regulation: An Introduction to the Microeconomics and Political Economy of Power Markets, by Thomas-Olivier Léautier (MIT Press 2019) 416 pages, ISBN 978-02620-3928-4 (hardcover and kindle edition)

In this challenging and dynamic time in the electricity industry, new digital and distributed energy resource (DER) technologies are transforming both actual and possible economic costs and benefits. They also stress existing regulatory and utility models, and strain market designs tailored to a more homogeneous and unidirectional transmission and distribution grid with passive demand. For the past 130 years, the vertically-integrated electricity industry has built and operated transmission and distribution grids designed for the one-way delivery of electricity to customers who were end users, and since the 1910s they have done so in the United States mostly as state-regulated investor-owned utilities with monopoly service territories. Now the powerful decentralizing forces of digitization and DER innovation, combined with an impetus for decarbonization, are changing the technological, economic, and policy landscape. A sound understanding of the economics of electricity markets is required for both academic and policy analyses of these challenges.

With *Imperfect Markets and Imperfect Regulation: An Introduction to the Microeconomics and Political Economy of Power Markets*, Thomas-Olivier Léautier offers such a foundation. This book serves multiple audiences—academics, researchers, and analysts wanting a thorough technical treatment of electricity economics, policymakers seeking familiarity with the issues and the implications of policy choices, and industry participants looking for an understanding of the economic implications of different policies and market designs. The complicated history of the industry's organization and regulation as vertically-integrated monopolies makes this understanding difficult. Léautier's analysis cuts through some of these institutional complications and focuses on underlying economic principles in ways that will be useful to these audiences. His focus is on the economic theory of electricity markets, and he does not cover related topics of natural monopoly or regulatory theory. He does not open the "black box of price formation" (p. 12), nor does he open the black box of regulators, their incentives, and the incentives of the industry participants they regulate.

Léautier organized the analysis in four sections: wholesale markets, retail markets, network issues, and policy issues. Each section has chapters delving into market design topics. Léautier begins with wholesale markets, including chapters on peak-load pricing and lessons from the California crisis regarding imperfect competition and the exercise of market power. The retail section has a chapter on retail competition and vertical structure, and one on price-responsive demand. Section III covers network issues, focusing on transmission pricing and the relationship between transmission constraints and generator market power in wholesale markets. The final section addresses policy issues with a chapter on the effects of integrating renewable energy sources into power markets and one on administrative capacity mechanisms in wholesale power markets.

Each chapter starts with a clear analytical narrative treatment of the subject, and then maintains the structure of that narrative while presenting a formal model and deriving conclusions from it that support the narrative. The penultimate chapter addressing capacity mechanisms is particularly noteworthy, providing a thorough analytical framework for thinking through the benefits and costs associated with implementing capacity mechanisms.

The book has several remarkable features that will make it a useful resource for those interested in electricity economics. It provides a clear and accessible narrative synthesis of electricity economics, engineering, and policy, and their interactions; it does so by making use of Léautier's extensive background in research and practice. By drawing on practice in both Europe and the United States, it offers institutional comparisons that expand the scope beyond national or regional bound-

aries. Its integration of practical political economy considerations is important and sadly unusual; Léautier's framing of "imperfect markets and imperfect regulation" embeds a Demsetz-style (1969) comparison of actual market design and performance to actual regulation design and performance. The structure of each chapter, with an analytical narrative followed by a formal model, makes the book both accessible and valuable to different audiences with different levels of technicality. Across the chapters, Léautier maintains a consistent modeling framework, making the models useful starting points for researchers pursuing their own work.

Léautier echoes his own academic work and expertise in what I think of as the MIT-Toulouse electricity economics (Jean Tirole wrote the book's foreword). While his treatment using this analytical framework is thorough, his analysis lacks insights from other related literatures. Given the book's title, the discussion of political economy throughout the work is not as deep as it could be. Each chapter has content that would have benefited from such an analysis. In particular, using positive political economy to open up the black box of regulators as individual maximizing agents in each chapter would have introduced a truly integrated political economy to the work.

Other than standard references to Stigler (1971) and Peltzman (1976), it does not draw on long-standing existing positive political economy work in law and economics (e.g., Posner, 1971) or public choice (e.g., Tullock, 1967, and Krueger, 1974, on rent seeking; see also Dal Bo's, 2006, survey of regulatory capture). If, for example, Léautier incorporated a deeper analysis of raising rivals' costs (Salop, Scheffman, & Schwartz, 1986, and subsequent literature, following the seminal industrial organization work of Salop and Scheffman, 1983), he could have analyzed the role that generators play as stakeholders in the governance and market design choices made in regional transmission organizations in the United States, particularly in their ability to shape capacity mechanism rules that reward the construction of new generation. Léautier could also have incorporated institutional and transaction cost economics (Spiller and Tommasi, 2008) more deeply to expand the reader's understanding of why the economic and political institutions of electricity have the structure that they do.

Finally, he could have included transactive energy in his analysis, which merges automation and market design to enable local energy markets to coordinate among producers and consumers to achieve both system balance and surplus creation (e.g., Chassin and Kiesling, 2008; Rahimi and Ipakchi, 2012). This literature is both more applied and more focused in engineering than economics, but transactive energy is an energy system architecture that implements Léautier's well-articulated economist's vision:

> The economists' prescriptions are clear. . . . The wholesale market is an energy-only market (chapter 2), with locational marginal prices. . . . No structural intervention is required in the retail sector, as long as switching to a different supplier is easy and information about potential savings from competition is shared widely (chapter 4). Legitimate social concerns are addressed through transfers. . . . Retail and wholesale markets operate under the watchful gaze of an analytically strong and legally empowered market monitor . . . Finally, CO_2 is priced. . . . (p. 364)

This vision has yet to find much traction in the political reality of imperfect markets and imperfect regulation. *Imperfect Markets and Imperfect Regulation* is a valuable and thorough treatment of its subject that both suggests and leaves open several areas for further research, particularly those focused on political economy, transaction costs, and transactive energy.

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George P. Mitchell: Fracking, Sustainability, and an Unorthodox Quest to Save the Planet, by Loren C. Steffy (Texas A&M University Press, Kenneth E. Montague Series in Oil and Business History, 2019) 289 pages, ISBN 978-1-62349-803-0 (Cloth), ISBN 978-1–62349-804-7 (Ebook).

Economists recognize the importance of technological change but understand little about where it comes from. The suite of technologies that allow the economic exploitation of unconventional oil and gas resources, often lumped together under the umbrella of "fracking," have transformed North American and increasingly regional and global markets. One way to help understand the unconventional revolution is to see it from the perspective of an individual often credited with its creation—George P. Mitchell. Loren Steffy, a longtime Houston business reporter, stitches together a fluid and enjoyable account of Mitchell's life and career. Given Mitchell's central role in helping understand how hydraulic fracturing might change in ways that ultimately led to massive increases in well productivity, there are many delicious morsels for the student of technological change. The industry history buff will also enjoy the detailed account, which focuses more on specific contributions of Mitchell than more general accounts like Geoffrey Zuckerman's *The Frackers*, Russell Gold's *The Boom*, or Daniel Yergin's *The Quest*.

While some readers might be interested in other of Mitchell's varied exploits, such as the development of The Woodlands north of Houston as a model sustainable development project, the investment in reinvigorating Mitchell's native Galveston, the effort to build a superconducting supercollider in Texas, or even support for a nascent professional tour for women's tennis players, the main contribution of the book is in carefully documenting Mitchell's energy business that focused on natural gas production.

Mitchell spent more than fifty years in the oil industry, but the story of how he came to be recognized as the "father of fracking" is packed into six of the book's 26 chapters. The account is more history than hagiography, and is filled with primary accounts by Mitchell's employees like Nick Steinsberger and Kent Bowker, who contributed to the effort to demonstrate that hydraulic fracturing could help economically produce natural gas from the Barnett Shale. George Mitchell was an aging executive with wide interests rather than an obsessive tinkerer intent on demonstrating a particular outcome. While he did not discover the gas content of the Barnett, he did worry about how to find more gas and approved the first well into the Barnett itself in 1981. Mitchell did not tweak any frac recipes to avoid expensive gels, but he did try to push his staff to improve well performance and foot the bill when they failed along the road to success.

The detailed account clarifies some of the specific events that contributed to the ultimate success. The timing of natural gas delivery contracts, experimental drilling and fracturing projects, debt and contractual obligations, and the vagaries of the oil and gas markets from 1981–2001 are all important to understanding the course of events. The final technological breakthrough was far from certain as a commercial success. Many other oil and gas companies would not have persisted down the road that led to commercial hydraulic fracturing. Mitchell did not know where it would end up, but refused to take the several off-ramps that were offered to him. In so doing, George Mitchell helped create a set of conditions that allowed a technology capable of transforming an entire industry and indeed the world to make it across the formidable "valley of death" that undermines many promising ideas.

It might be fitting that he helped bring unconventional resources to the industry, because Mitchell was an unconventional oilman. His affinity for a wide range of like thinkers Buckminster Fuller, E.F. Schumacher, Stephen Hawking, and Rachael Carson set him apart from his peers. Mitchell Energy and Development, was an energy and real estate conglomerate, which made for a discomfortable combination at times. For all of his idiosyncrasy, Mitchell was fundamentally an oilman, and had been from a young age. He made several important discoveries in North and South Texas, for which he was rewarded handsomely. He supported the petroleum engineering program at Texas A&M, his alma mater, for many years. And yet he also philanthropized other fields at A&M and beyond. Steffy returns repeatedly to this duality of George Mitchell.

One of the strong contributions Steffy makes is an unvarnished account of the early legal challenges Mitchell Energy faced in the mid-1990s—well before it "invented" fracking—from local landowners who were concerned about rural residential water quality. In a preview of the subsequent political opposition that coalesced as fracking spread across the country, Mitchell argued, unsuccessfully and then successfully, that the causes of degraded well water were not directly related to its wells. The natural gas that was causing some water wells to catch fire was chemically different from the natural gas Mitchell Energy was tapping much further underground. Weaving this legal battlefield in amongst the technical and business fronts that Mitchell Energy also overcame richens the story. It is also an important touchstone for economists interested in policy surrounding oil and gas development, where clearly identifying treatment effects is an important but underappreciated endeavor.

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