Why Gasoline Costs So Much (And Why It’s Going to Cost More)

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Abstract

Gasoline markets today are dangerously fragmented, the result of almost one hundred years of often-contradictory economic and environmental regulations. In this paper, we analyze that regulatory history, highlighting how the unintended consequences of regulation have been to reverse market pressures toward a broad, deep national market in a commodity, pushing the United States toward a series of loosely connected regional markets. As a result, the American economy is vulnerable to natural disasters, terrorist attacks, and foreign dictators in ways that it need not be. In addition, the weakening of market forces produces higher prices for consumers and reduced innovation by refiners. We conclude by suggesting steps that can be taken to reduce this vulnerability and improve gasoline markets.
Market Fragmenting Regulation: Why Gasoline Costs So Much (and Why It’s Going to Cost Even More)

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Introduction

Virtually everyone holds an opinion on what is wrong with gasoline markets. Some people argue that gasoline costs too much, fattening greedy oil barons at the expense of consumers;¹ some link reducing oil producers’ profits to stopping terrorism.² Others contend that it costs too little, subsidizing suburban sprawl and gas-guzzling SUVs at the expense of the environment.³ Web sites track gasoline prices⁴ and grocery stores sell low cost fuel to lure shoppers.⁵ Policy makers debate whether gas taxes should be cut to lower the cost of living;⁶ should be a user fee for highway use;⁷ or need to be


³ See, e.g., Jacob Weisberg, I Smell Gas, SLATE (April 26, 2006) (available at http://www.slate.com/id/2140613/ (last visited June 19, 2006) (“cheap gasoline imposes its own costs on society: greenhouse gas emissions, air pollution and its attendant health risks, traffic congestion, and accidents. The ideal way to cope with these externalities would be with higher gas taxes or a carbon tax.”).


⁶ See, e.g., Russell Nichols, Bill Proposes Tax Cut to Save 21 Cents a Gallon, BOSTON GLOBE (May 11, 2006) (discussing proposed temporary repeal of Massachusetts gasoline tax to reduce cost of living for “working families and small businesses.”)

⁷ David Forkenbrock & Paul F. Hanley, Mileage-Based Road User Charges, PUBLIC ROADS (March/April 2006) (available at http://www.tfhrc.gov/pubrds/06mar/02.htm (last visited June 19, 2006)) (“For almost a

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increased to make drivers pay the full cost of their behavior.\textsuperscript{8} The Federal Trade Commission, Congressional committees and a host of state governments have repeatedly investigated gasoline prices, searching for someone to blame when prices rise.

These debates treat gasoline as a fungible commodity, widely traded in a national or international market. And for most Americans, gasoline gives every appearance of being just such a commodity – you can fill up from Boston to Los Angeles from pumps that look much the same from city to city and your car will run without noticeable differences in performance regardless of where you bought your gas. But Gulf Coast refinery closures in the wake of Hurricanes Rita and Katrina highlighted the fragility of gasoline markets,\textsuperscript{9} and significant differences in gasoline prices between locations in the United States over the last few years\textsuperscript{10} have raised questions about whether a national market really exists. If the gasoline market is not a national one, there are serious implications for both consumer welfare and public policy. Broad, national markets are able to absorb the impact of regulations at lower cost to the consumer than are narrow, fragmented markets. Moreover, fragmented markets offer the potential for implicit collusion among producers, collusion that can be facilitated by regulatory measures.

A recent regional price spike in Phoenix, Arizona illustrates the fragmented nature of U.S. gasoline markets. On July 23, 2003, the pipeline supplying gasoline to Phoenix ruptured, cutting gasoline supplies to Phoenix by 30 percent.\textsuperscript{11} Phoenix gas stations sought alternate supplies from west coast refineries, offering higher prices to bid the gasoline away from California retailers. These refiners had limited gasoline supplies, however, after earlier unplanned refinery closures had left them with lower than normal inventories. Because the Environmental Protection Agency (EPA) requires Phoenix to use a special blend of gasoline to control air pollution, gasoline from nearby Tucson could not be sold in Phoenix until EPA waived the boutique fuel requirement on August 20.\textsuperscript{12} Once the waiver was granted, gas from Tucson was trucked to Phoenix, raising prices in Tucson but lowering them in Phoenix.\textsuperscript{13}


\textsuperscript{9} See \textit{Congressional Budget Office, The Macro-economic and Budgetary Effects of Hurricanes Katrina and Rita: An Update} (Sept. 29, 2005) 19-20 (describing impact of Hurricanes Rita and Katrina on refineries) (available at \url{http://www.cbo.gov/fpdocs/66xx/doc6669/09-29-EffectsOfHurricanes.pdf} (last visited June 19, 2006)); \textit{U.S. FEDERAL TRADE COMMISSION, GASOLINE PRICE CHANGES: THE DYNAMIC OF SUPPLY, DEMAND, AND COMPETITION (2005).} (hereafter “\textit{FTC, GASOLINE PRICE CHANGES}”) at 28-29 (noting that as a result of Ivan, crude oil production fell by 83% immediately and continued below normal for several months, with reductions in crude from Venezuela also occurring due to tanker delays caused by the storm.)

\textsuperscript{10} Carl E. Behrens & Carol Glover, \textit{Gasoline Prices: Policies and Proposals}, CRS Report 1B10134 (July 1, 2005) at [2] (in 5 years before 2004 “gasoline prices demonstrated a great deal of regional volatility but less of an increase at the national level.”)

\textsuperscript{11} This example is drawn from \textit{FTC, GASOLINE PRICE CHANGES}, supra note 9, at 1-6.

\textsuperscript{12} The delay was due to Arizona’s delay in requesting a waiver, not EPA’s processing. The waiver was requested on August 19 and granted on August 20. \textit{FTC, GASOLINE PRICE CHANGES}, supra note 9, at 3-4.

\textsuperscript{13} \textit{FTC, GASOLINE PRICE CHANGES}, supra note 9, at 5-6. Tucson prices also rose because the pipeline passed through Tucson on its way to Phoenix. The break, which was between the two cities, prevented the Phoenix blend gasoline from being shipped on to Phoenix, reducing storage capacity in Tucson and so reducing supplies in Tucson. Id. at 6. Although the grant of the waiver resolved the immediate problem, the
U.S. gasoline markets are fragmented and that fragmentation stems from over a century of often inconsistent, overlapping regulations of gasoline and petroleum markets. This article charts the sources and extent of that fragmentation and its likely effects on the domestic gasoline market. We highlight the dangers of following the current regulatory trend toward additional fragmentation and recommend that policy makers and industry analysts acknowledge the market’s fragile condition and take remedial steps to avert potentially serious future crises. Part I outlines the characteristics of competitive markets and examines the structure of the gasoline market as shaped by the characteristics of gasoline, refining, and crude oil. Part II turns to the regulatory measures that affect the market for gasoline, tracing the impact of economic and environmental regulation. We then identify the incentives created by the structure of U.S. environmental regulation that lead to the creation of regulatory market externalities and suggest measures to reduce those incentives and so avoid market fragmentation. Part III concludes with recommendations for avoiding the problem in the future.

I. Competitive Markets & the Market for Gasoline

The impact of regulation on gasoline markets can be understood only against the backdrop of the role of market forces in competitive markets and an understanding of the complex nature of gasoline production and marketing. This section provides a baseline for our analysis of the regulatory market externalities created by economic and environmental regulations.

A. The Role of Competition

The United States was born out of efforts to create a national market. Ensuring a national market is thus a longstanding value in American jurisprudence – and with good reason. Economic theory teaches that markets discipline firms, forcing them to seek
methods of cutting costs to compete and survive. Recent business news demonstrates that this is not simply a textbook concept: Wal-Mart has forced retail costs down, competition from Toyota and Honda has pushed General Motors to force its suppliers to drastically cut costs, and the competition from Southwest Airlines has driven passengers’ costs down significantly in many markets. This competition has costs for some market participants: Wal-Mart’s competitors have suffered from Wal-Mart’s low prices; General Motors’ suppliers are fewer and leaner and their workforces smaller and less well paid as a result of G.M.’s cost-cutting, and the major American “legacy” airlines have been regularly forced into bankruptcy and to cut their employees’ compensation by the upstarts. It also has benefits: retail customers, purchasers of cars, and airline passengers all pay substantially less as a result of the market pressures produced by competition.

The competitive pressures in these examples derive from the breadth and depth of the markets in which these firms operate. Because a bottle of a particular shampoo in Dallas is (aside from its location) identical to a bottle of the same shampoo in Boston or, for that matter, a bottle in Bombay, the market is deep. Because there are many possible shampoos that deliver roughly equivalent hair cleaning experiences, the market is broad. As a result, Wal-Mart can buy shampoo to resell in a market that is both deep and broad. If a bottle of shampoo is available more cheaply in one location than another (taking transportation costs into account), Wal-Mart can buy in the cheaper location and ship the bottle to the more expensive market. If the maker of one brand raises its price, Wal-Mart can buy from a different manufacturer. The same is true in our other examples. If auto parts can be made more cheaply in Mexico than Detroit, General Motors can obtain parts from Mexico instead of from Detroit. If the profitability of airline fares is higher in one market than another, Southwest can shift planes from the market where the profits are lower to the market where the prices are higher. Of course, by shifting resources to the higher margin markets, market pressures increase in the more profitable markets as supply in them increases, and decrease in the less profitable markets as supply there decreases. Over time, therefore, prices tend to converge across linked markets.

17 See Emek Basker, Selling A Cheaper Mousetrap: Wal-Mart’s Effect on Retail Prices, Univ. of Missouri Working Paper 04-01 (March 2005) available on SSRN at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=484903 (finding price impacts on commodity goods from Wal-Mart stores opening); Steven Greenhouse, Mixed Grade for Wal-Mart on Report Card, N.Y. TIMES (November 5, 2005) at C4 (“a respected economic forecasting firm, Global Insight, found that by keeping its prices low and pressuring rival retailers over the last 19 years, Wal-Mart has kept the Consumer Price Index 3.1 percent below what it would have otherwise been.”)
19 See, e.g., Steven Greenhouse, Wal-Mart, Driving Workers and Supermarkets Crazy, N.Y. TIMES (Oct. 19, 2003) at 43 (“Wal-Mart has already helped push more than two dozen national supermarket chains into bankruptcy over the past decade.”)
22 Before they actually converge, of course, new events may produce a new set of price pressures.
Consider the counterfactual: what if trade barriers blocked markets from expanding and deepening? What if shampoo sold in Dallas were required to be formulated differently from shampoo sold in Boston? What if auto parts made in Mexico were subject to lengthy inspections when they were brought into the United States? What if airlines needed regulatory permission to fly between cities and that permission could be denied if allowing a flight would injure competitors? These barriers to trade would fragment the relevant markets and reduce competitive pressures. This would benefit existing providers of shampoo, auto parts, and air travel as well as existing providers of other competing products, since the reduction in market pressures could allow market incumbents opportunities to charge supra-competitive prices or reap other benefits from reduced competition. The costs of fragmenting these markets would fall on consumers, who would face higher prices for the goods and services. Fragmented markets also raise important equity considerations, since consumers in such markets will face different prices for similar goods.

Curbing market forces has effects on more than price. Competition pushes firms to innovate in product design, cut costs in production, find new markets, and engage in a host of additional beneficial activities. As discussed below, improvements in gasoline quality since World War II are largely attributable to “intense competition in the petroleum industry.” Similarly, the rapid rise in microprocessor capabilities in recent years tracks the fierce competition between Intel and AMD. Such innovations yield widespread benefits. In the case of microprocessors, a wide range of products which incorporate microprocessors become more powerful and less expensive as the cost of

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23 This is not entirely fanciful. Guatemala requires sugar sold there to have vitamin A added, a requirement that serves no purpose other than to protect Guatemala’s high cost sugar industry from imports. See Emerging Markets: Will Canada Meet the Challenge, CAFTA (Nov. 30, 2004) (available at http://www.cafta.org/emerging_markets.html (last visited July 14, 2006)) (listing fortification requirement as a non-tariff barrier to trade).


26 Subcommittee on Oversight and Investigations, Committee on Interstate and Foreign Commerce, U.S. House of Representatives, 's of Deregulation of Crude Oil (96-183), 96th Congress, 2d session (1980) [hereafter “Cost to Consumers”]. at 43-44 (In an exchange over the impact of price controls in the 1970s on consumers, the then-Secretary of Energy, Charles Duncan, argued that uniformity of gasoline prices across the nation constituted equitable treatment of consumers.)

27 See, e.g., DANIEL YERGIN, THE PRIZE: THE EPIC QUEST FOR OIL, MONEY, AND POWER (1992). at 549 (“Competition [in the 1950s and 1960s] took other forms [besides price] as well. Never had motorists been better served. Tires and oil were checked, windows washed, drinking glasses and sweepstakes entry forms were handed out – and all for free – in order to win and hold the affection of motorists. . . . Texaco also proudly assured its patrons that, for their benefit, it had gone so far as to ‘register’ all its restrooms throughout the forty-eight states.”)


microprocessors fall in price. Markets also serve an important role as a discovery process, with prices revealing opportunities to market participants.

Competitive markets depend on the ability of firms to enter and exit product markets. Perfect competition rarely exists outside the textbook, but the existence of rivals forces firms to innovate and compete even when competition is imperfect. Even the existence of potential rivals can be an important source of pressure on incumbent firms. Not surprisingly then, incumbents often seek regulations to raise barriers to entry to prevent competition. By erecting barriers to entry through regulations, incumbents can deter new entrants and make supra-competitive pricing possible.

Although the environmental law literature has traditionally focused on the special case of unpriced waste disposal services in analyzing market forces, market forces also have a significant role to play in reducing negative environmental impacts of production and consumption of goods. For example, even where disposal of wastes to the environment is unpriced due to the failure to fully specify property rights in environmental goods, disposal of a waste product represents the loss of any potential value contained in the waste product. Increasing the efficiency of a production process, which by definition involves the reduction in waste production, allows a firm to produce more with the same or fewer inputs.

Gasoline provides a classic example of this process. Gasoline initially was simply “the portion of crude petroleum too volatile to be included in kerosene. The first refiners had no use for it and often dumped an accumulation of gasoline into the creek or river that was always nearby.” Consumer demand, generated by the rising automobile

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32 The airline industry is an excellent example of the impacts of such competition. Despite their desperate need to raise fares, the legacy carriers (American, Continental, Delta, Northwest, and United) have been forced to discount fares and restructure their businesses in response to competition from discount carriers such as Southwest. See THOMAS PETZINGER, JR., HARD LANDING 317-333 (1995) (describing impact of Southwest Airlines).
33 See, e.g., Joel B. Dirlam & Alfred E. Kahn, Leadership and Conflict in the Pricing of Gasoline, 61 YALE L. J. 818, 826 (1952) (describing how potential competition limits market leaders in gasoline markets as “A good margin may tempt independents and majors, other than the leader, to cut price in order to increase volume. Implicit competitive influences of this sort may place very narrow limits upon the discretion of the leader, even though overt price warfare is sporadic.”). See also William G. Shepherd, Potential Competition vs. Actual Competition, 42 ADMIN. L. REV. 5, 15-17 (1990) (describing potential competition theory).
34 See John S. Moot, Economic Theories of Regulation and Electricity Restructuring, 25 ENERGY L. J. 273, 273 (2004) (“Many forms of regulation . . . became suspect as creating barriers to entry and regulating price as a means of providing supra-competitive rents to producers, rather than correcting market failures.”)
35 See, e.g., Noah Sachs, Planning the Funeral at the Birth: Extended Producer Responsibility in the European Union and the United States, 30 HARV. ENVTL. L. REV. 51, 56-57 (2006) (criticizing products whose price does not take into account the cost of disposing of their waste, noting that “In this zero-price disposal market, neither manufacturers nor consumers have any incentive to reduce waste generation or packaging or to consider the costs of disposal in production or consumption decisions.”)
36 See, e.g., TERRY L. ANDERSON & DONALD R. LEAL, FREE MARKET ENVIRONMENTALISM (2nd ed. 2001);
37 JAMES G. SPEIGHT, THE CHEMISTRY AND TECHNOLOGY OF PETROLEUM (3rd ed. 1999) 567 (hereafter “SPEIGHT, CHEMISTRY”). Similarly, when increasingly sophisticated cracking operations increased gasoline
industry, transformed gasoline into a highly valued commodity. By 1900, demand for gasoline exceeded the quantities produced by the existing distillation process and chemical engineers began experimenting with “cracking” crude (using heat to boost gasoline yields at the expense of the kerosene yield) and “widening the cut” of gasoline. Ten years later, kerosene was no longer the most important product and refiners were worried about a shortage of gasoline. Production yields capture the magnitude of the change: In 1880, one hundred barrels of crude produced, on average, 75.2 barrels of kerosene and 10.3 barrels of gasoline, while in 1940 the same hundred barrels yielded an average of 40-50 barrels of gasoline but only 5.5 barrels of kerosene.

Thus while it is true that in the presence of incompletely specified property rights to environmental goods, market forces sometimes provide an incentive to dispose of waste products in potentially environmentally damaging ways, this is best viewed as a special case caused by the failure to completely specify property rights rather than as the paradigmatic case. The general market incentive is to reduce waste, an incentive which is greater when the cost of waste disposal is positive than when it is zero. The incentive to reduce waste exists even in the limited case of free disposal, however, because the waste yields in the 1930s, they also increased byproduct gases, which initially had no economic value and were simply disposed of by venting or burning. Paul H. Giddens, Standard Oil Company (Indiana): Oil Pioneer of the Middle West 32 (1976) (“the quantity of these byproduct gases increased until their disposal became an economic problem.”) Polymerization processes enabled refineries to turn these gases from wastes to valuable octane enhancing feedstocks. Id. More generally, Miller and Shea’s 1941 review concluded that “[t]he constant practical application of chemical and engineering research to refining operations has resulted not only in improvement of products to meet changing conditions and requirements but in the reduction of waste in processing and in the manufacture of an almost infinite variety of products.” H.C. Miller and G.B. Shea, Gains in Oil and Gas Production Refining and Utilization Technology, (Technical Paper No. 3, National Resources Planning Board, 1941) at 36. Refineries continue to find ways to reduce costs by making use of waste products. See Eric Martin, Environmental Protection, in 2 Modern Petroleum Technology 197, 209 (Alan G. Lucas, ed. 2000) (“The optimum place to recover wastes is within the refinery itself” and listing examples.). 38 U.S. Auto sales doubled “approximately every two years” between 1900 and 1916. Yvette Taminiau, Room for Maneuvre 57 (2001).

39 U.S. Department of Commerce, Office of Domestic Commerce, United States Petroleum Refining: War and Postwar (Industrial Series No. 73) (1947) at 14 (“Demand for gasoline arising from the increased use of the automobile was the principal force behind the increasingly complicated refining technology and larger percentage conversion of crude oil to gasoline.”). 40 Leffler, supra note 38, at 4. See also Yergin, The Prize, supra note 27, at 111-112 (describing invention and commercialization of cracking).

41 This was done by raising the gasoline fraction to include hydrocarbons with boiling points up to 250 degrees Celsius rather than only up to 140 degrees Celsius. Taminiau, supra note 38, at 57.

42 Giddens, supra note 37, at 33.

43 Id. at 140 (“One of the most urgent and important problems confronting the petroleum industry in 1909 was the rapidly growing demand for gasoline. . . . alert refiners realized that, at the rate gasoline was being consumed by 1909, the normal supply would soon be inadequate and prices would skyrocket.”)

44 Miller & Shea, supra note 37, at 27.

45 Some critics of market processes object to the tendency of markets to provide individuals with consumer goods, arguing that consumption itself is problematic. See e.g. Barry Schwartz, The Paradox of Choice: Why More is Less 221 (2004) (“Having too many choices produces psychological distress, especially when combined with regret, concern about status competition, social comparison, and perhaps most important, the desire to have the best of everything – to maximize.”). Because such criticisms rest on a presumption that a minority is entitled to dictate its preferences to the majority, however, we do not address them here.
itself has potential value that is lost when it is discarded, as early refiners learned in the case of gasoline.

Despite its beneficial social effects, competition is privately costly for market participants and many prefer to avoid it. If participants in a market can arrange to collude, they can reduce competition and increase their profits, perhaps even approaching what a monopolist could earn.\textsuperscript{46} Collusion on prices is, of course, illegal.\textsuperscript{47} Monopoly profits are sufficiently desirable, however, that market participants sometimes attempt alternative methods which allow collusion without the use of explicit agreements.\textsuperscript{48} Where it avoids the attention of antitrust authorities, such implicit collusion can result in higher prices and reduced output.\textsuperscript{49}

Difficulties for the would-be cartel go beyond avoiding antitrust authorities, however. By undercutting the cartel price slightly, a cheating member can greatly expand output and so gain greater revenue – provided, of course, that the chiseling can go undetected and unpunished by the rest of the cartel.\textsuperscript{50} Because all cartel members face this incentive, a cartel without an effective enforcement mechanism will quickly unravel as members cheat the price down to the competitive price. Thus, a cartel will only succeed if it can effectively monitor its members’ behavior and punish those who cheat.\textsuperscript{51} Of course, antitrust law restricts explicit contracts in aid of cartels, and would-be oligopolists must resort to less effective, more expensive indirect methods of maintaining a cartel. Such methods can be effective, and allow cartel members to escape legal sanctions, in some cases.\textsuperscript{52}

Firms that wish to avoid competition must find a substitute for explicit contracts that allows them to coordinate their pricing behavior.\textsuperscript{53} This is difficult but coordinating

\textsuperscript{46} See, JEAN TIROLE, A THEORY OF INDUSTRIAL ORGANIZATION 239-262 (1988) (summarizing literature on tacit collusion); Alexis Jacquemin & Margaret E. Slade, Cartels, Collusion, and Horizontal Merger, in 1 HANDBOOK OF INDUSTRIAL ORGANIZATION 415, 417-18 (Richard Schmalensee & Robert D. Willig, eds. 1989) (“Sellers who recognize their mutual interdependence will have an incentive to cooperate as long as the profit which each can obtain when acting jointly is higher than when they act independently.”)

\textsuperscript{47} See Sherman Act, sec. 1.

\textsuperscript{48} See DAVID M. KREPS, A COURSE IN MICROECONOMIC THEORY 524-526 (1990) (explaining economics of implicit collusion).

\textsuperscript{49} See Id. at 528-529 (discussing example of GE-Westinghouse implicit collusion in turbine generator market in 1960s). It can also improve environmental quality where it helps solve commons problems. See Jonathan H. Adler, Conservation Through Collusion: Antitrust As An Obstacle To Marine Resource Conservation, 61 WASH. & LEEE R. REV. 3 (2004).

\textsuperscript{50} See Jacquemin & Slade, supra note 46, at 420-21 (summarizing literature on incentive to cheat). There is some evidence that this occurs in the crude oil market, with OPEC functioning only imperfectly as a cartel. See FTC, GASOLINE PRICE CHANGES, supra note 9, at 23.

\textsuperscript{51} Jacquemin & Slade, supra note 46, at 417.

\textsuperscript{52} See, e.g., id. at 453 (discussing evidence of collusive bidding practices in government auctions); id. at 443 (listing “cement, drugs, dyes, lumber, theaters, and tobacco” as industries that may exhibit “conscious parallelism”).

\textsuperscript{53} Id. at 429 (discussing the “phases of the moon” strategy used in one cartel to allocate low bid privileges). Critics of the oil industry continue to believe such behavior explains much of the industry’s conduct. For example, a U.S. labor union seeking to ensure that “a far higher proportion of the international tanker fleet bringing petroleum to the United States should consist of American ships with American crews,” commissioned a study of the oil industry, aimed at proving that “there is a hard core of joint action and control in the oil industry surrounded at its periphery by semi-independent fiefdoms which offer a somewhat deceptive patina of truly independent competition.” STANLEY H. RUTTENBERG & ASSOCIATES, THE AMERICAN OIL INDUSTRY: A FAILURE OF ANTI-TRUST POLICY (1973) at iii-iv.
behavior can occur even in the absence of legally enforceable restrictions. Such efforts are simpler with fewer competitors. 54 (If the cartel is successful at earning supra-competitive profits, those profits will attract new rivals. 55) Regulations can play an important role here, as they can aid cartels by helping cartels restrain output by assisting informal cooperation by members. 56

This brief survey of the impacts of market forces suggests three issues to consider in our examination of regulation’s effect on gasoline markets. First, competitive forces exert more influence as the number of competitors increases, raising the question of whether gasoline regulations have reduced the number of competitors in the gasoline market. In particular, incumbent firms will naturally seek to erect barriers to entry, making it important to consider the impact of regulations on entry. Second, competitive forces exert more influence as the goods traded in markets become more like commodities, and so are more readily substituted for one another. We must therefore look to see if regulations inhibit the commodification of gasoline. Third, cartels face a serious enforcement problem when they cannot directly collude. We should therefore examine whether regulations create conditions under which the profit maximizing behavior for refiners results in tacit collusion without open violations of antitrust laws. We now turn to the influence of the particulars of the gasoline market on how these forces operate.

B. The Market for Gasoline

Like most markets, the gasoline market is not perfectly competitive even without taking into account the impact of economic and environmental regulations. 57 The two questions that must be answered are: First, whether the market so diverges from the textbook ideal as to demand regulatory intervention to increase competitiveness; and,
second, whether regulation has increased or decreased the market’s competitiveness. We begin with the features of the market created by the technical characteristics of crude oil, refining, gasoline, and distribution. Perhaps the most important overall development in refining is the trend toward fewer, larger, more capital-intensive refineries. As we shall see, this trend is partially the result of the nature of gasoline production and distribution.

1. Crude Oil’s Impact on the Market for Gasoline

“U.S. refiners compete with refiners all around the world to obtain crude oil.”58 As a result, world market trends have important impacts on U.S. gasoline supply by affecting the price,59 amount, and type of oil U.S. refineries can obtain.60 Because what can be produced in a refinery depends in part on the type of crude oil used as an initial feedstock, the market for crude affects the market for gasoline.

Crude oil is a complex mixture of hydrocarbons with a variety of characteristics relevant to gasoline production including density, sulfur content, pour point, carbon residue, salt content, nitrogen content, metals content, and boiling range.61 Crude’s qualities vary considerably depending on its source.62 Characteristics of a particular crude may make it unsuitable or more costly for particular refineries and more or less expensive to formulate into gasolines with specific characteristics.63 Refineries are often designed to

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58 FTC, GASOLINE PRICE CHANGES, supra note 9, at 13.
59 Id. at 15 (“Variation in the price of crude oil drives most of the variation in the price of gasoline.”) The FTC found that changes in crude prices accounted for 85% of the variation in gasoline prices between 1984 and January 2005. Id. See also NPC, ADEQUACY, supra note 37, at C-7 (“The characteristics of the crude oil feedstock are critical to process selection. There are hundreds of crude oils available on the world market today that vary in physical properties.”)
60 Those inclined to see conspiracies behind oil issues should note that estimates of the concentration of the oil industry ranges from “very low” to “moderately concentrated,” depending on whether all nominally independent oil firms are considered independent in fact or whether OPEC is considered a single producer (as it would be if the cartel functioned perfectly). See FTC, GASOLINE PRICE CHANGES, supra note 9, at 21. In particular, the FTC’s 2005 review of the oil industry concluded that “[m]ajor private oil companies, both individually and collectively, control only a very small share of world crude oil production.” Id. at 22.
61 JAMES H. GARY & GLENN E. HANDWERK, PETROLEUM REFINING: TECHNOLOGY AND ECONOMICS (4th ed. 2001) at 22-26; SPEIGHT, CHEMISTRY, supra note 37, at 244 (“It is now generally recognized that the name petroleum does not describe a composition of matter but rather a mixture of various organic compounds that includes a wide range of molecular weights and molecular types which exist in balance with each other.”); NATIONAL PETROLEUM COUNCIL, FACTORS AFFECTING U.S. PETROLEUM REFINING: A SUMMARY (1973) [hereafter “NPC, FACTORS AFFECTING”] at 53 (“Crude oil is a substance comprised of a very complex mixture of hydrocarbons, which are molecules consisting almost solely of carbon and hydrogen atoms in various arrangements. Crude oil contains thousands of different molecules of varying sizes. . . .”); FTC, GASOLINE PRICE CHANGES, supra note 9, at 17 (“Crude oils from different fields usually have different chemical properties, including differences in density and sulfur content.”)
62 SPEIGHT, CHEMISTRY, supra note 37, at 215 (“Petroleum is not a uniform material. In fact, its chemical and physical (fractional) composition can vary not only with the location and age of the oil field but also with the depth of the individual well.”).
63 Carl Mortished, Western Refineries Spurning Sulphurous Saudi Oil, THE TIMES (London) (Sept. 17, 2005) (available at http://www.energybulletin.net/print.php?id=8949) (“Few refineries are able to convert” high sulfur Saudi oil into low sulfur gasolines required by U.S. environmental regulations); NPC, FACTORS AFFECTING, supra note 61, at 13 (“A change in the type of crude oil available to a refinery will affect the capacity of the refinery to process crude oil. Many refineries are designed to process low-sulfur crude oils and would soon become inoperable if significant volumes of high-sulfur crude oils were processed.”); NATIONAL PETROLEUM COUNCIL, PETROLEUM REFINING IN THE 1990S: MEETING THE CHALLENGES OF THE CLEAN AIR ACT (1991) [hereafter “NPC, 1990s”] at 15 (“The kind of crude oil, other raw materials, and the
process particular types of crude oil and cannot easily change to a different type (e.g., from low to higher sulfur crude) without extensive and expensive modifications. Indeed, refineries differ so significantly that some analysts suggest that it is not even meaningful to attempt to describe an “average” refinery.

Crude oil supplies have shifted toward higher sulfur crude of the type supplied by Saudi Arabia, and away from the low sulfur crudes that typified West Texas Intermediate. The shift in crude supplies has occurred at the same time as the demand for lower sulfur content in gasoline has increased due to environmental regulations. As a result, many smaller refineries optimized for low sulfur crudes shut down rather than incur the cost of modifications to handle high sulfur crudes.

Crude prices also affect refinery operations. The price of crude oil fluctuates based on a wide variety of international and political events, seasonal demand, and other factors, with the price of crude determined in the global market. Changes in relative prices between crude and refinery products have large effects on individual refineries’ profitability, and these effects can be quite different depending on the characteristics of the refinery. As a result, particular refiners may experience economic conditions that reduce their profitability, even as other refiners continue to make money, producing temporary or permanent shutdowns or product mix changes.

wide array of processing units employed in its manufacture will determine the gasoline batch composition.”); FTC, GASOLINE PRICE CHANGES, supra note 9, at 17 (“refineries are usually designed to be most productive using a specific range of crude oil. When they substitute... Even as early as the 1950s, some refineries were specifically designed for particular foreign oil sources. BOHI & RUSSELL, supra note 124, at 44.

64 NPC, FACTORS AFFECTING, supra note 61, at 4 (“A given refinery cannot effectively process every type of crude oil. If a refinery processes a type of crude oil for which it was not designed, the effective throughput capacity of the refinery will in many cases be reduced substantially. ... High sulfur crude oil ... cannot be exclusively processed in a domestic refinery designed for low-sulfur crude oil without the installation of additional facilities and/or extensive modification of existing facilities to prevent corrosive damage and to meet product specifications.”) When energy policies have dictated reallocation of crude supplies among refineries, the task has proven to be a challenge. See notes 420 - 431 infra. The FTC considers the technological capabilities of refineries to process particular types of crudes relevant to its antitrust analysis of proposed mergers in the oil industry. FTC, MERGERS, supra note 5, at 24.

65 NPC, FACTORS AFFECTING, supra note 61, at 55.

66 JAMES G. SPEIGHT & BAKI ÖZÜM, PETROLEUM REFINING PROCESSES (2002) at 27 (“In a more general sense, the average quality of crude oil has become worse in recent years. This is reflected in a progressive decline in API gravity... and a rise in sulfur content. ...”) Lower sulfur crudes are referred to as “sweet” and higher sulfur crudes are termed “sour”. “Typical sweet crudes are West Texas Intermediate (the popular, traded crude on the New York Mercantile Exchange), most Louisiana and Oklahoma crudes, North Sea, and Nigerian crudes. Sour crudes include Alaska North Slope, Venezuelan, and West Texas Sour from fields like Yates and Wasson. Intermediate crudes include California Heavy, such as from the San Joaquin Valley and many Middle East crudes.” LEFFLER, supra note 38, at 17.

67 NPC, FACTORS AFFECTING, supra note 61, at 16. See also U.S. Environmental Protection Agency, Office of Compliance, Profile of the Petroleum Refining Industry (EPA 310-R-95-013) (Sept. 1995) [hereafter “EPA, Profile”] at 11 (noting that cost of upgrading to meet 1990 Clean Air Act Amendments also made it more economical “in some cases” to close refineries rather than upgrade to meet the new standards).

68 GOVERNMENT ACCOUNTABILITY OFFICE, ENERGY MARKETS: EFFECTS OF MERGERS AND MARKET CONCENTRATION IN THE U.S. PETROLEUM INDUSTRY (GAO-04-96) (2004) at 18 (“The price of crude oil produced in the United States is determined in the world oil market because the decontrol of domestic oil prices in 1981 has effectively linked the U.S. oil market to the world oil market.”).

69 LEFFLER, supra note 38, at 219-221.
The evolution of the crude oil market also influenced refinery location. Refineries were initially located near oil fields but soon came to be located closer to the markets for their products, in part because of security concerns that developed during World War I, and in part because of supply problems for oil field plants. Limited infrastructure continues to give refiners in some locations cost advantages. Trade regulations also encouraged location of refineries near markets, as many countries adopted preferential tariffs for crude oil relative to refined products to offset crude’s higher transportation costs and encourage domestic refining. Locating a refinery away from oil fields requires infrastructure to deliver the crude to the refinery, and as the oil market became an international one, oil increasingly came to be transported by tanker. Eventually, refineries concentrated relatively close to ports capable of handling tankers in order to reduce transportation costs once the tanker arrived, whereby “refinery operations have become more concentrated both regionally and nationally” since the 1980s.

Today the only real alternative to locating a refinery near a port is to locate it near a pipeline connected to a crude oil source (either an oil field or a port). Because land near ports is desirable for other uses, and because refineries are often not considered desirable neighbors, the potential sites for new refineries are limited. Building a new

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71 USDOC, *War and Postwar*, supra note 39, at 13 (“The modern [1947] refinery with its several expensive units and laboratories needed to make selected hydrocarbon products is being built at locations where markets are accessible. A steady source of supply can be depended on through trunk pipe lines, or tankers.”).
72 Butler, supra note 70, at 195; EPA, *Profile*, supra note 67, at 7 (“For reasons of efficiency in transporting crude oil feed stocks and finished products, petroleum refineries typically were sited near crude oil sources (onshore petroleum terminals, oil and gas extraction areas) or consumers (heavily industrialized areas).”).
74 Refineries initially located near U.S. oil fields but capacity soon shifted to coastal areas as the shipment of oil by tankers became common after 1920. See J. Sidney Gould, *Recent Changes in Location and Size of Petroleum Refineries*, 1 J. Bus. U. Chi. 497, 501 (1928) (discussion of trend toward coast locations). For example, Rocky Mountain state refineries are the major market for some Canadian oil fields and the lack of more than “minimal infrastructure in place to deliver oil produced in the Rockies and Canada to other refining regions” gives those refineries a price advantage. Morningstar, *Frontier Oil*, (March 27, 2006) at 1.
76 See USDOC, *War and Postwar*, supra note 39, at 15 (describing transportation constraints on location requiring refineries to be built near ports or pipelines). See also Yergin, *The Prize*, supra note 27, at 410 (discussing impact of need to build pipelines and tankers to accommodate post-War boom in gasoline consumption.)
78 Peterson & Mahnovski, supra note 75, at 23 (“The refinery industry is dominated by legacy assets. In many cases these are century-old sites, chose because they were near major population centers or crude oil supplies (e.g., major producing fields, crude oil pipelines, and ports) of that time. As a result, most major refineries are clustered along the coasts. Because of demographic shifts, the movement of industry, and
refinery is thus made more costly and complicated, inducing refiners to expand existing refineries rather than build new ones, and limiting competition from new entrants since owning an existing refinery has become a de facto requirement for entry.

In sum, crude markets have three important impacts on gasoline markets. First, the international nature of the crude market creates powerful incentives to locate refineries in places where crude shipments can readily reach the refinery. As a practical matter this limits refineries in the United States to locations near domestic oil fields, near deep water oil terminals, or near pipelines connected to terminals or oil fields. Securing a feasible location for a refinery thus becomes a barrier to entry into the refining industry. Second, crude supplies are trending toward types of crude which are more costly to refine into less-polluting forms of gasoline, particularly with respect to sulfur content. This increases the capital intensity of refining, contributing to the trend toward fewer, larger refineries. It also makes entry into the refining business more difficult, an additional limit on competition. Third, the relationship between crude prices and refined products’ prices has a significant impact on refinery economics, putting a premium on refineries that are capable of flexible production methods, which puts older, less sophisticated refineries at a competitive disadvantage. This contributes to the trend toward more capital-intensive refineries, again increasing barriers to entry.

2. Gasoline Refining’s Impact on the Market

The method of producing gasoline also has significant impacts on the market for gasoline. At the most abstract level, producing gasoline is simply a matter of separating crude oil into the hydrocarbons with the appropriate boiling range and those with higher or lower boiling ranges. Early petroleum refineries did so by distilling off the various components from small batches of crude,\textsuperscript{79} making refining “a wasteful, underdeveloped operation in the hands of many people, each one working on a small scale.”\textsuperscript{80} While distilling remains an important step in refining,\textsuperscript{81} technological progress quickly added more sophisticated processes, with a refinery today best described as “a complex network of integrated units for the purpose of producing a variety of products from crude oil.”\textsuperscript{82}
Refineries use a variety of methods to transform the crude into refined products. “Any hydrocarbon can be converted into any other hydrocarbon by the appropriate application of energy, chemistry, and technology.”83 Among the most important is “cracking,” which converts higher molecular weight components into lower molecular weight components by rupturing the carbon bonds with heat (“thermal cracking”), or catalysts (“catalytic cracking”).84 A second important technique is “cooking,” in which low-value residual fuel oils are cracked into transportation fuels, leaving a residual of carbon with impurities known as coke.85 Further significant advances in refinery technology and design enable refiners to extract greater amounts of gasoline and other high value products.86

As a result of these technological changes, gasoline refineries today do not simply produce a single product. Rather they now produce a variety of intermediate components of gasoline, which they then blend in a complex operation to achieve the desired characteristics for the final gasoline product.87 Because components blended into gasolines may have multiple uses, with refineries often closely integrated with

83 James G. Speight, Thermal Chemistry of Petroleum Constituents, in PETROLEUM CHEMISTRY AND REFINING (James G. Speight, ed. 1998) at 121, 122.
84 SPEIGHT, CHEMISTRY, supra note 37, at 503-504. Catalytic cracking took off after World War II, with U.S. capacity increasing fivefold from 1945 to 1965. NPC, IMPACT, supra note 28, at 285. There may be higher molecular weight by-products produced as well. Id. at 503. See also EPA, Profile, supra note 67, at 21-24 (describing and diagramming process); LEFFLER, supra note 38, at 59-70 (describing process in nontechnical terms).
85 EPA, Profile, supra note 67, at 20. See NPC, IMPACT, supra note 28, at 284 (describing coking’s development after 1930). Leffler gives a colorful description of coking: “If thermal cracking is like throwing a hamburger on a hot grill, coking is like Texas barbeque—slow cooked all the way through.” LEFFLER, supra note 38, at 110.
86 SPEIGHT, CHEMISTRY, supra note 37, at 585 (“The last 60 years have seen substantial advances in the development of catalytic processes . . . This has involved not only rapid advances in the chemistry and physics of the catalysts themselves but also major engineering advances in reactor design . . . [which together] have allowed major improvements in process efficiency and product yields.”) This progress had an impact on costs as well: total operating costs for refineries fell 12 percent in real terms from 1946 to 1965. NPC, IMPACT, supra note 28, at 257.
87 Blending various outputs of refineries developed early. In 1917, for example, Haney complained that gasoline “had ceased to be a homogeneous product and in its name were sold blends of heavy naphtha or ‘cracked’ residual products combined with more volatile elements.” Lewis H. Haney, Gasoline Prices as Affected by Interlocking Stock Ownership and Joint Cost, 31 Q. J. ECON. 635, 647 (1917). Yet by 1924, Thompson reported without comment that “[t]he great bulk of gasoline used as a motor fuel for automobiles and other internal combustion engines is a blended product. Formerly only ‘natural’ or ‘straight run’ gasoline, obtained by distilling petroleum by the application of heat at atmospheric pressure, was sold for motor fuel purposes.” Thompson, supra note 89 in Error! Bookmark not defined., at 89. The FTC also noted blending and cracking had begun to play a significant role in 1915. Federal Trade Commission, Report on the Price of Gasoline in 1915 (1917) at 21-22. By World War II the transition to “a product made by careful blending of refinery stock prepared by involved new processes and special additives developed in research programs” was complete. NPC, FACTORS AFFECTING, supra note 61, at 51-52. By the late 1960s, in-line blending techniques were used for about half of U.S. gasoline production, a technique which a technical survey called “one of the significant new developments in the refinery industry.” NPC, IMPACT, supra note 28, at 293. Blending today is done in virtually all refineries. J.D. Robinson & R.P. Faulkner, The Oil Refinery: Types, Structure and Configuration, 2 MODERN PETROLEUM TECHNOLOGY 1, 8 (Alan G. Lucas, ed. 2000). See D.R. Blackmore, Gasoline and Related Fuels, in 2 MODERN PETROLEUM TECHNOLOGY 217, 245-246 (Alan G. Lucas, ed. 2000) (discussing complexity of modern blending techniques).
petrochemical plants,88 and because unit shutdowns affect the available blendstocks,89 the components of the final product may vary considerably even within a single refinery over time. The mix of components operational at any particular time at a particular plant that also has an impact on the refinery’s ability to operate at its full capacity.90

The process of improving oil production and refining began almost as soon as oil was commercially produced.91 Cracking and coking techniques first appeared after World War I,92 during a period in which “the field of hydrocarbons chemistry took off in a series of revolutionary discoveries,”93 and the technology again rapidly advanced during and after World War II, in response to the war’s demand for fuel for combat aircraft.94 From then on, “the refining industry became a branch of the chemical industry and it was capable of transforming the complex mixtures that constitute petroleum into high-quality fuel components by controlling specific chemical reactions.”95 One significant example of technological progress shows how dramatically refining changed under demand pressures. In the early 1930s, the 100 octane reference fuel “was a rare chemical costing $25 per gallon in the small quantities necessary for anti-knock testing purposes” but by 1941, “the industry [was] manufacturing millions of gallons of iso-octane for use directly as aviation fuel at little more than 25 cents per gallon.”96

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89 NPC, 1990s, supra note 63, at 15 (“As an individual processing unit is shut down for scheduled or unscheduled maintenance, the gasoline formula may be adjusted to compensate for a shortage of that unit’s blendstock.”).
90 See, e.g., NPC, ADEQUACY, supra note 37, at 25 (“configuration and processing capability in units downstream of the atmospheric distillation unit may be such that the product output is uneconomic at full utilization of atmospheric distillation capacity.”)
91 1 Bradly, supra note 73, at 19 (noting “innumerable mechanical innovations that lowered business costs and reduced oil waste.”)
92 USDOC, War and Postwar, supra note 39, at 7 (“The refinery process used to convert crude petroleum to products at the Titusville plant [the first refinery], and the only one used up to about the time of World War I, was the crude-distillation process.”); Miller & Shea, supra note 37, at 26 (“the introduction of the cracking process in 1912 marked the beginning of a new epoch in the chemistry and refining of petroleum. . . . [and] led the way for further technical advances in refining practices. . . .”)
94 Speight, Chemistry, supra note 37, at 536; id at 565; Taminiu, supra note 38, at 61 (“World War II was a trigger for the production of fuel that had an octane number of 100 and for the production of vast quantities of aviation gasoline of a high quality.”). Consider one particularly dramatic example: catalytic cracking was first put into commercial operation in 1936 and refinery capacity for it was at 122,000 barrels/day in 1940. By November 1944, U.S. catalytic cracking capacity reached 1,011,650 barrels/day, a 729 percent increase in four years. USDOC, War and Postwar, supra note 39, at 9. Automobile engine advances also spurred improvements in refining technology. Miller & Shea, supra note 37, at 26 (“The petroleum-refining industry has had to keep pace with the rapid strides in development made by the automobile engine and the changing demands of the automotive industry. . . .”)
95 Taminiu, supra note 38, at 61.
96 Miller & Shea, supra note 37, at 30. Demand for higher octane gasolines beginning in the 1930s led to innovations as well. Speight, Chemistry, supra note 37, at 681 (discussing use of thermal reforming to improve octane). Average octane ratings rose steadily from World War II into the mid-1960s. NPC, IMPACT, supra note 28, at 262 (showing increase for premium from MON 78 / RON 85 to MON 90 / RON 99 by 1965).
The increasingly sophisticated technology gave refiners ever greater control over the refining process. As a result, refineries became increasingly capable of producing a wide range of outputs with multiple uses.97 “[M]ajor changes” in refinery processing after World War II vastly increased output quantity and quality.98 Refineries were able to obtain increasing amounts of gasoline and other high value transportation fuels from each barrel of crude,99 and today use a wide range of “downstream” processing units to process lower quality crudes, make products with more demanding specifications, and increase yields.100 Investment in these technologies has soared since the 1980s, with hydro-treating capacity increasing 53.6% from 1985 to 2003, thermal cracking capacity increasing 29.5% over the same period, and catalytic hydro-cracking capacity increasing 42.4%, compared to a 9% increase in atmospheric distillation capacity and a 15.6% increase in vacuum distillation capacity.101 The payoff from this investment has been significant. Gasoline production grew from 142,465 bbls/day in 1900 to 4.1 million bbls/day in 1960, reaching 8.3 million bbls/day in 2005.102 In addition there has been dramatic progress in catalysts, substrates, and catalysis modeling as well, which has allowed improvements in “environmental performance, product quality and volume, feedstock flexibility, and energy management without fundamentally changing fixed capital stocks.”103

As the production process became more complex, gasoline evolved as well. “Prewar [World War II] gasoline was a simple mixture of largely unprocessed stocks with basic additives for octane improvement and storage stability.”104 By the 1960s, additives had become more sophisticated and refineries produced a range of specific hydrocarbons to blend into the finished gasoline.105 Refineries have also become more complex in an effort to reduce raw material costs, adding technology to allow processing of lower quality fuels.106 Refineries today are essentially solving a complex linear

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97 LEFFLER, supra note 38, at 77.
98 NPC, IMPACT, supra note 28, at 281. The NPC’s assessment of technological change from 1945 to 1965 in refining concluded that

The product specifications of all refinery products have been steadily changing since World War II to improve the performance of these products in end use. As the equipment and machinery using petroleum products have become more sophisticated, so have the treatment and finishing techniques. Technology advances have improved the operating and economic aspects, resulting in a beneficial influence on blending, as well as improvements in the uniformity of product quality.

Id. at 293.
99 FTC, GASOLINE PRICE CHANGES, supra note 9, at 53 (“Consumer demand for products such as gasoline and diesel has motivated investment in downstream processes that can increase the yield of these products from a given barrel of crude.”).
100 FTC, MERGERS, supra note 5, at 182.
101 Id. at 201, Table 7-3.
NPC, ADEQUACY, supra note 37, at C-1 (1900 figures).
103 PETERSON & MAHNOVSKI, supra note 75, at 44.
104 NPC, IMPACT, supra note 28, at 256.
105 NPC, IMPACT, supra note 28, at 256. See also NPC, ADEQUACY, supra note 37, at 28 (“Demand for light products such as gasoline and diesel fuel exceed the natural quantity of these products in crude oil” and so prompt investment in conversion technology).
106 NPC, ADEQUACY, supra note 37, at 28-29.
programming model to optimize the mix of hydrocarbon fractions produced and the blends of gasoline created. 107

In short, refinery production is not a static process. Refineries can adjust the fraction of their output which goes to various products and regularly do so. 108 A more recent development is the operation of a network of refineries as a unit, allowing “for movements of feedstocks and blending stocks across refineries and therefore more efficient use of capacity at each refinery.” 109 Regulations dictating the characteristics of outputs place additional constraints on the process, substantially increasing its complexity, making compliance with the various regulatory mandates and technical constraints a managerial “art form.” 110 Moreover, crude oil price and product price variations also influence the decision about the operation of refineries. For example, as oil prices climbed, refinery economics changed and the ability to maximize production of the appropriate mix of high value products became more important than maximizing volume. 111 The result was “increasingly wide variations in refinery margin” depending on whether refineries had the ability to produce the appropriate combination of products, leading to the closure of some older refineries and significant upgrades to others. 112

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107 GARY & HANDWERK, supra note 61, at 243. Because of the technological changes induced by demand for higher performance fuels by World War II, the post-war period is the most appropriate for examining long term trends in the industry. See also NPC, IMPACT, supra note 28, at 297 (noting increasing sophistication of refinery controls as refinery complexity grew.); PETERSON & MAHNOVSKI, supra note 75, at 44 (“Innovations in advanced process monitoring and controls have allowed refineries not only to operate more efficiently and safely but also to produce fuels to more-exacting product quality specifications in a more reliable manner—not unlike a highly automated chemical plant.”).

108 PARKASH, supra note 81, at 119 (“The yield of products in FCC [fluid catalytic cracking] depends on the feedstock quality, type of catalyst, and operating conditions. FCC units are usually operated to maximize the yield of gasoline; however, the process is versatile and can be operated to maximize middle distillate or LPG, both of which are at the expense of gasoline.”); U.S. Department of Energy, An Analysis of Refiners’ Total Barrel Costs and Revenues from the Sale of Petroleum Products: 1976-1979 (November 1980) (DOE/RG-0048) at 23 (discussing impact of product prices on production mix). One regular change is the shifting of production between maximizing gasoline in the summer and maximizing heating oil in the winter. LEFFLER, supra note 38, at 65.

109 FTC, MERGERS, supra note 5, at 102.

110 LEFFLER, supra note 38, at 147. Leffler describes the competing constraints as follows:

The emissions from burning gasoline cannot exceed various combinations of the four emitters [toxics, NOx, VOCs, SOx] . . . The control mechanism sets limits on combinations of the four.

At the same time the generation of the four emitters is connected in complicated way to the gasoline characteristics [a wide range of technical criteria including RVP, oxygen content, benzene, aromatics content, olefin content, sulfur content, and the T50 and T90] . . . Because of their impact on the four emitters, all these properties have explicit limits, some by statute, at least in the U.S.

Finally, in order for gasoline to work well in car engines, refiners must make gasoline that meets their own performance specifications . . . .

LEFFLER, supra note 38, at 147.

111 Jones, supra note 39, at xviii (“The key to refinery economics became the addition of value – the excess of realizable value of the saleable products over the cost of crude and other feedstocks, and other economic inputs such as chemicals, catalysts, utilities, maintenance and salaries.”).

112 Id. at xviii-xix.
This increased sophistication of refinery operation comes at a price. Investments in hydrotreating in the 1970s and 1980s, for example, allowed the Gulf Coast refiners in particular to process cheaper, sour crudes but roughly trebled capital expenditures. The equipment necessary to maximize the production of economically valuable products, which requires the production of precisely calibrated intermediate hydrocarbons, and blending them into consistent products, is considerably more sophisticated and expensive than the rudimentary distillation equipment used in the industry’s early years. Accordingly, gasoline’s production process has become complex and capital intensive, which in turn allows the product’s final characteristics to be controlled quite precisely. Although technology has repeatedly revolutionized refining over the last hundred years, refining’s modern sophistication may be nearing the limits of current technology’s ability to squeeze additional capacity out of existing refineries, due in part to the maturity of many refining technologies.

Wider trends in manufacturing also affected gasoline refining and retailing. The last decades of the twentieth century saw increased attention paid to inventory control, with “just-in-time” manufacturing processes cutting inventory costs in a wide range of businesses. Trends in retailing, such as the rise of retail giants like Wal-Mart also had an impact as those companies moved into gasoline retailing, bringing their buying power to bear on the price and terms of gasoline sales. Refiners expanded vertically into

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113 Not all refineries are equally complex, of course. NPC, 1990s, supra note 63, at 15 (“Of the more than 120 refineries producing gasoline in the United States, processing complexity ranges from the relatively simple topping-reforming plants to extensive coking deep conversion systems.”).
114 PETERSON & MAHNOVSKI, supra note 75, at 62. See also FTC, GASOLINE PRICE CHANGES, supra note 9, at 66, n. 66 (noting investments to enable processing lower quality crude).
115 See USDOC, War and Postwar, supra note 39, at 13 (new technology developed in 1930s “require[s] much larger capital to construct and maintain the refinery proper.”); id. at 28 (listing the need to secure “adequate capital” to build new capacity and technology as one of the major problems of smaller refiners.).
116 PETERSON & MAHNOVSKI, supra note 75, at 39 (“upgrading pipes, controls, catalysts, and boosting process temperatures and pressures is no longer cost effective without major changes in the capacity or configuration of reactor vessels—changes that are much more expensive. ‘Most of the easy, low-hanging-fruit investments have been made,’ said one participant. Another concurred: ‘The capacity for additional improvements is declining.’ Mid-size and smaller refineries could probably still obtain 10-15 percent increases, observed a third respondent, but larger firms ‘probably can’t go a whole heck of a lot higher.’”).
117 Id. at 43 (“The petroleum refining industry relies on mature technologies and processes—many of which were developed decades ago. The increases in productivity experienced in the 1990s were achieved through incremental improvements in existing refinery equipment, processes, and practices. ‘Not much is being done on the processes themselves,’ said one executive of a leading operating company.”).
119 See id. at 518-522 (describing cost cutting). Just-in-time techniques have spread to the gasoline business with “better market information and transparency. With greater information about the status of a firm’s supply chain and inventories, maintaining just-in-time operations and running on the edge have become less risky from a business perspective.” PETERSON & MAHNOVSKI, supra note 75, at 42. See also FTC, GASOLINE PRICE CHANGES, supra note 9, at 54-55 (noting trend toward reduction of inventories of gasoline to reduce costs and to free up capital for other investments); 76 (noting impact on reducing prices by making refineries more efficient and increasing them by making the system less tolerant of unplanned outages.)
120 See note 160 infra.
higher margin retailing, with service stations evolving to include convenience stores. These changes, together with the closure of smaller and less efficient refineries, reduced refiners’ excess capacity, and so the amount of spot market, unbranded gasoline. The spot market for essentially commodified gasoline had provided needed flexibility for the national market, allowing quick response to shortages. As the spot market shrank in the 1990s, the ability to make up shortfalls caused by even a temporary closure of a particular refinery declined.

Refining’s evolution has regularly increased gasoline yields, lowering operating costs while increasing capital costs. Technological progress thus both increased barriers to entry and provided a cushion that could adsorb the costs of increasing regulation without increasing the prices consumers perceived.

3. The Properties of Gasoline & the Market

The physical gasoline production process is crucial to understanding the market for gasoline. Refineries produce a wide range of products, including nonfuel products from solvents to asphalt, chemical feedstocks such as benzene, and fuels including diesel, jet fuel, kerosene, liquefied petroleum gas, residual fuel oil, distillate fuel oil, and motor gasoline. Gasoline comes in many varieties, as it has done almost from the beginning of the industry. Indeed, “gasoline” is now defined in the technical literature simply as “complex mixtures of hydrocarbons having typical boiling ranges from 100 to

121 Yergin describes the early evolution of the gasoline retail market as follows:

Before the 1920s, most gasoline was sold by storekeepers, who kept the motor fuel in cans or other containers under the counter or out in back of the store. The product carried no brand name, and the motorist cold not be sure if he was getting gasoline or a product that had been adulterated with cheaper naptha or kerosene. . . .In 1920, certainly no more than 100,000 establishments sold gasoline; fully half of them were grocery stores, general stores, and hardware stores. Few of those stores were selling gasoline a decade later. In 1929, the estimated number of retail establishments selling gasoline had grown to 300,000. Almost all of them were gas stations or garages. YERGIN, THE PRIZE, supra note 27, at 209.

122 A spot market is one “in which a commodity or currency is traded for immediate delivery. It is distinguished from a futures or forward market, in which contracts for delivery at some future date are traded.” THE MIT DICTIONARY OF MODERN ECONOMICS (3rd ed., 1989. David W. Pearce, ed.) at 398.

123 See PARKASH, supra note 81, at 384 (noting need for refineries to change product mix in response to conditions such as “a critical pump-out of service, partially coked-up furnace, catalyst bed with high pressure drop or low activity, a delayed ship causing severe ullage constraints, or a change of specifications can upset the best-laid plans” for output). The need to shift from aviation fuel to gasoline had contributed to the post-World War II shortages. YERGIN, THE PRIZE, supra note 27, at 410.

124 Residual fuel oil (or “resid”) “is the viscous residuum of the refining process which strips the lighter molecules from crude oil. Because of its consistency—it sometimes cannot be pumped unless heated—resid cannot be transported long distances economically except by water . . . The primary U.S. market for resid is as a utility and industrial fuel.” DOUGLAS R. BOHI & MILTON RUSSELL, LIMITING OIL IMPORTS: AN ECONOMIC HISTORY AND ANALYSIS 144 (1978).

125 EPA, Profile, supra note 67, at 4.

126 As early as 1917 the FTC noted that “[t]he idea that gasoline is gasoline is erroneous.” FTC, 1915, supra note 87, at 44. A 1958 survey identified forty types of gasoline produced by refineries. American Petroleum Institute, Inform. Bull. No. 11 (1958) quoted in GARY & HANDWERK, supra note 61, at 9. Today, “gasolines of many different designs have evolved to meet local needs and legislation.” Blackmore, supra note 87, at 218. See also JOHN K. PEARSON, IMPROVING AIR QUALITY: PROGRESS AND CHALLENGES FOR THE AUTO INDUSTRY (2001) at 83 (“Gasoline composition varies depending upon the crude oil source, refinery processes used in its manufacture, and the amount of oxygenated compounds added in the final blend.”)
400°F (38 to 205°C) as determined by the ASTM method,” leaving open the application of the term to a wide range of substances. As one refinery executive noted, “Gasoline is not gasoline anymore. It is a specialty chemical.”

There are many properties that differentiate gasolines from one another. These properties determine both engine performance and the environmental effects of burning the particular gasoline. These impacts are not simple or unidimensional. Particular characteristics of gasoline can have both positive and negative impacts on both engine performance and the environment, often making the precise mix of characteristics a matter of tradeoffs. The motives for changes in gasoline characteristics vary over time. For example, EPA seeks to reduce SOX emissions and to improve catalytic converter performance by reducing the amount of sulfur in fuels. Yet early efforts to reduce gasoline’s sulfur content were market-driven, both in the 1880s, when the Lima, Ohio oil field produced sulfur-contaminated oil that yielded products so odoriferous that they were virtually impossible to sell, and in the post-World-War II period, because sulfur is “an important contributor to engine wear and deposits.” Similarly, controlling evaporation from storage tanks first became an industry priority as a cost cutting measure, only later becoming an environmental measure.

One major characteristic is gasoline’s volatility, measured in terms of Reid Vapor Pressure (RVP) or the Driveability Index (DI). “Overall, lower RVP appears to be the major contributor to lowered VOC emissions resulting from the use of [reformulated

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127 GARY & HANDWERK, supra note 61, at 9. See also J.G. Calvert, J.B. Heywood, R.F. Sawyer, & J.H. Seinfeld, Achieving Acceptable Air Quality: Some Reflections on Controlling Vehicle Emissions, 261 SCIENCE 37, 42 (1993) (“Gasoline is a complex mixture containing hundreds of different HCs; its physical and chemical properties are difficult to describe with a few parameters.”); Blackmore, supra note 87, at 217 (discussing meaning of term “gasoline”).

128 PETERSON & MAHNOVSKI, supra note 75, at 21 (quoting a “technology and services executive.”).

129 GARY & HANDWERK, supra note 61, at 14 (“The Reid vapor pressure (RVP) and boiling range of gasoline governs ease of starting, engine warm-up, rate of acceleration, loss by crankcase dilution, mileage economy, and tendency toward vapor lock.”); LEFFLER, supra note 38, at 130-131.

130 Data from a study before the widespread use of boutique fuels found major differences in emissions from different forms of gasoline. A 1993 article, for example, reported that recent data . . . indicate that the highest exhaust emission fuels had some combination of T50 (the temperature at which 50% of the fuel evaporates) values greater than 100°C, T90 (the temperature at which 90% of the fuel evaporates) values exceeding 171°C, or sulfur content greater than 300 parts per million by weight. . . . According to a 1992 survey, 20% of commercial fuels exceeded these distillation cutpoints and 40% of commercial fuels exceeded the sulfur cutpoint.

131 TAMINIAU, supra note 38, at 218 (“changes in a given property may lower the emissions of one pollutant but may increase those of another . . . [and in] some cases, results also depended on vehicle category,” with changes in fuel improving emissions from some types of vehicles but not from others.)

132 NPC, ADEQUACY, supra note 37, at 43.

133 GIDDENS, supra note 37, at 3.

134 NPC, IMPACT, supra note 28, at 262.

135 Id. at 258.

136 “The Reid vapor pressure is approximately the vapor pressure of the gasoline at 100°F (38°C) in absolute units (TSTM designation D-323.” GARY & HANDWERK, supra note 61, at 15. See Blackmore, supra note 87, at 228 (discussing volatility issues). The Driveability Index is calculated from “three specific distillation points plus an oxygen content measurement in some forms of the calculation.” NPC, ADEQUACY, supra note 37, at 93.
gasoline (RFG)). But too low an RVP can cause combustion in the engine to be incomplete, leading to higher HC emissions due to unburnt fuel. Gasoline with a higher RVP improves starting in cold conditions, but, at high temperatures and altitudes, can cause vapor lock, degrading engine performance. Optimizing the volatility of a gasoline blend thus involves tradeoffs over several performance characteristics and consideration of the altitude and temperatures of the area where the gasoline will be used. Since at least the 1930s, refiners have optimized their products’ volatility for different temperature and pressure conditions, and a number of other characteristics as well.

Different gasolines are generally defined in terms of desired properties rather than by their particular components. But the definition of the optimal mix of characteristics has changed significantly over time as production techniques evolved to give refiners greater control over gasoline composition. For example, “front end volatility” of gasolines increased after World War II into the 1960s because the higher volatility “improved performance characteristics markedly.” Today, of course, a primary concern is reducing volatility to reduce vehicle emissions.

In addition to their various hydrocarbon components, gasolines often contain a variety of additives designed to improve some aspect of their performance. In general, customers will be looking for good performance under all weather conditions (power, smoothness (driveability), cold starting, fuel economy), for reliability (no engine damage, no undesirable combustion noise such as knock, cleanliness and non-corrosion of the components) and for environmental acceptability (not only legislated exhaust and evaporative emissions, but also low odour levels, and the ability to meet regular emission checks.)

As early as the 1930s, refiners began to introduce “seasonally balanced” gasolines with characteristics that varied with location and season, making them more volatile in winter to help starting, and less volatile in the summer to boost mileage. In general, customers will be looking for good performance under all weather conditions (power, smoothness (driveability), cold starting, fuel economy), for reliability (no engine damage, no undesirable combustion noise such as knock, cleanliness and non-corrosion of the components) and for environmental acceptability (not only legislated exhaust and evaporative emissions, but also low odour levels, and the ability to meet regular emission checks.)

137 NATIONAL ACADEMY OF SCIENCES, OZONE-FORMING POTENTIAL OF REFORMULATED GASOLINE (1999) at 142.
138 Blackmore, supra note 87, at 228. Too low an RVP, however, and “the vapour pressure in the fuel tank can fall to a dangerously low level under cold ambient conditions whereby it falls below the upper flammability limit of the gasoline, thereby posing a risk of fire during refueling.” Blackmore, supra note 87, at 225. See also id. at 228-229 (discussing impact of volatility on driving performance and emissions).
139 GARY & HANDWERK, supra note 61, at 11.
140 As early as the 1930s, refiners began to introduce “seasonally balanced” gasolines with characteristics that varied with location and season, making them more volatile in winter to help starting, and less volatile in the summer to boost mileage. GIDDENS, supra note 37, at 478. NPC, IMPACT, supra note 28, at 256 (volatility optimization); LEFFLER, supra note 38, at 131. There are a range of characteristics of gasoline sought by customers.

In general, customers will be looking for good performance under all weather conditions (power, smoothness (driveability), cold starting, fuel economy), for reliability (no engine damage, no undesirable combustion noise such as knock, cleanliness and non-corrosion of the components) and for environmental acceptability (not only legislated exhaust and evaporative emissions, but also low odour levels, and the ability to meet regular emission checks.)

Blackmore, supra note 87, at 217.
141 See NPC, IMPACT, supra note 28, at 261-262 (“Following World War II, motor gasoline changed from a relatively simple mixture of petroleum fractions into a complex product made by careful blending of many intermediate refinery stocks. . . . the refiner is able to exercise close control over the final product to give it desired properties.”)
142 NPC, IMPACT, supra note 28, at 263. These improvements include “starting easier, warmup is quicker, there is less crankcase dilution and, to a lesser extent, an improvement has been made in cylinder deposits and engine wear.” Id.
143 See note 498 infra.
144 NPC, IMPACT, supra note 28, at 263 (“Prior to 1950, the number of different additives used in gasolines was relatively small.”); NPC, FACTORS AFFECTING, supra note 61, at 52 (noting that in 1970s “[s]pecial detergent or dispersal additives are now available to help maintain a clean carburetion system, resulting in improved engine performance, better mileage in city driving, reduced carburetor maintenance and reduced exhaust pollutants.”); Blackmore, supra note 87, at 238 (discussing increasing need for additives for product differentiation, to maintain engines, and to prevent corrosion and deposits from mandated oxygenates); NPC, IMPACT, supra note 28, at 256 (Additives now [1967] are used not only for octane improvement and stability, but also to reduce carbon deposits, clean carburetors, prevent carburetor icing,
particular, additives to control engine “knock” by increasing octane have played an important role. Perhaps the most important innovation was the Ethyl Corporation’s introduction of anti-knock gasoline in the 1920s, which forced companies without contracts for Ethyl’s additives to develop their own high performance fuels. Lead, for example, was added to gasoline for many years to improve its octane rating and, more recently, methyl tertiary butyl ether (MTBE) was added to reduce the environmental impact of combustion and boost octane. In short, products sold to motorists labeled “gasoline” initially varied substantially from retailer to retailer. Early gasoline retail competition focused on quality claims as consumers gradually learned to distinguish differences relevant to performance. Some states attempted quality regulations but...
these initial efforts were based on imperfect understanding of gasoline quality. Similarly, today many gasolines are blended with ethanol, initially thought to improve environmental quality, but now largely seen as ineffective.

Over time, however, the consistency of gasoline converged in several key respects. From the consumer’s point of view, the most important was the gradual standardization of octane ratings; three roughly similar grades of gasoline are now generally offered by most U.S. gasoline retailers. Although some gasoline retailers attempted to differentiate their products through the use of particular additives or by offering unusual octane ratings, from the 1920s to the 1980s gasoline steadily became more of a commodity in which price competition dominated competition through product differentiation. Not surprisingly, as the product became more of a commodity the refinery business became a low margin business, and any effort to raise prices caused

152 Id. at 179 (States regulated gasoline quality and these laws “were based upon gasoline obtained directly from crude oil” and refined products processed with cracking, etc. could not satisfy the definitions (which specified a gravity of at least 63 degrees)).


154 NPC, 1990S, supra note 63, at 15 (“With the exception of the additives package, which is typically unique from brand to brand, gasolines are generally interchangeable.”); id. at 30 (“most current gasolines are truly interchangeable products”). See also NPC, ADEQUACY, supra note 37, at 95 (noting development of ASTM standards for gasoline specifications and efforts by refiners to use “internal specifications” to assure quality.)

155 LEFFLER, supra note 38, at 137.

156 Mobil, for example, promoted the inclusion of detergents in its gasoline starting in the 1950s. See Mobil, http://www.udfinc.com/mobil/ (last visited July 13, 2006) (“Mobil has long recognized that gasoline detergent additives are necessary for modern vehicles to stay in top operating condition. In fact, Mobil was the first gasoline marketer to use detergents, back in 1954, 40 years before the U.S. government began to require their use. Since that time, we’ve continued our leadership position in gasoline detergency. In 1985, Mobil was the first to use detergents that cleaned fuel injectors. We continue to use state of the art detergent additives in all of our gasoline grades.”) Exxon told consumers to “put a tiger in your tank”. See Tiger, Wikipedia http://en.wikipedia.org/wiki/Tiger (last visited July 13, 2006) (describing use of tiger mascot by Exxon). Amoco sold unleaded gasoline long before gasoline retailers were required to do so and marketed the absence of lead as an advantage. See Leslie H. Moeller, Nick Hodson, and Brad Wolfsen, The Superpremium Premium, Strategy+Business, Issue 37, http://www.strategy-business.com/press/16635507/04401 (last visited July 13, 2006).

157 Dirlam & Kahn, supra note 33, at 831 (describing how Sun Oil competed in the 1950s by “offering higher than standard octane gasoline at standard prices” and so “giving the customer more for his money”); James B. McNallen, A New Concept in Gasoline Marketing, J. MARKETING 273 (1958) (discussing Sun market strategy).

158 Jones, supra note 39, at xxii (“In the period up to the late 1970s there was an element of performance competition amongst the major oil companies, but since that time this element of competition has largely disappeared and, in respect of petroleum fuels at least, it has become much more of a commodity market meeting industry standard specifications. Where companies have sought to distinguish their fuels in recent years it has rarely been on the basis of performance. . . .”) See also Vernon T. Clover, Price Influence of Unbranded Gasoline, 17 J. MARKETING 388, 393 (1953) (a study of independent gasoline retailers in the 1950s found that “[i]dependents, as compared to standards, offer little in the way of services, and put little stress upon attractive buildings and facilities, and uniformed employees” instead stressing prices below the standards.).

159 See, e.g., Walter Pfeiffer, Refining: Let the Good Times Roll, Accenture (2005) (available at http://www.accenture.com/Countries/Canada/Research_And_Insights/RefiningLetGoodTimesRoll.htm (last visited July 15, 2006) (“Over the last 20 years conventional wisdom has been that refining is capital
the price leader to lose market share.\textsuperscript{160} As attempts by refiners at different times to reduce competition failed, the gasoline market increasingly approached the economics textbook ideal. Thus, market forces helped bring about a relatively steady decline in the real price of gasoline – aided, of course, by declining real crude oil prices through most of this period.

The crucial points for our purposes are that gasoline is a complex commodity, the design of which presents refiners with a large number of tradeoffs.\textsuperscript{161} Gasolines differ in terms of their environmental impacts and their performance in engines. With gasoline composition largely unregulated through the 1980s,\textsuperscript{162} market pressures through the 1980s commodified gasoline, pushing it toward a more-or-less standard set of the characteristics about which consumers cared (e.g. octane), broadening and deepening the market for gasoline.\textsuperscript{163} Refiners remained free to alter other characteristics of gasolines to maximize profits, producing gasoline blends that varied with refinery equipment and crude supplies. Since then, however, environmental regulations and engine performance demands have complicated the market by introducing new requirements.\textsuperscript{164}

4. Distribution Systems’ Impact

Gasoline was originally transported by tank wagons and rail cars.\textsuperscript{165} The “most revolutionary development” in transportation was the 1929 conversion of an oil pipeline into a gasoline pipeline, running from Bayonne, New Jersey to Pittsburgh, Pennsylvania.\textsuperscript{166} “With a carrying charge far below railroad freight rates, gasoline could be shipped into the Middle West via the Ohio River and the Great Lakes and have a profound competitive effect upon the price of gasoline from Wood River, Whiting, and

\begin{itemize}
\item \textsuperscript{160} Further evidence of the commodification of gasoline is the development of new forms of marketing gasoline to develop alternative revenue streams. As early as the 1920s, Standard Oil of Indiana was treating its service stations as vehicles for the sale of a broad array of products, giving managers quotas for its entire range of products from furniture to lubricants. GIDDENS, supra note 37, at 283 (“By the late 1920s Standard service stations had evolved into stores for the sale of petroleum products instead of simply being gasoline filling stations.”). Grocery stores are increasingly using gasoline sales as a loss leader today. See Wal-Mart’s Next Victims, FORBES (Nov. 2004) (describing Wal-Mart’s move into gas sales); Gas Group Fumes Over Giant Eagle Discounts, PITTSBURGH BUSINESS REPORT (March 14, 2005) (available at http://www.bizjournals.com/pittsburgh/stories/2005/03/14/daily7.html (last visited July 13, 2006)) (describing grocery store use of fuel discounts to gain market share).
\item \textsuperscript{161} For example, hydrotreating gasoline to remove sulfur also reduces octane by approximately 10 numbers in “FCC gasoline” (that made with fluid catalytic cracking units). NPC, ADEQUACY, supra note 37, at 45.
\item \textsuperscript{162} The major exception was the mandatory phase out of lead in 1970s and 1980s. See notes 480 - 486 supra.
\item \textsuperscript{163} Market pressures during the 1980s were particularly effective as the industry had excessive demand refining capacity through the mid-1990s as a result of the distortions introduced by the MOIP and 1970s price controls/allocation system. See NPC, ADEQUACY, supra note 37, at 21.
\item \textsuperscript{164} PETERSON & MAHNOVSKI, supra note 75, at xiv (“As demand for petroleum products has grown, their quality and performance have changed substantially as a result of environmental regulations and motor vehicle performance requirements.”); NPC, OBSERVATIONS, supra note 13, at I-18 (“As product specifications become more restrictive, the ability to utilize all the flexibility and volume capacity inherent in the refining system can be diminished.”)
\item \textsuperscript{165} GIDDENS, supra note 37, at 46-48 (describing early distribution methods).
\item \textsuperscript{166} Id. at 466.
\end{itemize}
other Mid-Continent refineries.”167 Pipeline capacity rapidly expanded in the 1930s. Capacity grew from 1,289 miles in 1929 to over 8,000 miles by 1940.168

By the 1980s, the pipeline networks and the rest of the transportation system169 had grown to allow refiners to ship across wide territories,170 although significant gaps remained.171 Pipeline shipments went from 236 billion ton-miles in 1979 to 299 billion ton-miles by 2001.172 As gasolines became commodities, this network allowed shipments to be treated as interchangeable173 and refiners routinely engaged in product exchanges to reduce transportation costs and solve temporary shortages.174

Today the United States has a “complex set of facilities” that distribute gasoline and other fuels which “includes a network of geographically dispersed pipelines, marine vessels, and occasionally rail cars” and which “is made more complex by the number of product variations that must be transported to the marketplace.”175 Most large petroleum markets are supplied primarily by local refineries because “[t]he fundamental transportation and flexibility advantage of moving crude oil versus a variety of products generally favors local refiners serving local markets.”176 Distribution systems are critical to the competitiveness of a local market, however, as they link markets and allow shipments in and out as local demand and supply conditions vary. “In some cases a pipeline may have more control over the pricing and volume of products entering a market than do the refiners supplying the pipeline.”177

Unfortunately, however, “[a]ccess to refined product pipelines also varies widely among different regions in the U.S.”178 The amount of refinery capacity and the interconnection of an area with other areas are important determinants of whether or not market pressures can produce a response to temporary shortages.179 For example, almost

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167 Id. at 455-467.
168 1 BRADLEY, supra note 73, at 825.
169 NPC, 1990s, supra note 63, at 23 ("As gasoline moves from each refinery through the complex maze of transportation modes, through terminals and bulk plants to the consumer, it may move into many tanks and vessels owned and operated by different companies.").
170 PETERSON & MAHNOVSKI, supra note 75, at 23 ("The East Coast and the Midwest, while having relatively few refineries given the size of their population, obtain approximately 40 and 20 percent, respectively, via pipeline and water carriers from Gulf Coast mega-refineries. The Northeast also relies on a large increment of refined products (17 percent in 1999) imported from abroad, giving that region a measure of additional market liquidity."); FTC, MERGERS, supra note 5, at 210 ("Pipeines are the leading method used for bulk transport of refined products within the United States; transportation by water is also important.").
171 PETERSON & MAHNOVSKI, supra note 75, at 23 ("California, Nevada, and parts of Arizona are largely walled off from the rest of the country by both geography and stringent local environmental regulations.").
172 FTC, MERGERS, supra note 5, at 210.
173 NPC, 1990s, supra note 63, at 23 (The "preponderance of shipments" of gasoline are "interchangeable").
174 Id. at 23 ("The interchangeability of base motor gasolines is further demonstrated by the product exchanges between refiners in different locations. It is typical for a refiner in one location to trade or exchange surplus product to another refiner located in a different state. . . . Unique additive packages, specified by each company, are often added at the terminal upon truck loading in order to achieve unique product quality and marketing differentiation.").
175 NPC, ADEQUACY, supra note 37, at 101.
176 Id. at 22.
177 FTC, MERGERS, supra note 5, at 189.
178 FTC, GASOLINE PRICE CHANGES, supra note 9, at 80.
179 Id. at 69.
half of U.S. refining capacity is concentrated on the Gulf Coast, while 95% of east coast refineries sit in Pennsylvania, New Jersey, and Delaware.\textsuperscript{180} New England, on the other hand, has no refineries or pipelines, and California remains isolated by a combination of a lack of pipelines and special fuel formulations.\textsuperscript{181}

As might be expected then, “refinery capacity varies widely among different regions of the U.S.”\textsuperscript{182} Refined products are often not produced where they are used, whereby they must be transported to the market. These transportation costs limit the extent to which any particular refinery can sell its gasolines in each location and define the extent of market power each will have in particular areas.

The product mix is also crucial to determining the cost of transportation. When different products are sent through a pipeline, for example, the interface between the two products where some mixing occurs must be sold as the lower quality product, producing a loss in value.\textsuperscript{183} Boutique fuels make this even more difficult.\textsuperscript{184}

Transportation networks and product variety thus combine to delineate the size of markets. A low degree of connectivity to the broader market has been crucial in determining the success of some refiners. For example, “[a] critical asset of many smaller refiners is their location in interior markets where a lack of pipeline access protects them from competition from large coastal refineries.”\textsuperscript{185} Extending a pipeline into a small refiner’s territory is a “real threat.”\textsuperscript{186} Thus, these higher cost producers survive only because they are insulated from competitive pressures by their relative isolation from the broader market and the costs and regulatory obstacles associated with entering those markets.

\textbf{C. Understanding the Market for Gasoline}

This brief overview of the non-regulatory aspects of gasoline markets paints the following picture of the market. Gasoline has a broad range of characteristics produced from a substance that itself varies significantly, using equipment that varies from location to location. Its production remains subject to various constraints imposed by the crude, the equipment, and the characteristics of the final product demanded by consumers. Market pressures produced a commodity fuel from this mix of unique inputs, equipment, and outputs, at least with respect to the characteristics about which consumers have a preference (e.g., octane, RVP). Refiners were able to create this commodity by using other aspects of gasoline composition (e.g., the particular combination of hydrocarbon fractions blended into a particular batch) because the differences among these

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\textsuperscript{180} \textit{Id.} at 81, 84.
\textsuperscript{181} \textit{Id.} at 85, 87,
\textsuperscript{182} \textit{Id.} at 79.
\textsuperscript{183} \textit{NPC, ADEQUACY, supra note 37, at 105.}
\textsuperscript{184} \textit{Id.} ("As the number of different products increases and batch sizes decrease, quality control become more difficult and the effective capacity of the pipeline system decreases.") \textit{See also Id.} at 108 (For each new fuel specification, “there will be distribution system modifications required.”)
\textsuperscript{185} \textit{PETERTON & MAHNOVSKI, supra note 75, at 18-19; NPC, ADEQUACY, supra note 37, at 29 ("In some situations, local markets are isolated from direct product supply routes and are therefore more expensive to supply from distant refining centers."); FTC, GASOLINE PRICE CHANGES, supra note 9, at 52 ("A small refinery’s cost disadvantages from small-scale operation may be offset if it is located near an area of crude oil production or strong gasoline consumption, so that transportation costs are low, or if it is able to serve a niche market.")}
\textsuperscript{186} \textit{PETERTON & MAHNOVSKI, supra note 75, at 67.}
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characteristics were invisible to, and so irrelevant for, consumers. Refiners were also able to continually expand output from refineries through technological progress, again making use of the ability to use a variety of blendstocks without changing the consumer-demanded characteristics of the gasoline. The price of being able to do so, however, was increasing the complexity of refineries to give them the flexibility to process quite different crudes into gasolines with the appropriate consumer-demanded characteristics.

Without the impact of either economic or environmental regulation of refining, the market for gasoline seems likely to have been headed toward fewer, larger, more complex refineries producing a product with sufficiently commodified characteristics that consumers primarily differentiated among gasolines by price. In the absence of regulation, therefore, we would expect to see a national market for gasolines, with regional variations in composition designed to promote uniform performance under a range of local conditions. The limit to such a market would likely be transportation costs. Those in turn would likely have been derived primarily from the extent of the pipeline and tanker network. Because businesses in other markets have prospered by solving similar logistical problems, an unregulated gasoline market would likely have led to logistical innovations, extending the market’s size. This conclusion stems from the above analysis and the almost uninterrupted trends toward such a market, despite the radical shifts in regulatory policy since World War II, which are described in the next section.

How competitive would gasoline markets be in the absence of regulation? Counterfactuals are always difficult to prove, but it seems most likely that markets would have tended toward the competitive end of the spectrum for two reasons. First, from the consumer’s perspective, gasoline has moved steadily toward commodity status, particularly during the comparatively unregulated early period and the brief return to relatively unregulated status during the 1980s. During this period (and into the 1990s), refineries became more efficient and competitive. Second, although the capital intensity of modern refineries makes entry more costly than it would be into a less capital-intensive industry, capital intensity alone is not a sufficient barrier to entry to prevent the development of competition where opportunities for profit exist. The industry would likely have attracted new entrants. Indeed, when excess capacity declined in the 1980s, additional capacity in existing refineries quickly eliminated the higher than usual returns that the industry briefly enjoyed during the late 1980s. Moreover, as economic deregulation occurred in the 1980s, new firms did enter the refining industry by buying existing refineries. We now turn to the impact of regulatory policy and the question of whether it produced regulatory externalities that fragmented the market.

II. Regulatory Impacts

Energy markets have historically been subject to numerous regulations from a wide range of federal and state agencies. One analysis of U.S. policy through the 1970s
concluded that the dominant theme was a “drift toward government control” of the oil industry, perhaps best explained “by the tendency to presume that any situation defined as a problem must have a solution, and that a solution is, ipso facto, worth pursuing.”191 These regulations have had a major impact on gasoline markets, if not always the impact intended. Although the focus shifted from economic regulation to environmental regulation after the 1981 decontrol of oil prices, the depth of the interaction between the government and the market continued. In this section we describe the major economic and environmental regulations that shaped the gasoline market.

A. Economic Regulatory Activity and Gasoline Markets

U.S. energy policy reflects numerous twists and turns, falling into distinct periods, each characterized by a different approach to government intervention.

1. The Early Years

Regulation of the refining business, and the oil business more generally, began with Standard Oil and its opponents’ efforts to defeat its alleged monopolistic advantage.192 Indeed, one of the abiding themes of American regulatory policy – fear of monopoly – was present virtually from oil’s start. The recurrence of government intervention aimed at preventing monopoly bred “an unusually virulent and mutual distrust between government and the oil industry” that has persisted ever since.193

There is an extensive literature on Standard Oil and the evidence on whether the company harmed or helped consumers remains decidedly mixed.194 Despite playing the villain to the trust-busters’ hero, Standard contributed positively toward the creation of a national market in gasoline, taking the lead in creating a standard form of gasoline. Indeed, John D. Rockefeller chose the name “Standard Oil” in part to convey the image of a standardized product, a key marketing advantage in the early years of the petroleum industry when many refined products varied widely in quality.195 Standard also played an integral part in establishing a national market for petroleum products by building infrastructure to help move oil and refined products around the nation.196 By 1910, a truly national gasoline market had begun to emerge, ironically weakening Standard Oil’s market power just as the antitrust assault on the company reached its climax.197 On the other hand, there is little doubt that Standard Oil and its successors repeatedly attempted

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191 BOHI & RUSSELL, supra note 124, at 14-15.
193 VIETOR, supra note 93, at 34.
194 See 1 BRADLEY, supra note 73, at 1070-1105 (summarizing Standard Oil case and analyzing welfare effects).
195 Id. at 1093.
196 Id. at 1090-1094 (summarizing Standard’s contributions).
197 WHITTEN & WHITTEN, supra note 80, at 147 (“At the peak of Standard’s power, the trust controlled over 90 percent of crude oil production and refining capacity. By the time the firm was dismembered under court order—the manifestation of the public’s fear and ignorance—Standard controlled less than 70 percent of production and refining, and the percentages were falling.”).
to cartelize the industry. Indeed, the trend toward consolidation was apparent by the end of the Civil War, only a few years after the first oil well began producing.\textsuperscript{198} Such efforts are unsurprising. After all, the dream of monopoly profits casts a tempting lure and there is no reason to expect the oil industry to be any better able to resist than other firms.

Anti-monopoly efforts give government involvement in gasoline markets a lengthy pedigree. In the Standard Oil cases, the result was a famous court-ordered breakup in 1911,\textsuperscript{199} followed by various antitrust actions seeking additional remedies when the newly-separated Standard companies provided less vigorous competition for one another than antitrust authorities thought optimal.\textsuperscript{200} Despite these aggressive antitrust efforts, before the outbreak of the First World War U.S. refining was “expanding and profitable.”\textsuperscript{201}

By the end of World War I, a second regulatory concern was dominant: national security. The Great War highlighted the military importance of oil supplies\textsuperscript{202} and wartime price controls caused supply problems.\textsuperscript{203} Responding to these concerns, the federal government deemphasized its antitrust activity as attention shifted to maximizing production for the war effort.\textsuperscript{204} Because national security concerns often run in the opposite direction from the antitrust policies, their appearance gives federal energy policy a bipolar appearance as it cycles between them.\textsuperscript{205}

A third regulatory motive also appeared during World War I: energy companies recognized that influencing government policy was lucrative. Wartime price controls put many refiners into financial difficulties, prompting some to seek government assistance.\textsuperscript{206} Rent-seeking by oil interests began in earnest as the wartime experience created new players in energy regulation debates in the form of oil trade associations organized to lobby for industry favors in Washington.\textsuperscript{207}

\textsuperscript{\textit{198}} ID. at 10.
\textsuperscript{\textit{199}} Standard Oil Company of New Jersey v. United States, 221 U.S. 1 (1911).
\textsuperscript{\textit{200}} The breakup was insufficient to end the “problem,” however, as the new companies created continued to be owned by overlapping shareholder groups. 1 BRADLEY, supra note 73, at 1087. Public suspicions of the oil companies continued, fueled by observations that the newly independent Standard companies did not invade one another’s territories. Id. at 1089. Thus although formal coordination had been ended, antitrust regulators feared that informal coordination among the Standard companies was continuing to restrain competition and keep prices above the competitive level.
\textsuperscript{\textit{201}} 2 BRADLEY, supra note 73, at 1110.
\textsuperscript{\textit{202}} Subcommittee on Mineral Resources Development and Production, Committee on Energy and Natural Resources, U.S. Senate, Mining Laws of 1872 and 1989 (101st Congress, 2nd Session, 1991) at 35 (“The 1920 Mineral Leasing Act . . . was passed in 1920 after the United States had fought the great war in which powered ships and other vehicles had played a vital role.”); CARL J. MAYER & GEORGE A. RILEY, PUBLIC DOMAIN, PRIVATE DOMINION (1985) at 169 (Oil lands policy after war “met the needs of a powerful official constituency, the American military.”)
\textsuperscript{\textit{203}} 1 BRADLEY, supra note 73, at 28.
\textsuperscript{\textit{204}} HAWLEY, supra note 54, at 10.
\textsuperscript{\textit{205}} VIETOR, supra note 93, at 33.
\textsuperscript{\textit{206}} 2 BRADLEY, supra note 73, at 1111.
\textsuperscript{\textit{207}} HAWLEY, supra note 54, at 10 (“The newly organized trade associations remained a prominent part of the postwar economy. Business leaders, especially those who had worked in Washington, had caught a new vision of what could be done by economic planning and business-government cooperation. A new breed of public administrators, skilled in the techniques of wartime control, were more prone to reject competitive values and stress the goal of a planned economy.”). Of course, national security and military concerns continue to surface in energy policy debates today, and often touch on a wide range of related issues. See Jon Schutz, An Analysis Of The 2001 National Energy Policy: Is A Domestic Production-Based Oil Policy
A related desire to prevent “excessive competition” presented yet another justification for regulation after the war. The post-war boom saw oil production and gasoline use soar. Domestic oil discoveries increased, and although these made the United States a net exporter of petroleum by 1923, increased supplies exerted consistent downward price pressure. Oil producers worried that too much competition in production kept prices low, while conservationists worried that excessive consumption would deplete stocks. State regulators in oil producing states tried to regulate production to prevent technical inefficiencies from dissipating the resource through over-drilling, and made an effort to keep prices higher for mineral rights owners by restraining production. These efforts had limited success, although the development of legal doctrines such as pooling held out the promise of a solution to the problem of wastefully rapid production.

Demand for gasoline continued to grow through the 1920s, rising from 2,747,000,000 gallons per year to 15,051,000,000 gallons per year between 1918 and 1929, primarily from increased automobile use. Refined product imports soared from 3,000 bbls/day in 1918 to 375,000 bbls/day in 1929. Although the U.S. remained the chief oil producer, foreign discoveries began to create a world-wide crude industry and many of the major oil companies took steps to limit competition. For instance, the 1928 “As Is” agreement aimed to preserve existing international market shares; the “Red Line” agreement that same year limited competition over Middle Eastern production; and various patent pools restricted competition between the chemical and petroleum industries. Nevertheless, without enforcement powers these arrangements typically failed to prevent competition from resurfacing.

These four cornerstones of monopoly, national security, rent-seeking, and restraining excessive competition laid the foundation for energy policy throughout the twentieth century and into the twenty-first. Often contradictory, they yielded ever-shifting coalitions that brought each policy to the fore at different times and contributed to the general incoherence of energy regulatory policy by providing a wide range of policy targets in different directions. Nonetheless, on the eve of the Great Depression, despite

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208 GIDDENS, supra note 37, at 172 (Crude consumption up from 240,000,000 bbls. to 412,000,000 bbls. from 1912 to 1918).

209 BOHI & RUSSELL, supra note 124, at 20.

210 1 BRADLEY, supra note 73, at 88.

211 Id. at 88-89 (describing industry concern with overproduction of crude in mid-1920s).

212 HAWLEY, supra note 54, at 27.

213 See 1 BRADLEY, supra note 73, at 78-131 (comprehensive survey of state conservation legislation).

214 VIETOR, supra note 93, at 22 (Waste in oil fields a real problem in 1910s-1920s; state boards had been unsuccessful in reining in production).

215 See 1 BRADLEY, supra note 73, at 200-211 (describing mandatory pooling and unitization rules).

216 GIDDENS, supra note 37, at 213.

217 1 BRADLEY, supra note 73, at 716.

218 VIETOR, supra note 93, at 23, 26-28.

219 Id. at 28 ("despite the elaborate administrative procedures and interlocking joint-ventures designed to implement these agreements, their effectiveness was limited by the absence of sovereign authority. Only prorationing in the United States proved to be durable, comprehensive, and enforceable.").
the shifting attentions of the federal and state governments, the market for gasoline was well on its way to being a national market. Transportation costs\(^{220}\) and crude prices were falling, while demand for gasoline continued to skyrocket. Refiners were competing on quality, driving gasoline toward commodity status,\(^{221}\) and new technologies were boosting gasoline yields from crude.\(^{222}\) The monopoly problem was held in check by vigorous competition and the ease of entry; America was a leading oil producer, temporarily vitiating the national security concerns; states were groping toward legal mechanisms like unitization to solve the technical problems of wasteful production, if not the economic problem of increasing supply; and regular new discoveries limited the ability of the incumbents to rent seek by undermining collusion.

2. The New Deal

When the Great Depression suffocated the economy of the Roaring Twenties, oil prices fell dramatically.\(^{223}\) They were hit particularly hard because of the supply boom caused by the discovery of substantial reserves in East Texas in 1930.\(^{224}\) More than 5,000 new wells were drilled there between 1930 and 1932 and the East Texas field alone met one third of U.S. demand.\(^{225}\) Refinery capacity greatly exceeded the Depression-reduced demand, with the capacity-to-demand ratio at 1.48.\(^{226}\) Despite the Depression, technological progress continued and began to have an important impact by the end of the 1930s, improving gasoline quality, as an “octane race” developed.\(^{227}\) In oil and refined products, as elsewhere, Franklin Roosevelt’s administration sought recovery through measures promoting higher, more stable prices, bringing the “excessive competition” policy to the forefront.

Existing state regulatory schemes offered one means of raising oil prices, but these schemes were too porous, allowing the so-called “hot oil” to leak out of regulated channels into commerce, undercutting prices.\(^{228}\) "This bootleg oil was secretly siphoned off from pipelines, hidden in camouflaged tanks that were covered with weeds, moved about in an intricate network of secret pipelines and by trucks, and then smuggled across state borders at night."\(^{229}\) In 1932 oil prices plummeted further, falling from $1.25 per barrel to $0.25 per barrel, and Texas and Oklahoma declared martial law in the oil fields in an attempt to stop hot oil.\(^{230}\) Even when the states were successful in raising prices and limiting domestic production, foreign oil imports threatened to undermine their

\(^{220}\) See notes 165 - 167 supra.
\(^{221}\) See note 97 supra.
\(^{222}\) See note 107 supra.
\(^{223}\) YERGIN, THE PRIZE, supra note 27, at 254.
\(^{224}\) HAWLEY, supra note 54, at 212. [J
\(^{225}\) VIETOR, supra note 93, at 23.
\(^{226}\) BOHI & RUSSELL, supra note 124, at 292, Tbl. 8-8.
\(^{227}\) GIDDENS, supra note 37, at 600. See also id. at 482 (Despite Depression, Standard expanded to upgrade equipment to produce more high grade gasoline); 2 BRADLEY, supra note 73, at 1134 ("On the eve of hostilities, the U.S. refining industry was prospering with the automobile age. Markets were expanding, and technological advances abounded.").
\(^{228}\) YERGIN, THE PRIZE, supra note 27, at 255-256; HAWLEY, supra note 54, at 213.
\(^{229}\) YERGIN, THE PRIZE, supra note 27, at 255.
\(^{230}\) VIETOR, supra note 93, at 23.
efforts, sparking demands for tariffs to protect domestic producers.\textsuperscript{231} The Roosevelt Administration severely limited imports of both crude and refined products in September 1933.\textsuperscript{232}

The federal government moved to assist the states in restricting hot oil,\textsuperscript{233} including a provision in the National Industrial Recovery Act ("NIRA") giving the president authority to ban hot oil,\textsuperscript{234} and imposing a tariff on crude oil imports of twenty-one cents per barrel in 1932.\textsuperscript{235} The Roosevelt Administration took several additional steps, including promulgating an industry-designed Oil Code under the National Recovery Administration ("NRA"), which limited competition, created a production quota for each state\textsuperscript{236} and, as amended in 1934, allocated crude among refineries,\textsuperscript{237} further restricting competition. As with other industries’ codes, the rules included policies that enabled the industry to take steps that to limit competition and so promote higher prices.\textsuperscript{238}

The Supreme Court struck down the NRA system and its hot oil provision in 1935,\textsuperscript{239} but federal intervention had established a framework in the oil industry that survived the demise of the statute. Congress quickly passed the Interstate Transportation of Petroleum Products Act (also known as the Connally Hot Oil Act)\textsuperscript{240} banning transmission of hot oil in interstate commerce and lending federal assistance in stopping the leakage.\textsuperscript{241} Together with “suggested” federal production limits, this created an informal system that effectively enforced the nominally voluntary federal quotas and coordinated production even without mandatory federal controls.\textsuperscript{242} A congressional investigation later concluded that the various oil controls formed “a perfect pattern of monopolistic control over oil production, the distribution thereof among refiners and distributors, and ultimately the price paid by the public.”\textsuperscript{243} It also encouraged the oil industry to look to Washington for aid.\textsuperscript{244} The addition of a tariff on foreign oil in 1932 limited the ability of the growing number of foreign oil producers to compete on price

\textsuperscript{231} GIDDENS, supra note 37, at 461 (mid-continent and gulf coast producers wanted a tariff of $1/bbl in 1929).
\textsuperscript{232} 1 BRADLEY, supra note 73, at 721.
\textsuperscript{233} Id. at 99-103 (describing hot oil provisions of NIRA).
\textsuperscript{234} HAWLEY, supra note 54, at 213.
\textsuperscript{235} VIETOR, supra note 93, at 93. In an attempt to head off the tariff, several producers agreed to voluntary cuts in imports of 25% and more. GIDDENS, supra note 37, at 462.
\textsuperscript{236} YERGIN, THE PRIZE, supra note 27, at 255-256. “Theoretically, [these quotas] were justified as conservation measures, but in reality the rate of withdrawal bore little relation to what a geologist might regard as the rate necessary to minimize waste. The state allowances, in fact, rarely deviated from the monthly estimates of the Federal Bureau of Mines, estimates that in effect merely stated how much crude oil would be needed to meet demand for gasoline at the existing market price.” HAWLEY, supra note 54, at 217-218.
\textsuperscript{237} GIDDENS, supra note 37, at 517.
\textsuperscript{238} 2 BRADLEY, supra note 73, at 1120-1127.
\textsuperscript{240} 49 Stat. 30.30-33 (1935).
\textsuperscript{241} YERGIN, THE PRIZE, supra note 27, at 255.
\textsuperscript{242} Id. at 257. See also HAWLEY, supra note 54, at 216-217 (describing debates over federal role).
\textsuperscript{243} Quoted in HAWLEY, supra note 54, at 219.
\textsuperscript{244} 1 BRADLEY, supra note 73, at 97-99.
with domestic producers in the U.S. market, while declining production from the East Texas oil field helped limit hot oil. Although crude tariffs began to fall at the end of the 1930s, the relatively high refined product tariffs stayed in place, protecting domestic refiners from foreign competition. In effect, a little more than 25 years after the decree breaking up Standard Oil, the federal government created a more effective oil cartel than Standard Oil ever accomplished.

Antitrust concerns reemerged in the late 1930s, with an FTC investigation finding evidence of “a wide variety of price-fixing, market-sharing, exclusive dealing, and production-restricting arrangements” in many industries, including refining. The Madison Oil cases in 1937-1938 led to the convictions (later overturned) of sixteen corporations and thirty individuals of a conspiracy to fix prices through a buying arrangement in which major companies agreed to buy the surplus gasoline of specified independent refiners to keep it off the market. Antitrust activity was sufficiently vigorous in the 1930s and early 1940s that when Attorney General Tom Clark reviewed the list of proposed names for industry representatives to the National Petroleum Council in 1946, he found that more than half of the executives on the list had been convicted personally, pled nolo contendere, or headed companies convicted or under indictment for antitrust violations.

In the early 1940s, efforts to prepare for war refocused attention on national security issues. A “Petroleum Industry War Council” was set up with seventy-eight oil company executives to coordinate working with the government, and there was “an unprecedented degree” of government control of the industry. As they had in World War I, the demands of war production dramatically affected the petroleum industry, as submarine attacks in the Atlantic disrupted shipments of crude and refined products and “infinite” military requirements challenged the industry. To take just one example, the 1941 goal for 100 octane aviation fuel was 120,000 bbls/day at a time when capacity was under 40,000 bbls/day. By 1944, military demand for 100 octane fuel was more than 600,000 bbls/day.

Refineries broke records for production and new facilities were built to satisfy the demand for aviation fuel, lubricants, and toluene (used in bombs). Standard of Indiana

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245 YERGIN, THE PRIZE, supra note 27, at 258.
246 GIDDENS, supra note 37, at 542.
247 1 BRADLEY, supra note 73, at 722-723.
248 HAWLEY, supra note 54, at 166.
249 United States v. Socony-Vacuum Oil Co., 310 U.S. 150 (1940). See also HAWLEY, supra note 54, at 374; 433 (new trials ordered in eighteen cases and all charges dismissed in eleven). The defendants argued they were merely continuing activities which the NRA had encouraged. Id. at 374.
250 VIETOR, supra note 93, at 35-36.
251 Antitrust concerns resurfaced in the “Mother Hubbard” case, brought in 1940 by the Justice Department against the American Petroleum Institute and twenty-two of its largest corporate members. The case was suspended during the war, and resumed in 1946, and then dismissed in favor of several suits against smaller groups of defendants. The clear message of the case was “that its every action was subject to question by the Attorney General of the United States.” VIETOR, supra note 93, at 34.
252 GIDDENS, supra note 37, at 607; 1 BRADLEY, supra note 73, at 235-239 (discussing World War II era regulation); 243-248 (criticizing same).
253 NPC, IMPACT, supra note 28, at 324.
254 Id. See also 2 BRADLEY, supra note 73, at 1136-1139 (describing crash aviation fuel program).
255 GIDDENS, supra note 37, at 609, 615.
alone, for example, had a daily capacity for 1,150,800 gallons of 100 octane aviation gasoline in 1944, more than the entire industry had before the war.\textsuperscript{256} Once again, technological progress in refining was rapid and coordination of production took precedence among regulators over competition, encouraging coordinated efforts among refiners to meet the military’s needs for fuel.\textsuperscript{257}

The period from the Depression to the end of World War II saw gasoline markets buffeted by the constant cycling among government policy aims. Concern over ruinous competition swung to antitrust vigilance only to have national security issues trump both. These inconsistent energy policies had a threefold effect. First, just as they had in World War I, the demands of wartime production produced rapid technological innovation which, in turn, spurred better quality that helped commodify gasoline. Second, the growth in domestic and international crude supplies, the source of the “ruinous” competition that the NRA oil code sought to prevent, kept downward pressure on crude prices. This pressure on prices masked industry-rent seeking to some degree, since the rents could be funded by having refined product prices fall more slowly than crude prices. Third, the artificial limits on U.S. crude production kept crude prices above world levels, creating conditions that produced the post-war Mandatory Oil Import Program to restrict the importation of cheaper foreign crude oil.

World War II led to improved refinery technology and, applying that technology to peace-time needs, the market for gasoline advanced significantly. After the war much of the federal petroleum regulatory bureaucracy was “dismantled.”\textsuperscript{258} With gasoline quality improved, gasoline production ready to soar, and demand for gasoline poised to explode, had there been no further interventions, it seems likely that a truly national and competitive gasoline market would have emerged.

3. From World War II to Price Controls

The end of World War II unleashed tremendous demand for gasoline as the lifting of wartime rationing and the post-war boom put Americans on the road in record numbers.\textsuperscript{259} Demand for other oil-based fuels also surged as the United States shifted from a coal-based to an oil-and-gas-based energy economy.\textsuperscript{260} Despite shifting refineries from war production to automobile gasoline, this surge in demand meant there was little excess refinery capacity,\textsuperscript{261} as can be seen from the fall of the ratio of operating refining capacity to domestic consumption from 1.48 in 1930 to 1.03 in 1950.\textsuperscript{262} The creation of the GATT in 1947 cut tariffs on both crude and refined products,\textsuperscript{263} boosting imports and making the U.S. a net importer of oil for the first time in 1947.\textsuperscript{264} Prices soared, more

\begin{itemize}
\item \textsuperscript{256} Id. at 619.
\item \textsuperscript{257} 2 Bradley, supra note 73, at 1138-1139 (discussing government coordination of refining “as though all [plants] were components of one huge refinery” and use of regulation and subsidies to accomplish that end.)
\item \textsuperscript{258} 1 Bradley, supra note 73, at 248.
\item \textsuperscript{259} NPC, Impact, supra note 28, at 255-256; Yergin, The Prize, supra note 27, at 409.
\item \textsuperscript{260} Vieter, supra note 93, at 3.
\item \textsuperscript{261} NPC, Impact, supra note 28, at 255-256; Yergin, The Prize, supra note 27, at 409.
\item \textsuperscript{262} Bohi & Russell, supra note 124, at 296, Tbl. 8-8.
\item \textsuperscript{263} 1 Bradley, supra note 73, at 724.
\end{itemize}
than doubling between 1945 and 1948.\textsuperscript{265} Within a few years, however, the high prices induced so much entry by new producers\textsuperscript{266} that refinery capacity increased beyond demand, creating “an intensely competitive industry, with the individual refiners working diligently, as new equipment is installed, to find ways of increasing efficiency and reducing operating cost.”\textsuperscript{267} Gasoline markets continued to deepen, prices continued to fall, and product quality continued to improve as competition drove refiners to innovate.

Internationally, producing countries began to move into refining in an effort to boost their share of the revenue from their oil\textsuperscript{268} and the ever-growing stream of cheap foreign oil began to roil domestic oil politics.\textsuperscript{269} “Before foreign oil became available, the state prorationing agencies had managed output in order to avoid such circumstances. But once cheap oil was available anywhere in the world economy, it was irresistibly drawn into the market vacuum that prorationing had created in the United States.”\textsuperscript{270} The major oil companies invested heavily in foreign sources, tanker fleets, shipping facilities, and coastal refineries, bringing cheaper crude to their U.S. refineries, gaining a cost advantage over independent refiners reliant on higher cost U.S. sources of crude.\textsuperscript{271} By January 1949, imports were growing at an annual rate of 25%.\textsuperscript{272} By 1957, imports as a percentage of rising demand reached 18%, up from 11% just eight years earlier.\textsuperscript{273} Independent domestic refiners, particularly those located away from easy access to foreign crude, were left with only the more expensive domestic crude supplies. These refiners worried, correctly, that they would lose market share as the refineries with access to the cheaper foreign crude exploited their cost advantage to extend their market penetration into the independent refiners’ territories.\textsuperscript{274} Thus, domestic oil producers

\begin{footnotesize}
\begin{enumerate}
\item[265] \textcite{Yergin, \textit{The Prize}, supra note 27, at 409. Not surprisingly this led to “more than twenty Congressional investigations” and accusations of an oil company conspiracy to force prices up. Id.  
\item[266] Over $2 billion in refining expansion and improvement went into production between 1946 and 1952. \textcite{Bradley, supra note 73, at 1151.}
\item[267] \textcite{NPC, \textit{Impact}, supra note 28, at 255-256; Yergin, \textit{The Prize}, supra note 27, at 409. Differential tariffs encouraged imports of heavy fuels, such as residual oil, and discouraged imports of lighter fuels such as gasoline, biasing U.S. refinery production toward the lighter end. \textcite{Vietor, supra note 93, at 101 (The tariff on gasoline was 51 cents per barrel but only 5 cents for resid; as a result resid imports rose 136% while imports of more valuable distillate declined 18% in 1953); Vietor, supra note 93, at 113 (Some importers began bringing in even more “unfinished oils”, a category that wasn’t covered and was stuff that needed more refining.).}
\item[268] \textcite{Yergin, \textit{The Prize}, supra note 27, at 436 (Venezuela’s move into refining to capture downstream revenues); id. at 518 (organization that became OPEC formed in 1959 and a “key decision” was to move into downstream industries like refining).
\item[269] \textcite{Vietor, supra note 93, at 91 (imported oil available at half the price of US oil, “caused a major disruption” in energy markets.).}
\item[270] Id. at 115.
\item[271] \textcite{Bohi & Russell, supra note 124, at 110 (“Import patterns by firms were already changing at the time mandatory controls were instituted [in 1959]. A minority of refineries were importing crude oil; a shrinking majority were not.”)}
\item[272] \textcite{Vietor, supra note 93, at 93.}
\item[273] Id. at 105, Tbl. 5-5.
\item[274] Id. at 125 (Arguing for protection, “the inland refiners asserted that if imports were limited to the real importers, their cost advantage would allow them to penetrate the markets of the inland refiners and put them out of business. The right to trade quotas to real importers in exchange for domestic oil was a paper transaction….”).
\end{enumerate}
\end{footnotesize}
feared free trade in oil, turning domestic producers’ attention to rent-seeking.\textsuperscript{275} Domestic crude oil price controls were reintroduced from 1950 to 1953.\textsuperscript{276} At the same time, tax incentives for refinery projects, nominally motivated by national security concerns, produced a boom in refinery expansion and construction, especially among small refiners.\textsuperscript{277}

Heavy reliance on foreign oil returned national security concerns to the U.S. energy debate.\textsuperscript{278} The massive wartime collaboration between the refining industry and the government continued after the war on a slightly smaller scale.\textsuperscript{279} The Suez Canal crisis in 1956, for example, strengthened those favoring a more interventionist policy toward oil by highlighting the vulnerability of foreign supplies.\textsuperscript{280} The 1950s and 1960s also saw “huge investments” in refining drive down gas prices through “hard competition.”\textsuperscript{281} In part, this reflected the rise in domestic crude production that the quotas had produced, a 29% increase between 1959 and 1969.\textsuperscript{282}

The federal government first attempted to encourage domestic production on national security grounds through voluntary programs, including a voluntary quota system begun in 1957.\textsuperscript{283} These failed for several reasons.\textsuperscript{284} Some companies did not cooperate because they had disproportionately large foreign oil holdings and some refused because of fear of antitrust prosecutions.\textsuperscript{285} New importers fought controls, even voluntary ones, because their imports would be frozen at low current levels, some going so far as to build coastal refineries “in an effort to establish themselves as legitimate importers before the regulatory die was cast.”\textsuperscript{286} And the price differentials between foreign and domestic crude caused by state-level prorationing rules limiting domestic

\textsuperscript{272} ID. at 3 (Conflict in the 45-58 period shifted from stimulating supply to protecting market share as market went to super surplus conditions.).
\textsuperscript{273} 1 BRADLEY, supra note 73, at 250-257.
\textsuperscript{274} 2 BRADLEY, supra note 73, at 1156-58.
\textsuperscript{275} BOHI & RUSSELL, supra note 124, at 139 (“Import controls, and their administration, were ostensibly designed to enhance the national security, however defined. In general, this goal required maintenance of a larger domestic petroleum industry than would otherwise exist, and one secure from attack.”).
\textsuperscript{276} The Secretary of the Interior convened the National Petroleum Council. NPC, IMPACT, supra note 28, at 324; VIETOR, supra note 93, at 38 (function of National Petroleum Council was for industry and government to talk, and for industry to discuss policy among itself). And, after the Korean War broke out, the federal government formed the Petroleum Administration for Defense. NPC, IMPACT, supra note 28, at 324; VIETOR, supra note 93, at 41 (during Korean War the government sought to replicate WWII organization of oil industry with the Petroleum Administration for Defense that reported to the Sec of Interior.). See 1 BRADLEY, supra note 73, at 253-257 (describing Korean War era planning agencies).
\textsuperscript{277} BOHI & RUSSELL, supra note 124, at 41; YERGIN, THE PRIZE, supra note 27, at 536 (“The Suez crisis of 1956 highlighted concerns about national security. The price fall that followed the crisis further increased the clamor among independents for protection in the form of tariffs or quotas.”).
\textsuperscript{278} YERGIN, THE PRIZE, supra note 27, at 548.
\textsuperscript{279} Id. at 539.
\textsuperscript{280} When the voluntary plan was announced, with a goal of cutting imports to 1,031,000 bbl/day from 1,266,700 bbl/day (the 1957 level), fourteen of twenty-two importers agreed, one refused on the advice of antitrust counsel, five sought adjusted quotas informally, and two invoked the plan’s formal process to receive a higher quota. BOHI & RUSSELL, supra note 124, at 45-47.
\textsuperscript{281} 1 BRADLEY, supra note 73, at 732-733 (discussing reasons for failure).
\textsuperscript{282} YERGIN, THE PRIZE, supra note 27, at 537; VIETOR, supra note 93, at 112 (Sun Oil refused to participate in voluntary quota b/c of antitrust implications.).
\textsuperscript{283} VIETOR, supra note 93, at 109. Moreover, politically it would have been impossible to give the major oil companies a cartel controlling imports. ID.
production continually attracted new competitors into the oil import business, undermining the voluntary quota system.\textsuperscript{287}

Economic conditions also weakened the voluntary system. “The recession of 1958 did in the voluntary program. While oil demand dropped substantially, imports increased further, and the political pressure for mandatory controls became irresistible.”\textsuperscript{288} In particular, powerful Texas and Oklahoma politicians like Senate Majority Leader Lyndon Johnson, House Speaker Sam Rayburn, and Oklahoma Senator Robert Kerr pushed hard for mandatory controls to benefit U.S. oil producers.\textsuperscript{289} Although the Eisenhower administration was ideologically opposed to government intervention in the market, it yielded to the political realities of oil politics, giving the United States “centralized decision making and free market rhetoric.”\textsuperscript{290}

The mandatory quotas which began in March 1959 became “the single most important energy policy in the postwar era,” one which quickly “accumulated policy goals outside of promoting energy security.”\textsuperscript{291} The quota system, known as the Mandatory Oil Import Program (MOIP), was in effect from 1959 to April 1973, although it effectively constrained refiners only until late 1972.\textsuperscript{292} MOIP produced “a decade of stasis in policy,” locking in a regulatory approach which ignored major changes in energy supply and demand.\textsuperscript{293} MOIP brought rent-seeking to new heights, with “[a] roll call of the special interest groups in energy policy” benefiting.\textsuperscript{294} Although the beneficiaries

\textsuperscript{287} BOHI & RUSSELL, supra note 124, at 24-25. The “new importer” problem was serious. The growth in imports by these firms, partly due to niches created in the market by limitations on the more visible major firms, made them impossible to ignore even while they were difficult to police on a voluntary basis. Newcomers for the most part were not constrained by the unofficial sanctions that could be imposed on large, multinational, established firms. They were less affected by public or industry opinion. Moreover, some were not involved in domestic production and thus did not even have the incentive to restrain imports that would follow from sharing production losses within the United States if collective restraint on imports failed.

\textsuperscript{288} ID. at 35.

\textsuperscript{289} ID. at 538. Oil state senators, who supported MOIP, also delivered other benefits to big companies and support for MOIP was price for those benefits.(overseas tax credits, depletion allowance overseas, etc.).

\textsuperscript{290} VIETOR, supra note 93, at 134 (quoting La. Sen. Russell Long making this point to the oil companies, saying “I believe your industry would make a great mistake not to realize that; as far as the government is concerned, as far as the fair treatment you are entitled to expect from your government is concerned, the people who will be your advocates are people who are very much interested in domestic oil. . . It is very much to your advantage to have a very healthy domestic industry and do everything within your power to cooperate to that end.”).

\textsuperscript{291} ID. at 84 (“Schemes surfaced to use the program to the special benefit of some segments of the refining industry and some domestic producers and marketers; to promote economic development of certain areas and enhanced air quality; and to aid special consumer groups.”).


\textsuperscript{293} ID. at 263-264 (“Quotas are inherently discriminatory. The criteria by which government allocates import licenses are not based on impersonal market forces (unless the licenses are auctioned); licenses are allocated subjectively in a way that is usually influenced by political considerations and the fact that allocation necessarily benefits some and harms others.”)

\textsuperscript{294} ID. at 84 (“Schemes surfaced to use the program to the special benefit of some segments of the refining industry and some domestic producers and marketers; to promote economic development of certain areas and enhanced air quality; and to aid special consumer groups.”).
were identifiable, the costs of the import quota regime were largely borne by “the undifferentiated portion of the consuming public.”

Under the MOIP, the federal government granted refiners permits to import crude oil, holding the total amount imported below the amount that would have been imported in a free market. Established importers got quotas of 80% of their historic imports, with the amount to be gradually reduced until it was proportionate to the amounts new importers received, theoretically eventually putting all importers on the same level.

As a result, domestic crude prices were higher than they would have been in the absence of the quota system and the right to import the cheaper foreign crude became valuable. The “historical” allocations also attempted to address the equitable concern that “[r]efinery location, capital decisions, marketing arrangements and production and supply patterns,” all of which had been disrupted by the voluntary controls, “would be more dramatically altered by mandatory controls.” In particular, the MOIP shifted refinery construction from larger to smaller, rewarding each new refinery with a quota. Ultimately, the mandates hindered the refining industry response to changes in market conditions: “The quota discouraged the expansion of domestic refinery capacity, altered refinery location within the United States, altered the mix of the final products, encouraged investment in cracking capacity, and discouraged investment in capacity to handle high-sulfur feedstocks.”

A full account of the MOIP lies beyond the scope of this article, but the distinctive features in gasoline markets introduced by the program require some discussion. An important effect was that the administrative allocation of valuable import rights inevitably led to interest groups exerting tremendous political pressures in hopes of sharing in the allocations. Of course, as these groups organized politically,

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295 BOHI & RUSSELL, supra note 124, at 17; VIETOR, supra note 93, at 141 (Import controls estimated to cost consumers about $3.3 billion in 1968. Arabian crude selling at 1.25/bbl, domestic oil at $3).
296 LANE, supra note 292, at 4.
297 VIETOR, supra note 93, at 122.
298 LANE, supra note 292, at 4; VIETOR, supra note 93, at 120 (Quotas had “a tangible dollar value”).
299 BOHI & RUSSELL, supra note 124, at 110-111.
300 2 BRADLEY, supra note 73, at 1172.
301 BOHI & RUSSELL, supra note 124, at 295. See also 2 BRADLEY, supra note 73, at 1163 (MOIP affected “virtually all major aspects of refinery operation – entry, plant siting, plant size, merger and acquisition policy, product mix, and, of course, profitability.”)
302 The MOIP is described in detail in BOHI & RUSSELL, supra note 124, at 66-82. See also 1 BRADLEY, supra note 73, at 738-750; 2 BRADLEY, supra note 73, at 1160-1181.
303 2 BRADLEY, supra note 73, at 1175-1176 (noting that between 1954 and 1958, ten refineries with a capacity over 10,000 bbl/day were built, while in the next twelve years only nine such refineries were built).
304 YERGIN, THE PRIZE, supra note 27, at 538-539 (under the MOIP “there were continuing fights over allocations, struggles over interpretations, searches for loopholes, and the ever-more-intense hunt for exceptions and exemptions.”); BOHI & RUSSELL, supra note 124, at 139 (“Other interests understandably coveted the wealth thus transferred and sought to divert the import control program to achieve still other ends and different distributive effects. Once the subsidy-wealth-transfer character of quotas was recognized, it became increasingly difficult for the authorities to deny other ‘worthy’ causes entry into the
politics intertwined with a variety of technical questions, the resolution of which would reward some interests and punish others no matter how they were answered.\textsuperscript{306} For example, petrochemical companies sought their own import quotas for feedstocks, arguing that their plants faced unfair competition from petrochemical plants aligned with quota-possessing refineries.\textsuperscript{307} This raised definitional questions about what constituted a petrochemical plant compared to a refinery, since the two were technologically indistinguishable. The question had no easy answer.\textsuperscript{308} Granting the quotas rewarded independent petrochemical producers; denying them advanced integrated refinery-petrochemical operations.

The result was special interest lobbying on a grand scale. “However intricately wrought and carefully articulated the rationales for each action, the impression was inescapable that the mandatory quota program was being treated as a source of unappropriated funds available for a variety of putative public purposes.”\textsuperscript{309} Ultimately the interest group maneuvering led to a program so complex that “[f]ew other regulatory schemes in America’s history can match the Mandatory Oil Import Program for labyrinthine complexity, or for the distortion of markets and interest-group dissension that it caused.”\textsuperscript{310} By 1968, MOIP had metamorphasized far beyond its initial goals, with “special allocations” for interests from asphalt refiners to electric utilities.\textsuperscript{311}

Not surprisingly, the MOIP roiled refining in the United States. The system favored smaller refiners, giving them a disproportionate share of import rights.\textsuperscript{312} Yet

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\item \textsuperscript{307} BOHl & RUSSELL, supra note 124, at 167 (“When the petrochemical companies were included in the quota structure in 1966, they simply joined the group of other refiners who had enjoyed the subsidy benefits of import quotas from the beginning of the program. The great stake of the petrochemical companies in the long run was the extent to which they would lose their market share to petrochemical production by the oil and gas companies.”). \textit{See also} 1 BRADLEY, supra note 73, at 745.
\item \textsuperscript{308} BOHl & RUSSELL, supra note 124, at 164 (“Other administrative problems arose out of the technical difficulty of defining a petrochemical plant as distinct from a refinery, and of defining feedstocks for inclusion within the program [for allocations of quotas for petrochemical plants].”).
\item \textsuperscript{309} VIETOR, supra note 93, at 119. \textit{See also} YERGIN, THE PRIZE, supra note 27, at 538-539.
\item \textsuperscript{310} VIETOR, supra note 93, at 139.
\item \textsuperscript{311} \textit{See} supra note 93, at 131 (specialized trade organizations formed to fight over resid imports.).
\item \textsuperscript{312} LANE, supra note 292, at 4. The quota system incorporated a “sliding scale” that favored smaller refiners.
\item \textsuperscript{313} “The basis for the different incremental levels of quotas was the amount of refinery runs by firm, not by plant. It was advantageous, then, for refinery ownership to be fragmented. This policy had predictable effects. First, it reduced the value of a small refinery as a merger prospect for an established refining firm. Second, it provided incentives for the formation of ‘concubine’ relationships with large firms which could acquire informal control, but not integrated ownership, of small firms without losing the preferential quota of the small firm. The history of the program contains charges of concubinage but the extent of its existence is unknown. Finally, the sliding scale encouraged small refineries, or preserved their existence, by the additional revenues obtained through the sale of import tickets.”
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these refiners were often the least technologically sophisticated. The small refiner bias also failed to reward those oil companies which had invested heavily in foreign supplies, tanker fleets, and coastal refineries in anticipation of a growing reliance on imports. Moreover, the MOIP discouraged consolidation of ownership in refineries through the small refiner bias, preventing buyouts of these refiners by the larger companies that could have increased efficiency. Refiners were allowed to trade their import quotas, and many inland and independent refiners did, using them to gain access to domestic crude owned by rivals. In many respects, therefore, the program was simply a transfer of wealth from the large, integrated oil companies to the smaller, inland refiners.

Under the MOIP, some inland refineries received a particular bonus. Because every refiner received one, even refineries with no ability to actually import oil were given quotas. (Had this not been done, coastal refineries likely would have displaced inland refineries, as their cost advantage from using imports would have enabled them to expand at the expense of inland refineries.) The “Northern Tier” refineries using Canadian oil got a special bonus. These refineries received quota allocations in the initial distribution, when Canadian oil was labeled foreign and then an exemption from the quota system for Canadian oil when it was reclassified as “overland” oil not subject to quota limitations. Yet these refineries did not lose the quotas they had initially

BOHI & RUSSELL, supra note 124, at 115-116. The 11 real importers “objected strenuously” to this program. “They had to participate in it since their own quotas were insufficient to supply their coastal refineries” and Atlantic Refining calculated that the profits from quota exchanges were $135 million by 1964. VIETOR, supra note 93, at 125. This continued under its successor program in the 1970s. See EPA, Profile, supra note 67, at 11 (noting that the Crude Oil Entitlements Program “had encouraged smaller refineries to add capacity throughout the 1970s.”).

BOHI & RUSSELL, supra note 124, at 74-75 (summarizing the trading rules). See also 1 BRADLEY, supra note 73, at 738-739 (describing trading). As Bohi and Russell note, “[t]he exchange process was merely a veil covering the transfer to inland refineries of some of the benefits of importing cheap foreign oil. No productive function was changed in maintaining the façade that something was actually happening.” BOHI & RUSSELL, supra note 124, at 77.

VIETOR, supra note 93, at 114 (quotas would clearly be subsidy to inland refiners, who could not refine the oil they were allowed to import.).

Refineries located inland traded their import tickets to those companies with refineries located on the coast in return for access to domestic sources of crude owned by the coastal refineries. Companies with coastal refineries tended to be the larger, integrated companies. Thus, one result of the [quota system], and the trading system that evolved under it, was that smaller, inland refineries tended to depend on exchange agreements with major oil companies for access to crude. LANE, supra note 292, at 5. See also VIETOR, supra note 93, at 133 (“Independent refiners grew dependent on the Program form which they drew ‘tickets,’ knowing that without them they could not long compete with larger, integrated refineries running cheap foreign crude.”).

VIETOR, supra note 93, at 125 (The quota exchanges among inland refiners and coastal refineries “was the fundamental redistributive choice of the whole mandatory program. It was primarily a response to political pressure from domestic refiners, justified by a perverse obeisance to free enterprise.”).

BOHI & RUSSELL, supra note 124, at 71.

Id. at 72.

The special access to Canadian oil alone boosted growth in this region. See BOHI & RUSSELL, supra note 124, at 297, Tbl. 8-9 (Refinery capacity growth in Montana, Minnesota, ND, & Wisconsin – 1930 a total of 19.6 (000 bbl/day), 1950 total 66.5, 1955 – 157.4, 1960 214.1, 1965 287.7, 1970, 354.4). Two months after the MOIP began, however, it was first modified to allow land imports without quotas in order to assist Canadian oil exporters. VIETOR, supra note 93, at 129. It also helped Venezuelan exports to eastern Canada, since the western Canadian oil that the MOIP would have kept out of the U.S. market
received to allow them to import the Canadian oil, giving them what became known as the “double dip.”\(^{320}\) The double dip was “an obvious fluke,” but it was not remedied because of the political power these refineries mustered in its defense.\(^{321}\) Although the Northern Tier refineries’ historical quotas were reduced faster than it did those of other refiners – to partially compensate for the double dip, this did not entirely eliminate the special treatment.\(^{322}\)

The quota system also discouraged construction of new large refinery capacity in the United States.\(^{325}\) While the total amount allowed to be imported increased as refinery capacity increased, there was “no direct mechanism” to provide the “access to foreign crude oil supplies necessary to the operation of new refinery capacity in the United States.”\(^{324}\) In addition, oil companies began lobbying for and receiving exemptions for refineries in various U.S. territories outside the continental United States to serve the U.S. market.\(^{325}\) Not surprisingly, the ratio of domestic refining capacity to domestic petroleum consumption, which was 0.98 in 1960, fell during the MOIP to 0.81 in 1970.\(^{326}\)

A further impact involved the diversion of crude imports to uncontrolled products. Controls on crude were useless without controls on refined products, inasmuch as uncontrolled finished imports would simply substitute for U.S. refining of foreign crude unless their importation was also controlled. The original program design thus forbade imports of refined products outside the quota system.\(^{327}\) This proved impossible to sustain, however.\(^{328}\) Refiners with existing plants outside the U.S. which were refining for the U.S. market lobbied for allowances for imports of those plants’ products. They argued that restricting such imports “could virtually eliminate the market served by those refineries, with predictable serious consequences for the firms.”\(^{329}\) Moreover, some

would have otherwise displaced Venezuelan exports to eastern Canada. 1 BRADLEY, supra note 73, at 739-740

\(^{320}\) BOHI & RUSSELL, supra note 124, at 129.

\(^{321}\) VIETOR, supra note 93, at 129. For example, in May 1960 the Department of the Interior considered a rule change to eliminate the loophole, but North Dakota politicians intervened and Interior abandoned the revision. Id. One oil company that competed with the double dip refiners waged a five year war against the provision, but was unable to stop Minnesota Sen. Hubert Humphrey from preserving it.

\(^{322}\) Id. at 130.

\(^{323}\) 2 BRADLEY, supra note 73, at 1171-1172.

\(^{324}\) NPC, FACTORS AFFECTING, supra note 61, at 7.

\(^{325}\) BOHI & RUSSELL, supra note 124, at 51. In particular, refineries were built in the U.S. Virgin Islands and Puerto Rico as a direct result of the quota program exemption for oil imported to those jurisdictions on economic development grounds. YERGIN, THE PRIZE, supra note 27, at 539 (“the building of substantial refining capacity in the American Virgin Islands and Puerto Rico because of special exemptions to the quotas that were granted to refineries there on economic development grounds.”); VIETOR, supra note 93, at 136-137 (describing Puerto Rico exemption); BOHI & RUSSELL, supra note 124, at 297 (“Imports of products from Puerto Rico and the Virgin Islands received special treatment under the quota system. Consequently, refineries were encouraged to locate in these islands for reasons other than those the free market would dictate.”); 1 BRADLEY, supra note 73, at 743-746 (describing increase in refined produce exports from Puerto Rico).

\(^{326}\) BOHI & RUSSELL, supra note 124, at 296, Tbl. 8-8.

\(^{327}\) 1 BRADLEY, supra note 73, at 737.

\(^{328}\) Unrestricted fuel oil imports were allowed into the East Coast (PADD I region) and “clean-product imports” were allowed due to program incentives. NPC, ADEQUACY, supra note 37, at 20.

\(^{329}\) BOHI & RUSSELL, supra note 124, at 110.
refined products were exempt, encouraging their production outside the United States. For instance, residual fuel imports ("resid"), a heavy fraction of crude oil, soon entered outside the quota system. This exemption "altered the product mix capability of domestic refineries and created a special dependence on imports of heavy fuels." Predictably, U.S. production of resid fell after 1960 from 332,200,000 barrels of production with 233,200,000 barrels of imports, a ratio of 1.42, to production of 257,500,000 barrels with 557,800,000 barrels of imports, a ratio of 0.46. Overall the quota program "encouraged, through relatively cheap imports, northeastern utilities and other consumers to favor heavy fuel oil and encouraged domestic refineries to alter their output mix toward the lighter products," boosting in particular Caribbean refineries’ production of resid. Further reinforcing the quota-driven nature of resid use, resid consumption declined after these programs ended, with natural gas and distillates taking its place. Combined, these effects piled distortion upon distortion as interest groups competed in the political market place for special favors. Consider just one example of the dynamics of the MOIP. When Canadian oil was exempted under the overland exemption, not only did it create the “double dip” but it provoked complaints from Mexico that its oil was disadvantaged. To mollify Mexico, and with the assistance of the State Department, one of the most vivid of the MOIP distortions began: the “Brownsville U-Turn” or “Mexican Merry-Go-Round.” Despite the lack of an overland connection between Mexican oil fields and U.S. markets, a “crevice” in the import regulations was used to bring Mexican oil in as “overland” oil exempt from import quotas.

Mexican crude was moved by tanker from its producing regions to the U.S. port of Brownsville, Texas, on the Mexican border, unloaded in [customs] bond and then shipped into Mexico in trucks, which made a U-turn, and promptly reentered the United States. On reentry, the crude was taken out of bond, duty was paid on it, and it officially entered the United States under the overland exemption. Because a market for only a fraction of the Mexican oil existed in Brownsville, most of it was reloaded upon tankers and shipped to the East Coast U.S. ports as “domestic” oil.

330 NPC, FACTORS AFFECTING, supra note 61, at 7. The factors enumerated as providing incentives for offshore location included: “to accommodate revisions in U.S. import quota restrictions;” “logistical considerations,” such as better harbors for tankers elsewhere; “to minimize the risks associated with acquiring crude oil supplies,” because foreign refineries often have greater access to foreign crude supplies; “to avoid environmental delays” because regulations are “less severe” in some foreign locations; and “to minimize overall costs” due to higher U.S. tax rates. NPC, FACTORS AFFECTING, supra note 61, at 33.
331 BOHI & RUSSELL, supra note 124, at 298, & Tbl. 8-10.
332 Id.
333 Id. at 299.
334 Id. at 159 (“The increase in resid imports provided a wider market for foreign crude and made possible the further development of Caribbean refinery capacity. The unbalanced demand for resid led domestic refineries to be built with additional processing to minimize resid output, so that lighter products were more expensive to produce.”).
335 FTC, MERGERS, supra note 5, at 65.
336 BOHI & RUSSELL, supra note 124, at 133
337 Id. at 132.
338 Id. See also YERGIN, THE PRIZE, supra note 27, at 539.
Such strategies boosted Mexican exports to the U.S. from 7,000 bbl/day to 40,000 bbl/day.\textsuperscript{339} Venezuela also was given a special deal on resid imports because it too was upset by the Canadians receiving the overland exemption.\textsuperscript{340} As noted earlier, this transformed the U.S. refinery output away from resid.\textsuperscript{341}

Transforming gasoline into a political question also undermined the security of investments in refining capacity. For example, when oil companies raised the price of gasoline in February 1967, an unnamed administration official was quoted as saying that the government would flood the country with imported gasoline if the prices were not rolled back. Some were.\textsuperscript{342} Such threats undoubtedly discouraged investment.\textsuperscript{343} This can clearly be seen in the decline of U.S. capacity relative to U.S. demand.

In the years leading up to 1960, refinery capacity exceeded domestic product consumption, with the excess available to process crude oil for export. After 1960, the deficit in refinery capacity steadily widened. From 1960 to 1970, refinery capacity increased a total of 25.2 percent while domestic product consumption grew by 52 percent, or more than twice as fast. Thus, the United States became increasingly dependent on product imports. When U.S. crude production declined after 1970, and high-sulfur foreign crude could not be used, the dependence on product imports was exacerbated.\textsuperscript{344}

Overall, the MOIP-induced “decade of stasis in policy”\textsuperscript{345} meant that “[b]usiness and government were preoccupied with the tactical issues of administering [policy]: import quotas and ‘prorationing’ for crude oil.”\textsuperscript{346} The MOIP seriously distorted the supply of crude to refiners. “Without controls, cheaper foreign oil would have forced down domestic oil prices and driven marginal producers out of business.”\textsuperscript{347} The MOIP’s microeconomic impacts included preventing the international majors with access to foreign oil from gaining as much market share as they would have without the MOIP and allowing “several dozen, relatively inefficient independent refiners to stay in business.”\textsuperscript{348} Moreover, the MOIP encouraged the migration of refinery capacity to foreign locations.\textsuperscript{349}

\begin{footnotes}
\item[339] 1 BRADLEY, supra note 73, at 741.
\item[340] 1 BRADLEY, supra note 73, at 741.
\item[341] See notes 332 - 334 supra.
\item[342] BOHI & RUSSELL, supra note 124, at 140.
\item[343] Id. at 296-297.
\item[344] Id. at 296.
\item[345] VIETOR, supra note 93, at 145.
\item[346] Id. at 3.
\item[347] Id. at 115.
\item[348] Id. at 145.
\item[349] BOHI & RUSSELL, supra note 124, at 295 (“[S]ome of these [foreign] refineries were given access to U.S. markets. Consequently, domestic refinery capacity began to lag behind final product demand. To meet demand, importers increasingly sought to switch away from crude oil and toward finished products, and this switch was approved by import control authorities who foresaw domestic shortages if it was not
Because of declining U.S. crude production and growing U.S. energy demand, the increase in quota exemptions after 1970 helped devalue the quotas and ultimately made the system “meaningless” in terms of constraining imports.\textsuperscript{350} The increasing number of exempted imports eroded support among oil producers while the costs of the program became higher and more obvious as time passed.\textsuperscript{351} It was formally abandoned in April 1973.\textsuperscript{352} When the quota system changed in 1973,\textsuperscript{353} and the major companies no longer found trading for import quotas necessary, it disadvantaged the MOIP’s beneficiaries. For example, both the double dip and Canadian exemption encouraged refinery location along the northern border of the U.S. When the quota program ended, “these refineries could not compete with other domestic refineries better located to receive U.S. crude oil or imported feedstocks. Then, with the reduction and prospective elimination of Canadian crude oil exports, these refineries, and the markets they served, faced especially severe problems.”\textsuperscript{354} The small refiners sought a new crude oil allocation system to ensure their continued access to oil,\textsuperscript{355} discussed in the next subsection.

The gasoline market was thus under two sets of countervailing pressures between the Korean War and the Arab oil embargo. The first set, from market pressures, pushed the industry toward technological innovations, standardized products, and efforts to expand market share. The second, driven by the economic regulations imposed by the federal government, allocated resources to smaller, generally less-efficient refineries and limited foreign competition to domestic producers. The result was to partially offset the market’s incentives for larger scale refineries and to create incentives for importing exempt refined products rather than crude oil. Indeed, even before the embargo in 1973 “the United States was experiencing an unprecedented shortage of refined petroleum products” partly because of a lack of domestic refining capacity.\textsuperscript{356} Over time, however, the gains from subverting the crude oil import allocation scheme gradually eroded the effectiveness of the program, making the petroleum market in early 1973 freer than it had been since at least 1959. However, the combination of price controls imposed by the Nixon Administration in an effort to control inflation and the Arab oil embargo in 1973 created conditions under which opponents of liberalizing energy markets were able to regroup.

4. Price Controls & the Arab Oil Embargo to Decontrol

By the 1970s, the cumulative impact of the various exemptions and special provisions had eroded the MOIP and oil imports had risen sharply.\textsuperscript{357} Although the Nixon

\textsuperscript{350} LANE, supra note 292, at 6.
\textsuperscript{351} BOHI & RUSSELL, supra note 124, at 2.
\textsuperscript{353} The quota system was eroded by the combination of declining U.S. production, necessitating increasing imports, and the proliferation of exemptions and exceptions to the quotas for various interest groups that expanded the amount of crude imported. See LANE, supra note 292, at 6.
\textsuperscript{354} BOHI & RUSSELL, supra note 124, at 297.
\textsuperscript{355} LANE, supra note 292, at 5-6.
\textsuperscript{356} KATZ, supra note 264, at 13.
\textsuperscript{357} YERGIN, THE PRIZE, supra note 27, at 589 (“The Mandatory Oil Import Program . . . was laboring under mounting strain, creating controversies and gross disparities among companies and regions. Its loopholes
Administration initially considered scrapping the quota system entirely and replacing it with a tariff. However, after 1970, “rising world prices and general relaxation of controls progressively eliminated the protective effect of the quota.” Instead, the administration’s anti-inflation policy, based on a series of “phases” of price controls, overtook the quota system as the primary economic regulation of the petroleum industry.

Oil was at the heart of the Nixon price controls, with crude and refined product price increases in 1970 prompting the administration to investigate oil companies, Nixon himself to denounce them, and relaxation of the MOIP quota restrictions. Phase I of the Nixon price controls, which ran from August 1971 until November 1971, was intended to break expectations of price increases and froze the nominal price of gasoline and other refinery products and domestically produced crude. Of course, such rules had no impact on world markets and so the uncontrolled international price of gasoline and crude oil diverged sharply from the controlled domestic prices, putting firms selling gasoline made from imported oil at a severe disadvantage. The cost advantage imported oil had held was now reversed.

Phase II of the price controls lasted from November 1971 until January 1973, and limited wholesale price increases to no more than three percent annually. Multiproduct firms, including refineries, were given some flexibility through “Term Limit Pricing” and exceptions were very lucrative to those who had figured out how to capitalize on them, and all too visible.” .

358 VIECTOR, supra note 93, at 142 (Nixon appointed a task force to examine it headed by Philip Areeda, got 10,000 pages of comments, from more than 200 firms, associations, etc., position papers from 2 dozen agencies, etc. “In effect, the Task Force staff of economic liberals seized control of the review process and neither the Interior Department nor the White House could recapture it.”) The program had also come under intense criticism during 1969 Senate hearings. Id. at 141.

359 YERGIN, THE PRIZE, supra note 27, at 589. Oil consumers wanted looser controls to cut prices, domestic oil interests wanted to keep prices up, majors who had fought system when set up, “had by now generally reconciled and adjusted themselves to the system, and were content with it. Prices were protected for their domestic production, and the companies had devised distribution systems outside the United States to dispose of their foreign oil. Many of them, therefore, were alarmed at the prospect of change and argued against it.” Id. at 589.

360 BOHI & RUSSELL, supra note 124, at 268.

361 LANE, supra note 292, xviii (Attempts to control inflation preceded the Arab oil embargo and included price controls on oil and oil products.).

362 VIECTOR, supra note 93, at 120 (Nixon “acceded to market pressures by gradually liberalizing its controls until 1973, by which time they were irrelevant anyway.”); BOHI & RUSSELL, supra note 124, at 208 (Inflation had become a concern in the mid-1960s.).

363 1 BRADLEY, supra note 73, at 468.

364 BOHI & RUSSELL, supra note 124, at 210. See 1 BRADLEY, supra note 73, at 467-468 (describing Phase I).

365 LANE, supra note 292, at 8. In particular, imported crude oil price increases could not be passed on to consumers of gasoline because cost increases in imports could be passed through only if the imported product was kept in its initial form and inventoried and accounted for separately from any domestic materials. Since the foreign crude oil was refined (a change in form) and impossible to keep segregated from domestic source oil in most refineries (the inventory and accounting rules), the cost increases in foreign oil could not be passed on to consumers. LANE, supra note 292, at 8. See also BOHI & RUSSELL, supra note 124, at 213.

366 LANE, supra note 292, at 9. See also BOHI & RUSSELL, supra note 124, at 215. See 1 BRADLEY, supra note 73, at 469-471 (describing Phase II).
(TLP) agreements, which allowed them to meet the Phase II rules by keeping the average of prices across products within the guidelines rather than each individual price.\textsuperscript{367} Unfortunately for refiners, gasoline, home heating oil, and residual oil could not be included in the TLP agreements, and so refiners wishing to recoup the increased costs of imported oil had to do so through price increases for their other refined products.\textsuperscript{368} For example, diesel fuel, although chemically equivalent to home heating oil, was allowed in TLP agreements, resulting in plentiful diesel supplies and shortages of home heating oil.\textsuperscript{369} The Nixon administration refused to allow gasoline and home heating oil price increases out of fear of a political backlash.\textsuperscript{370} The TLP rules further distorted relative prices, discouraging gasoline production. Thus even before the Arab oil embargo in 1973, price controls were having a major impact on gasoline markets by keeping prices artificially low and discouraging gasoline production. Moreover, the differences in price for crude from different sources created pressure for a government allocation program to allocate access to cheap crude.\textsuperscript{371} “Conditions had been created [by Nixon programs] wherein there was no market incentive to raise domestic production, no incentive to reduce consumption, and no incentive to increase imports.”\textsuperscript{372} Shortages began to appear in late 1972 and early 1973.\textsuperscript{373}

When war broke out between Israel and her Arab neighbors in October 1973, approximately 17% of U.S. oil supplies derived from Arab sources.\textsuperscript{374} The Organization of Arab Petroleum Exporting Countries (OPEC) halted exports to the United States and several other countries in retaliation for their support for Israel, causing severe supply disruptions.\textsuperscript{375} Although a bill creating an import allocation system was already moving

\textsuperscript{367} LANE, supra note 292, at 9.
\textsuperscript{368} Id. at 11; BOHI & RUSSELL, supra note 124, at 215.
\textsuperscript{369} BOHI & RUSSELL, supra note 124, at 216. See 1 BRADLEY, supra note 73, at 469 (describing TLP provisions).
\textsuperscript{370} LANE, supra note 292, at 11-12. Oil companies that sought price increases were “almost invariably . . . turned down and encouraged to take [their] price increases among [products governed by TLP agreements]. Several oil companies were told that a price increase for a ‘visible’ product would require public hearings and lead to protracted delays.” W.A. Johnson, The Impact of Price Controls on the Oil Industry, How to Worsen an Energy Crisis,” in ENERGY: THE POLICY ISSUES (G. Eppen, ed., 1975) at 99 quoted in LANE, supra note 292, at 11.
\textsuperscript{371} BOHI & RUSSELL, supra note 124, at 223 (“The government was moving toward a system a mandatory allocations of petroleum products even before the oil embargo.”).
\textsuperscript{372} Id. at 218.
\textsuperscript{373} 1 BRADLEY, supra note 73, at 668.
\textsuperscript{374} RICHARD B. MANKE, PERFORMANCE OF THE FEDERAL ENERGY OFFICE (1975) at 1. The embargo “reduced Arab oil supplies from 20.8 million barrels per day in October to 15.8 million barrels per day by December.” LANE, supra note 292, at 30. Additional production from other countries eased the shortage in the early months of 1974. Id. at 31.
\textsuperscript{375} Id. at 1. The embargo consisted of rolling production restraints that cut supply more each month and a total ban on export of oil to the U.S., the Netherlands, Portugal, South Africa, and Rhodesia. YERGIN, THE PRIZE, supra note 27, at 613. Actual reductions in supply were smaller than they would have been without substitution of non-Arab supplies to the nations cut off. There were 20.8 million barrels/day sold in early Oct., at the lowest point during the embargo, non-OAPEC sales were 15.8 million barrels/day for a gross loss of 5 million barrels/day. But because other producers increased production, the net loss was only 4.4 million barrels/day or about 9% of total world production in the “free world” before embargo. The impact was worse than this suggests, however, because demand was growing at 7.5% / year. Moreover, during the cutbacks information on substitution was not yet completely available and so the loss seemed larger. Id. at
toward passage in Congress before the embargo, the supply disruptions caused by the embargo “gave impetus to the movement for an allocation system and added a new rationale for such a system: the distribution of crude oil and refined products during a period of supply disruption.”

Responding to the pressures for a new allocation program, Congress adopted the Emergency Petroleum Allocation Act (“EPAA”) in 1973 and the initial set of rules implementing it went into effect in January 1974. The legislation was originally drafted to deal with the problems smaller refiners, independent marketers and others had been experiencing in obtaining supplies prior to the embargo [and] . . . many of its provisions still reflected its more limited initial purpose. It was available, however, and so Congress quickly adopted this square peg to fill the round hole that world events presented. Nixon seized on allocation as a response to the politics of the situation, perhaps in part to undercut his potential Democratic rival in the 1972 presidential elections, Washington Senator Henry Jackson, who had promoted allocation during 1973.

To coordinate the response to the embargo, the government established the Federal Energy Office (FEO), which after a “glamorous, hyperactive six-month existence” became the Federal Energy Administration (FEA). “[T]he newly created Federal Energy Office began introducing an almost unimaginably complicated and wide-ranging set of regulations for allocating both crude oil and refined products. All assessments of the period agree that, viewed in toto, these allocation regulations aggravated consumer suffering stemming from the embargo.” Unfortunately, the FEO/FEA actions generally worsened the situation rather than mitigating the problems. For example, the FEO pressured refiners to produce more home heating oil at the expense of gasoline production because it feared a shortage of the former. But the FEO had overestimated demand for heating oil and underestimated demand for gasoline and so its pressure exacerbated gasoline shortages and produced a surplus of heating oil (supplies of heating oil in February 1973 were 38% higher than they had been in February 1972). The FEO’s crude oil allocation system “assured, perversely, that gasoline could not be shifted from an area already well-supplied to one where it was

614. The embargo was almost a complete surprise to U.S. policymakers, who, as a result, were unprepared for it. Id. at 608-609.
376 1 BRADLEY, supra note 73, at 487.
377 LANE, supra note 292, at xix; 1 BRADLEY, supra note 73, at 487 (embargo “hastened” allocation controls).
379 39 FED. REG. 1924 (Jan. 15, 1974).
380 LANE, supra note 292, at 38-39.
381 1 BRADLEY, supra note 73, at 671-673.
382 MANKE, PERFORMANCE, supra note 374, at 2.
384 MANKE, PERFORMANCE, supra note 374, at 8; LANE, supra note 292, at 43.
385 LANE, supra note 292, at 46 (Price increases in heating oil, however, reduced demand more than regulators anticipated and the result was a glut of heating oil and a shortage of gasoline.).
386 MANKE, PERFORMANCE, supra note 374, at 9.
needed.”387 In short, the federal response to the embargo eliminated the market’s ability to adjust, substituting an administrative allocation system that worsened the crude supply disruptions.

Nevertheless, the federal government failed to learn from the embargo experience that markets were a superior means of adjusting to supply shocks. Instead, each new problem provoked additional, quixotic regulations designed to “fix” the problems caused by the prior set. As a result, the quotas and controls introduced in response to the Arab oil embargo grew ever more complicated,388 because of the difficult political dynamic that produced them.389

Phase III of the price controls began in January 1973 and allowed companies to self-administer the price controls.390 However, after gasoline prices rose 7.4% by March (increases that were within the Phase III guidelines), greater controls were re-imposed on oil products.391

Price controls also increased the demands for a non-market allocation system. For example, after April 1973, Phase III of the price controls included “Special Rule No.

387 YERGIN, THE PRIZE, supra note 27, at 617. See also MANKE, PERFORMANCE, supra note 374, at 11. Federal allocations of gasoline to regions were not matched to demand because they were based on regional usage from before the shortages and did not take into account changes in regional population and changed driving patterns due to higher prices and jawboning efforts by the government. Erroneous allocations ranged from 63% of projected needs in New Hampshire and Virginia to 122% in Wyoming. MANKE, PERFORMANCE, supra note 374, at 11; LANE, supra note 292, at 48-49.


389 Yergin gives a clear explanation of the problem, which is worth quoting at some length:

The massive reallocation posed a very considerable logistical problem. Even under calm and relatively predictable circumstances, managing an integrated oil system was a highly complex matter. Supplies of varying qualities from various sources had to be linked into the transportation system and then moved to refineries that had been designed to handle those specific oils. Free will was not an option when it came to assigning crude oils. The “wrong” crudes could do considerable damage to the inners of a refinery, as well as reducing efficiency and profitability. And once the crude supplies were run through the refinery and turned into a number of products, they then had to be moved into a distribution system and linked with a “market demand” that wanted that particular balance of products—this amount of gasoline, that amount of jet fuel and heating oil.

And to make matters even more difficult, the companies still had to figure out what their oil supplies actually cost, so that they did not sell at a loss or invite attack for excessive profit margins. The cost for oil royalties, extent of government participation, buyback prices, volumes—all these were changing week by week, and were further complicated by leapfrogs and retroactive increases by the various exporting governments. “It was impossible to know whether a calculation made on the basis of all the known facts on one day would not be overturned by a rewriting of all those facts a month later,” said an executive from Shell.

YERGIN, THE PRIZE, supra note 27, at 622. In addition to the confusion created by the ever-shifting regulations on energy pricing and imports, the Nixon White House repeatedly reorganized its energy policy team during 1972-1973, KATZ, supra note 264, at 17-19 (describing various reorganizations and terming them “in chaos” by May 1973), and the piecemeal approach to energy issues in general meant that energy matters were scattered among sixty government agencies, “each operating with little or no communication with the others.” Id. at 31. Congressional efforts to produce a unified national policy failed to produce legislation. One analyst concluded that Congress “was whipsawed by regional concerns, conflicting special interests, and contradictory advice from various experts.” Id. at 34.

390 BOHI & RUSSELL, supra note 124, at 217. See also 1 BRADLEY, supra note 73, at 471-474 (describing Phase III).

391 BOHI & RUSSELL, supra note 124, at 217.
that barred the twenty-three largest oil companies from raising prices above their January 11, 1973 level. Among other things, Special Rule No. 1 created a disincentive for the large companies under it to import crude oil. This, in turn, put at a disadvantage the smaller, inland refiners, who had grown dependent on trading import permits under the MOIP for access to the oil fields controlled by the major oil companies closer to their refineries. They were “forced into direct competition with the majors for domestic sources of crude.” Some of these inland refiners then “joined the rising chorus of those demanding a government allocation system.”

Even the bureaucracy became overwhelmed by the complexity of the price controls, and Phase III failed to tame inflation adequately. Phase III was followed by “Phase III½,” a 60-day price freeze intended “to provide an opportunity for Federal price regulators to rethink and redesign the Phase III price controls” that lasted from June 12, 1973 to September 7, 1973. The freeze meant that oil companies were charging different customers different prices for the same goods. “Inequities and inefficiencies were created, harming some sectors and helping others, but confusing all.” It also meant that imported oil costs could not be passed on to consumers. Dissatisfaction with the Phase III½ freeze drew 1,000 heating oil distributors and 2,000 gasoline dealers to Washington for protest demonstrations in September 1973.

Phase IV followed, introducing a regulatory distinction between new and existing sources of domestic crude and allowing higher prices for the former in an effort to boost supply. By the spring of 1974 multiple groups clamored for federal allocation of oil and refined product supplies: “independent refiners wanted access to domestic crude; nonbranded independent gasoline marketers wanted allocation of gasoline; New England fuel oil marketers and consumers sought an allocation program for heating oil; and

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392 38 FED. REG. 6283-84 (March 8, 1973).
393 LANE, supra note 292, at 14-15. See also 1 BRADLEY, supra note 73, at 472-474 (describing Special Rule No. 1).
394 LANE, supra note 292, at 14-16 (giving full account of Special Rule No. 1’s impact). In short, since Special Rule No. 1 did not apply to smaller firms, which were “for all intents and purposes, free of controls” because the Phase III rules were not adequately enforced, these firms were able to buy at controlled prices and sell at uncontrolled prices. Because smaller firms were able to sell product at whatever price the market would bear, they could outbid large firms for supplies.
395 Id. at 17; BOHI & RUSSELL, supra note 124, at 219.
396 BOHI & RUSSELL, supra note 124, at 219.
397 LANE, supra note 292, at 17.
398 BOHI & RUSSELL, supra note 124, at 220.
399 LANE, supra note 292, at 18. See also 1 BRADLEY, supra note 73, at 474 (describing Phase III½).
400 The freeze increased demands for an allocation program. As the freeze period came to an end, gasoline dealers recognized that they would soon be able to sell the gasoline in their tanks at substantially higher prices. Many simply shut their stations or severely restricted sales. Gas station closings and the resulting shortages at the end of October seemed to underline the need for a system of mandatory allocation for petroleum products.
401 LANE, supra note 292, at 33-34.
402 BOHI & RUSSELL, supra note 124, at 221.
403 Id. at 220.
404 Id. at 223.
405 Id. at 221. See also 1 BRADLEY, supra note 73, at 474-478 (describing Phase IV).
farmers wanted a propane allocation system.\textsuperscript{404} While the oil price controls were supposed to end in 1974 along with the other “temporary” price controls, the Arab oil embargo’s price pressure led to an extension into the Mandatory Petroleum Price Regulations which continued them after the end of price controls generally.\textsuperscript{405}

With the Energy Policy and Conservation Act (EPCA) of 1975,\textsuperscript{406} Congress revised the EPAA scheme in an incoherent omnibus energy bill that “included provisions both to reduce and to raise the price of oil.”\textsuperscript{407} EPCA essentially incorporated the Phase IV program, including the classifications for pricing purposes\textsuperscript{408} which was intended to prevent “windfall” profits to domestic oil producers.\textsuperscript{409} But EPCA modified the Phase IV two tier system, turning it into a three tier system: old oil (from domestic wells that began producing before 1973), new oil (from wells that began producing during or after 1973), and uncontrolled oil (oil from the Alaskan North Slope, the Naval Petroleum Reserve, and “stripper”\textsuperscript{410} oil.\textsuperscript{411} Old oil’s price was set relatively low; new oil’s price was higher; and uncontrolled oil sold at the market price.\textsuperscript{412} Not surprisingly, the profits available from reclassifying oil into the market-price categories from the controlled price

\textsuperscript{404} LANE, \textit{supra} note 292, at 25. VIETOR, \textit{supra} note 93, at 248 (Independent Refiners Association of America and its customers, 47 associations of 70,000 gas station operators, all favored extension of controls in the 1970s.).

\textsuperscript{405} LANE, \textit{supra} note 292, at 19; VIETOR, \textit{supra} note 93, at 238 (“The price freeze eventually gave way to a series of price controls that finally expired in 1974 – except for the oil industry.”). PL 93-159.

\textsuperscript{406} PL 94-516 (12/1975). The EPCA was set to expire on October 1, 1981, ending all oil price controls at that time, Congressional Budget Office, \textit{The Decontrol of Domestic Oil Prices: An Overview} (1979) [hereafter “CBO, \textit{Overview}”]. at 5, because the Ford Administration traded an immediate price rollback on crude oil prices for authority to end the program after forty months and to end the controls on refined products sooner if Congress did not object and for larger price increases during the forty months. LANE, \textit{supra} note 292, at 54; KATZ, \textit{supra} note 264, at 58-59 (describing compromise). See also LANE, \textit{supra} note 292, at 105-106 (explaining compromise).

\textsuperscript{407} KATZ, \textit{supra} note 264, at 57.

\textsuperscript{408} LANE, \textit{supra} note 292, at 104. See also 1 BRADLEY, \textit{supra} note 73, at 494-497 (describing law’s implementation); BOHI & RUSSELL, \textit{supra} note 124, at 228 (“principle feature” of EPCA in 12/75 “was the retention of at least standby price and allocation controls on the industry for five years and the broadening of crude oil controls to include new oil, released oil, and stripper-well oil.”). “Lower tier” (or “old”) oil was the amount of oil produced from a property during the corresponding month of 1972. It could be sold at “the highest posted price for that grade of crude at that property on May 15, 1973, plus $1.35” giving a range from $3.50 to $7.00 per barrel. Id. at 104-105. “Upper tier” oil was “new, released and stripper – all produced domestically – plus imported crude.” Id. at 105. “New” oil was the excess over the 1972 base production level or oil from a new property. Released oil was the result of an incentive that allowed a barrel of old oil to become new for each barrel of new oil produced from a property. Id. Stripper crude came from wells producing 10 barrels or less per day. Id. Upper tier crude could be sold at market price.

\textsuperscript{409} LANE, \textit{supra} note 292, at 113.

\textsuperscript{410} “Stripper” oil came from wells producing ten or fewer barrels per day of petroleum and petroleum condensates, including natural gas liquids, during the preceding calendar year. Subcommittee on Oversight and Investigations, Committee on Interstate and Foreign Commerce, U.S. House of Representatives, \textit{The Case of the Billion Dollar Stripper: The Evasion of Price Controls on Domestic Crude Oil by Resellers}, 96\textsuperscript{th} Congress, 2\textsuperscript{nd} session (96-IFC58) (1980) at 2 [hereafter “\textit{Billion Dollar Stripper}”].

\textsuperscript{411} CBO, \textit{Overview}, \textit{supra} note 406, at 5-6. The various definitions had many subtleties and complexities, described in some detail in CBO, \textit{Overview}, \textit{supra} note 406, at 5-8. See also MANKE, \textit{Performance}, \textit{supra} note 374, at 18 (concise, clear explanation of pricing structure); FEA, \textit{Compliance Guide}, \textit{supra} note 388, at 7-34 (describing how to classify oil).

\textsuperscript{412} For example, in 1979 the old, new, and uncontrolled prices were $5.86, $13.06, and $18.50 per barrel respectively. CBO, \textit{Overview}, \textit{supra} note 406, at 6-7. The first two prices are wellhead prices, the latter is at the refinery gate and so includes transportation costs.
categories produced a number of successful schemes to do so.\footnote{413}{\textit{Billion Dollar Stripper}}, supra note 410, at 2 (noting that when price of stripper oil grew rapidly in January 1979, “a significant and growing discrepancy began to appear in data reported to the DOE. Refinery receipts of stripper oil, which had closely tracked production for several years, suddenly began to exceed production. On a sustained basis this is, of course, a physical impossibility.”) One method of doing so was to resell the oil through a number of entities, obscuring its origins. \textit{Id.} at 5. Eventually enforcement actions were brought against a number of firms for millions of dollars of false certifications. \textit{See Cost to Consumers}, supra note 26, at 42-43.\footnote{414}{\textit{Lane}, supra note 292, at 110-111 (“In some instances, techniques to maximize production from a unitized reservoir might be foregone in favor of techniques that maximized production which could be sold at upper-tier crude prices.”)}\footnote{415}{\textit{Bohi \& Russell}, supra note 124, at 222-23.}\footnote{416}{\textit{Viétor}, supra note 93, at 252. The extent to which the pricing system required far-reaching controls can be seen from considering just one set of consequences. Refiners differed in the proportion of old and less controlled crude they processed. To prevent those processing a higher proportion of old and cheaper crude from earning higher profits, “the FEO had to enforce differential ceilings on the prices refiners could charge for their products. The method was to allow each refiner a specified markup over its full unit production costs. Even within well-defined geographical markets, the price controls on old crude led to intercompany differences of as much as 12¢ per gallon in retail gasoline prices.” \textit{Manke}, \textit{Performance}, supra note 374, at 19. Once the embargo-related shortages passed, to prevent those with lower costs from underselling their competitors, the government required these refineries to sell at controlled prices some of their cheaper oil to their competitors. \textit{Id.} at 20.}\footnote{418}{\textit{Lane}, supra note 292, at 57. \textit{See also} Statement of James B. Edwards, Secretary, Department of Energy, in DOE’s Enforcement of Alleged Pricing Violations by the Nation’s Major Oil Companies, Hearing before the Environment, Energy and Natural Resources Subcommittee of the Committee on Government Operations, House of Representatives, July 9, 1981 at 4 (“The regulations implementing [the petroleum price and allocation] controls were quite complex, addressing as they did a very complex industry. The sheer magnitude of this industry is such that even a seemingly trivial type of violation of these complex regulations can result in apparent violations in the hundreds of millions of dollars.”) \textit{See also} \textit{Yergin}, \textit{The Prize}, supra note 27, at 660 (describing complexity and cost of regulations in 1970s).}
The allocation program attempted to equalize oil supplies so that all refineries operated at the same percentage of their operating capacity and to equalize the cost of crude. Refineries with supplies over the national average were required to sell, at their weighted average cost, the excess to those with supplies under the national average. This created a number of perverse incentives. For example, any refiner who found additional supplies on the world market at prices above its average cost would be forced to sell the extra oil to its competitors at a discount. (This “extra” oil’s marginal cost would have to have been above the average cost of the rest of the refinery’s oil because the average cost included the price-controlled domestic oil.) Price ceilings set under EPCA proved difficult to calculate precisely, given their relationship to the market price for foreign crude and its market share in the U.S. and necessitated multiple adjustments. The net effect penalized refiners who had taken steps to resolve the shortages for the benefit of those that had done nothing. In economic terms, the 1970s allocation program was a step backwards from the MOIP, which had at least allowed the price of quotas to be set in the marketplace, since the FEA set the prices under the new program.

The regulations also created incentives to operate inefficient refineries simply to get the entitlements to crude oil that owning a refinery produced: “the result was the bringing out of mothballs any piece of ‘refining junk’ that could be found – leading to the return of hopelessly inefficient ‘tea kettle’ refineries of the kind that had not been seen since the flood of oil in the East Texas field in the early 1930s.” Further modification of the program gave the small refiners additional entitlements based on a sliding scale in an attempt to reduce the cost advantage the larger, more efficient refiners had. As a

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420 BOHI & RUSSELL, supra note 124, at 226.
421 LANE, supra note 292, at 40; VIETOR, supra note 93, at 246. See also MANKE, PERFORMANCE, supra note 374, at 15-16 (a clear, concise discussion of the inter-refinery allocation problem). A particularly vivid example is the case of Sohio, operating in Ohio, had a huge price advantage over its competitors from Sohio’s Alaskan crude supplies (which received preferential treatment under DOE regulations). Forced by DOE regulations to pass this price advantage on to its customers, Sohio undersold its competition and increased its market share in Ohio. The independents sought a regulatory correction with an ad hoc lobby group, the Ohio Independents for Survival. Their lobbying precipitated a general rules change that favored the independents. LANE, supra note 292, at 171-172. Other lobbying groups also formed to attempt to secure changes in DOE rules to their advantage. Id. at 172-173. These efforts “diverted substantial amounts of managerial and entrepreneurial time and attention away from marketplace problems and toward political problems . . . [and] created constituencies for the continued existence of particular aspects of the controls, and in many cases for the controls themselves.” Id. at 172.
422 Id. at 41.
423 Id. at 107.
424 Id. at 41.
425 BOHI & RUSSELL, supra note 124, at 227.
426 YERGIN, THE PRIZE, supra note 27, at 660. See also FTC, GASOLINE PRICE CHANGES, supra note 9, at 51 (during the 1970s “government controls on crude oil prices and allocation favored small refineries, which provided incentives for companies to open and operate small, inefficient refineries, including many that produced little or no gasoline.”)
427 LANE, supra note 292, at 134. Under the “sliding scale” refiners got 11.1% of the first 10,000 bbls/day. of capacity and then smaller percentages of capacity above that. For example, if a refinery had capacity above 300,000 bbls/day, it received only 3.7% of the capacity above that amount. VIETOR, supra note 93, at
result, smaller, less efficient refiners profited at the expense of larger, more efficient refiners, and additional new inefficient firms entered the refinery industry.428

The price control regulations did not allow pass-through’s of capital costs even to the same extent that they allowed pass-through’s of higher crude acquisition costs, discouraging refiners from investing in the technology needed to process high sulfur crudes.429 Moreover, smaller refineries were less likely to have the ability to process high sulfur fuel or to maximize production of lead-free gasoline. This reinforced the negative impact of the quota system and discouraged investment in processing high sulfur crude.430 “Accordingly, most new refinery capacity brought on stream after the adoption of the small refiner subsidies was in the form of small refineries designed to operate on low-sulfur crude oil and to produce a relatively undesirable slate of products.”431 These refiners earned their owners economic rents from the allotments but contributed little to broadening and deepening the gasoline market. To some extent such refiners actually hindered the development of the market, for their existence denied the more efficient producers crude they could have used to expand into new regional markets and subsidized the creation of protected pockets within the national market.

Because the new refinery could receive its own allocation of the cheaper oil, building a new refinery became preferable to expanding an existing one.432 The gains were substantial. Economic analysts calculated that the annual value of the cheaper oil allocations reached $17 billion in 1979.433 As economists Kenneth Arrow and Joseph Kalt dryly noted in a 1979 analysis, “[t]he prospect of a transfer of $17 billion per year induces political competition for its acquisition among producers, refiners, and consumers. The entitlements program is an outcome of this process of competition and is the mechanism by which eventual ownership of the windfall gains that arise under crude

125 Over time the sliding scale became even steeper, rising to 22% for the first 10,000 bbls./day by the end of program. Id. at 126.
428 Between 1974 and 1980, 65 of the 67 new refineries built had a total capacity below 45,000 barrels per day and 60 of these had a total capacity below 30,000 barrels per day. LANE, supra note 292, at 134-135.
429 Id. at 138; BOHI & RUSSELL, supra note 124, at 295 In Senate testimony, a DOE official elaborated on how regulations had discouraged investment in refining:

First, the most serious aspect of the problem is that seven years of price controls and general regulatory uncertainty have inhibited investment in the refinery expansions and improvements needed to make unleaded gasoline, or to make gasoline-range material out of heavy and high sulfur domestic crude oils. . . . Second, price controls have discouraged refinery improvements that increase efficiency, since they require that the full amount of such cost savings be passed on in the form of lower product prices. Third, the regulations do not reflect the fact that during the period of controls cost increases relative to the production of gasoline have been much greater than for other products. . . . Finally, the regulations take a snapshot of each refiner’s prices as of May 15, 1973, and allow it to add certain costs to that price, no matter how that company’s relative pricing or competitive circumstances have changed in the meantime.

Statement of John F. O’Leary, Deputy Secretary, Department of Energy, Before the Senate Committee on Energy and Natural Resources, December 11, 1978, pp. 10-12 quoted in LANE, supra note 292, at 139-140.

430 BOHI & RUSSELL, supra note 124, at 295.
431 LANE, supra note 292, at 136.
432 PETERTSON & MAHNOVSKI, supra note 75, at 36 (“Despite falling demand, between 1975 and 1981 the construction of small, simple refineries was further stimulated by federal crude oil supply controls, which gave unusual supply advantages to small refineries.”)
Once crude shortages no longer existed, the allocation program was used to address the disparities in access to crude. When crude was limited, “disparities in crude costs had not been a problem [because] supplies had been tight and product could be sold at whatever price a firm could charge under the regulations.” Once supplies were more abundant, however, “those with higher than average crude costs feared that they would be forced out of the marketplace.” The “entitlements” program granted refiners “the right to refine a barrel of price controlled gasoline during a given month,” allocated in such a way as to give each refinery a share of the price-controlled gasoline but with a bias toward small refiners, who received more entitlements than their proportionate share would justify. This provided a tremendous cost advantage for small refiners, as much as ten cents per gallon of gasoline.

The Arab oil embargo spurred a rise in real gasoline prices of 65% from 1972 to 1976 (21% of that above the general rate of inflation). These prices pulled non-Arab oil and refined products into the United States from outside sources. Price controls on domestically produced crude oil – designed to prevent “windfall profits” to oil producers – instead resulted in windfalls for refiners because the demand for the cheaper domestic oil greatly exceeded the price controlled price. For example, refiners could include the price of gasoline they purchased for resale in the calculations of their average price, which determined the price at which they could sell all their gasoline. Thus refiners selling gasoline at a controlled price below the market price had an incentive to purchase gasoline at any price, including prices above market price, to bring their average up to the market price. In general, the regulations lowered the price of crude to domestic refiners, increasing their market share at the expense of foreign refiners, but also increased the average operating costs of domestic refiners.

When the Carter Administration took office, its initial policy goal aimed to find a way to decontrol domestic oil prices “so that consumers could react to correct price

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434 Id. at 11. See also LANE, supra note 292, at 28 (“it was government forces in effect during the previous two years that had not permitted market forces to operate in the petroleum industry. Thus, the allocation program was a direct consequence of the price control program.”)

435 VIETOR, supra note 93, at 238.

436 BOHI & RUSSELL, supra note 124, at 227.

437 LANE, supra note 292, at 128.

438 Id. at 129-131. The allocation formulas were complex and are described in detail in Id. at 129-130.

439 Id. at 133.


441 MANKE, PERFORMANCE, supra note 374, at 7.

442 LANE, supra note 292, at 143.

443 Id. at 147.

444 Id. at 158.
However, Carter’s attempts to reform energy policy quickly mired in special interest politics.\textsuperscript{446} The Carter Administration first attempted “voluntary” wage and price guidelines, “backed by moral suasion, publicity, and the denial of Federal contracts to firms that violated them. At least initially, this was taken to include denial of the right to bid on Federal oil leases,”\textsuperscript{447} which induced compliance by the major oil companies. These “voluntary guidelines” were in effect between October 1978 and December 1980.\textsuperscript{448} Like the mandatory regulations, these guidelines proved “quite complex in practice.”\textsuperscript{449} There is at least some evidence that these controls caused refinery-level shortages.\textsuperscript{450} Because price controls did not account for the interrelationships of products produced by refineries, they produced shortages in non-controlled products.\textsuperscript{451}

The Carter Administration was also hampered by the Iranian hostage crisis, which doubled spot market prices by February 1979.\textsuperscript{452} The loss of lighter Iranian crudes forced refineries to use heavier crudes, reducing gasoline yields.\textsuperscript{453} The allocation program had

\textsuperscript{445} YERGIN, THE PRIZE, supra note 27, at 663. See also 1 BRADLEY, supra note 73, at 503-510 (describing Carter’s “phased decontrol” strategy).

\textsuperscript{446} YERGIN, THE PRIZE, supra note 27, at 663 (Carter Administration got “a firsthand education in how special interests operate in the American system, including liberals, conservatives, oil producers, consumer groups, automobile companies, pro- and anti-nuclear activists, coal producers, utility companies, and environmentalists—all with conflicting agendas,” when the administration tried to reform energy policy.).

\textsuperscript{447} LANE, supra note 292, at 57-58.

\textsuperscript{448} Frank Camm, Charles E. Phelps, & P.J.E. Stan, Resource Allocation under the COWPS Price Guideline: The Case of Fixed Proportions (May 1981), Rand Corp. at v.

\textsuperscript{449} Id. at 3.

\textsuperscript{450} Id. at viii (“Some casual empirical evidence supports the belief that the COWPS controls were in fact the determinate cause of refinery-level shortages in 1978-1980.”)

\textsuperscript{451} Id. at vi. The economic analysis is relatively complex, and described in detail in the above cited report.

Briefly, the analysis can be summarized as follows:

If and only if the productive technology of the firm embodies certain types of fixed proportions (as appears to be the case for refineries), then complying with [Council on Wage and Price Stability (COWPS)] guidelines can lead to a shortage of refined product from any given refiner. If the COWPS constraint becomes so binding that the profit-maximizing refiner cannot charge market-clearing prices for its products at any level of output, then it will select the output that leads to the highest COWPS-allowed profits and will charge less than market prices. This, of necessity, leads to rationing of the product by the refiner among its customers and is a prima facie condition of shortage. Importantly, this theory shows how rationing of products can occur for products that were totally uncontrolled by the DOE, such as diesel fuel, heating oil, jet fuel, and other products. And indeed, there was nonprice rationing for each of these products by some refineries during the shortages, rationing that cannot logically be attributed to the DOE price controls on refineries.

Id. at vi. See also id. at 42 (noting shortages in jet fuel that occurred during a labor strike at a major airline and while the DC-10 fleet was grounded by the FAA, “a time when aggregate demand for fuel was unusually low.”)

\textsuperscript{452} YERGIN, THE PRIZE, supra note 27, at 688. Oil was cut off for 69 days starting at Christmas 1979, it returned at permanently lower production rate. Paul Kemezis, The Permanent Crisis: Changes in the World Oil System, in OIL DIPLOMACY: THE ATLANTIC NATIONS IN THE OIL CRISIS OF 1978-79 3, 4 (1980). Iran at time of crisis was source of approximately 15% of internationally traded oil. Manke, American Response, supra note 383, at 29. Iran source of 9% of US oil imports, 3% of US consumption before revolution. Manke, American Response, supra note 383, at 31. See also YERGIN, THE PRIZE, supra note 27, at 702 (When Carter ordered a freeze on Iranian assets and ban on Iranian oil imports in the wake of the seizure of the hostages in the American embassy and Iran retaliated with a ban on exports to the U.S., it disrupted supply channels and forced reallocation of oil.).

\textsuperscript{453} YERGIN, THE PRIZE, supra note 27, at 692.
“fallen into disuse” because a market surplus had rendered it moot, but the new shortages brought it back into play. By 1979 small refiners were again making extensive use of the program.\footnote{LANE, supra note 292, at 69.}

President Ronald Reagan decontrolled oil prices in January 1981.\footnote{Exec.Order 12287, 46 Fed. Reg. 9909 (Jan. 30, 1981).} With deregulation, the oil industry went through “a wholesale corporate reorganization from which no major company was immune.”\footnote{YERGIN, THE PRIZE, supra note 27, at 726.} Twenty-three small refiners shut down in 1981 alone.\footnote{2 BRADLEY, supra note 73, at 1237.} Add to this falling real prices and the rise of institutional investors interested in rapid returns and the oil companies were forced to become leaner and more profitable quickly, sparking inter-company battles and a wave of consolidations.\footnote{FTC, GASOLINE PRICE CHANGES, supra note 9, at 51.} The shift from a regulatory program that encouraged a proliferation of refineries focused on domestic crude sources and kept small, less efficient refineries open, to a market-place that punished inefficiency led many refineries to close in the 1980s.

5. Impacts on the Market for Gasoline

The post-World War II economic regulation of the oil industry flowed from the belief that such a vital commodity required government involvement. From there, “the drift of policy was inexorable. . . . because at each step the decision was marginal—only a little more control was involved—and the benefits to the entire enterprise appeared substantial.”\footnote{BOHI & RUSSELL, supra note 124, at 15.} But the regulatory scheme in place from the Korean War through 1981 failed to achieve what it attempted to accomplish, instead taking crude away from efficient refiners and allowing “refiners manufacturing lower proportions of the products in short supply to use higher than normal proportions of the available crude,” shifting crude from the coasts, where supplies were short, and to the Midwest, where supplies were already plentiful,” and establishing “the precedent of bailing out refiners that had come to depend on the spot market for a large proportion of their crude supplies, reducing whatever incentive they might otherwise have had to stockpile oil for such contingencies in the future.\footnote{LANE, supra, note 292, at 89.} Moreover, the regulatory system repeated its mistakes from one crisis to the next.\footnote{LANE, supra note 292, at 100-101 (“most of the ‘mistakes’ made by the government in handling the Arab oil embargo were repeated during the Iranian disruption six years later. . . [they] were made because the same groups were affected by the regulations and responded politically in the same ways.”).}

At virtually all times, but particularly during the 1960s and 1970s, economic regulations induced significant distortions in the market for gasoline. The decline of the U.S. refining industry’s world share is closely tied to American energy policies, policies
which included such disincentives for efficient investment as the 1970s price controls’
requirement that larger domestic refineries sell imported oil to competitors at below cost.
Combined with other nations’ interest in developing their own refining industries,
economic regulation contributed to the reduction in American refiners’ ability to meet the
growing American and world demand for gasoline.

Although these regulatory efforts ultimately had no more chance of success than
King Canute’s legendary command to the sea had of stopping the tides, they had two long
term impacts for our purposes. First, gasoline imports, as opposed to crude oil imports,
became more important in the American market.462 Until after World War II, most
gasoline oil refined and consumed in the United States was produced domestically.463
Indeed, through World War II, the United States had the vast majority of advanced
refineries, with “[a]proximately 60 percent of the total world crude-distillation and 65
percent of catalytic cracking capacity” at the end of the war.464

Second, the pervasive economic regulation had a more subtle, but in our
judgment, more debilitating effect. By making the pages of the Federal Register and
United States Code more important to the oil industry than developing new technologies
for recovering and refining petroleum, regulations convinced oil men, politicians, and
bureaucrats that “kings” could command the tides of the oil business. Regulators never
recognized that the burdens of their regulatory structures were bearable only because the
industry was simultaneously expanding production outside the United States, developing
new technologies to improve refinery productivity, and growing crude supplies so rapidly
that the real price of crude continued to fall. The regulatory burden thus went largely
unnoticed as it merely siphoned off portions of the gains from technical and economic
improvements.465 The widespread “regulatory trading,” in which oil was traded to allow
its reclassification and resale at a higher price (at least quasi-legitimately), during periods
of allocation controls is indicative of the destruction allocation programs caused.466

Whether these regulations served the real economic interests of their supporters at
the expense of the general welfare467 or, more benignly, whether they reflected a
combination of incompetence and ignorance among policy makers, we cannot say. The
key point is that energy policy in this period involved major interventions running

462 Gasoline imports became important in the 1970s. NPC, FACTORS AFFECTING, supra note 61, at 4.
Imports grew from “a net negative in the early 1950s to a peak of about 7% of domestic demand in the late
1980s” and have since fluctuated between 2% and 6%. NPC, ADEQUACY, supra note 37, at 21-22.
463 USDOC, War and Postwar, supra note 39, at 2 (“At present time the country’s more than 450 refineries
are supplied with crude oil by almost 425 thousand domestic producing wells and a relatively small volume
of crude oil from foreign sources.”)
464 USDOC, War and Postwar, supra note 39, at 6. The next largest shares were in the Netherlands West
Indies and the Soviet Union, “each having approximately 10 to 15 percent as much crude-distillation
capacity as the United States.” Id.
465 The same is true of some current environmental regulations of fuel composition. See, e.g., NPC,
ADEQUACY, supra note 37, at 37 (“The fact that product prices actually declined in spite of increased
[regulatory] costs suggests that the direct cost increase was more than offset by other efficiency gains
within the industry. Without increased environmental costs, prices would be lower.”) Imports have been
growing “significantly” in recent years, primarily from Europe. NPC, OBSERVATIONS, supra note 13, at I-2.
Although imports are small overall, they account for 25% of gasoline supplies in PADD I. Id. at I-9.
466 1 BRADLEY, supra note 73, at 681-682, 685-710 (describing history of regulatory trading in detail).
467 YERGIN, THE PRIZE, supra note 27, at 660 (The direct costs alone of the federal energy regulatory
system in the 1970s “measured simply in terms of expenditures by government agencies and by industry on
regulatory matters . . . added up to several billion dollars in the mid-1970s.”).
counter to the long term market trends in gasoline, propping up inefficient, smaller refineries and diluting the competitive pressures for securing supplies and technological innovation. Despite the massive scale of these interventions, they reversed the long term trends only briefly, during the immediate aftermath of the Arab oil embargo in the mid-1970s. Their distortions so pervaded the refining industry, however, that the industry in 1981 bore little resemblance to what it would have been in their absence. Most importantly, these distortions’ cumulative impact restricted the growth of a national market in gasoline by protecting isolated markets from competition, punishing firms that engaged in market-expanding behavior such as securing cheap, foreign crude supplies, and deterring investment in U.S. refineries.

By 1980, oil and refined gasoline were internationally traded commodities, abundantly and cheaply available primarily from non-U.S. sources. The failure to adapt to that fact itself distorted the U.S. refining industry. The legacy of oil regulation was a narrower, shallower national gasoline market than would have evolved in the absence of forty years of import and price controls. Refineries were smaller, less technologically sophisticated, and more concentrated on the Gulf Coast than they would have been in the absence of regulation. The gravity of these distortions was not fully felt in the 1980s, however, because economic conditions kept gasoline demand below 1978 levels well into that decade. Indeed, the problem’s impact is still mitigated today by imports of gasoline into the east coast from Europe, a solution possible only because Europe’s heavier reliance on diesel passenger vehicles produces a surplus of gasoline there. If the diesel market grows in the United States, as some forecast it will, supplies of diesel are not likely to be available from European refineries to play an equivalent role.

These regulatory factors in turn exacerbated the burden of the environmental regulations that followed. Competition in the gasoline market pushed refiners to adopt increasingly sophisticated and expensive techniques to convert larger percentages of crude oil feedstocks into the most valuable end products, transportation fuels like gasoline, and to control the consistency of the products they produced. With diverse inputs and a wide range of possible refinery outputs, refineries became increasingly sophisticated and costly to build. The increased capital costs required created a trend toward larger refineries.

Even before EPA directly regulated gasoline composition, pre-existing regulatory and market forces had virtually ensured that all but the most carefully designed environmental regulation would fragment the market. American refining capacity was

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468 2 BRADLEY, supra note 73, at 1226-28, 1163.
469 FTC, GASOLINE PRICE CHANGES, supra note 9, at 19 (“U.S. gasoline consumption fell significantly between 1978 and 1982, and remained lower during the 1980s than it had been in 1978, despite lower crude and gasoline prices during the 1980s. Those reduced prices resulted in part from substantially reduced U.S. gasoline consumption and decreased worldwide petroleum consumption due to increased price sensitivity and an economic recession.”)
470 NPC, OBSERVATIONS, supra note 13, at I-9 - I-11.
471 See John Peter, Plotting Diesel’s Stake in North America, DIESEL FORECAST (2005) (“The Big 3 domestic manufacturers are already well established in Europe’s diesel market where nearly 50 percent of all light-duty vehicles are diesel powered. And they would like nothing more than to add light-duty diesels to their respective powertrain portfolios in North America.”).
472 GARY & HANDWERK, supra note 61, at 1 (The highest value products from refining crude oil today are transportation fuels (gasoline, jet fuel, diesel) and light heating oils and the primary goal is to convert “as much of the barrel of crude oil into transportation fuels as is economically practicable.”).
insufficient to meet the U.S. demand for gasoline, requiring substantial imports of gasoline and leaving little excess capacity within the United States. Furthermore, the potential for expanding existing refineries was constrained by cost and the need for locations near oil pipelines and ports. Although these same forces had produced a national market for commodified gasoline, that market remained vulnerable in ways that policy makers appear to have ignored.

**B. Environmental Regulations and Gasoline Markets**

In this section we discuss environmental regulations that affect the market.

1. **Fuel Formulation**

   Although the federal government has long had authority to regulate various aspects of motor fuels, and exercised that authority to require registration of fuels and additives, state and federal regulators imposed only one important fuel formulation requirement before the late 1980s: requiring the removal of lead additives. Beginning in the late 1980s, however, the EPA and state and local governments began to intervene more, increasing their efforts after the passage of the Clean Air Act Amendments of 1990 (“the 1990 CAAA”). These fuel requirements added a set of constraints to refinery operation and transportation of fuels. This section analyzes the major fuel formulation requirements.

   As noted earlier, lead had been added to gasoline since the 1920s to boost octane. Price controls on tetraethyl lead produced shortages in 1946, which in turn spurred a federal octane ceiling to reduce demand. When price controls were abolished in late 1946, the shortage ended. Lead shortages reappeared in the early 1950s when Korean War era price controls were imposed. The federal government considered a plan, supported by small refineries, to regulate octane levels to reduce demand. The plan was abandoned, however, because the need for different octane levels in different regions due to climatic conditions made it too complex. Instead, the government rationed tetraethyl

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474 *Reitze, Fuels, supra* note 147, at 486-487, 491-497.

475 *FTC, GASOLINE PRICE CHANGES, supra* note 9, at 69 (“As a result of the proliferation of unique fuel requirements, differing fuel specifications apply in different parts of the country at various times of the year.”). EPA uses the term “boutique fuels” in a very limited way, including only “clean fuel programs designed and enforced under state authority to reduce motor vehicle emissions and improve air quality; and approved by the [EPA] under the authority of Section 211(c)(4)(c) of the CAA Amendments of 1990; and, included in an EPA-approved state [clean air] Implementation Plan (SIP).” EPA, Task Force on Boutique Fuels, Report to the President, June 2006 at 5. This excludes a wide range of state mandates for “bio-fuels,” among other things and so understates the extent of fuel formulation regulation.

476 *Jones, supra* note 39, at xxi (noting importance of issue of “providing products to the high specification now required by our customers, by the public and pressure groups and by regulators (both domestic and, increasingly, supra-national).” Research into ways to provide products that meet required specifications “at an acceptable cost” has been important in recent years. Id. at xxii.

477 *See* notes 144 - 147 *supra.*
lead until 1952.478 Technological improvements beginning in the 1950s gradually reduced the amount of lead added to gasoline, primarily through improved catalyst use.479

When Congress set automotive emissions standards with the Clean Air Act Amendments of 1970, it “assumed that the automobile manufacturing industry would meet those standards by installing catalytic converters in the exhaust stream.”480 Lead would have harmed the catalysts in these converters, and so the 1970 Amendments authorized the EPA to order refiners to alter gasoline formulations to protect the catalytic converters.481 EPA quickly began the process of banning lead additives.482 In addition to protecting catalytic converters, EPA also initiated rulemaking in 1972 based on lead’s health effects.483

Not surprisingly, small refiners were again the beneficiaries of special treatment, winning an exemption from the rule until January 1, 1977 “in recognition of [their] special lead-time problems”484 and then an additional partial extension from Congress through October 1, 1982.485 The result was appearance between 1979 and 1982 of “a small subindustry of ‘blenders,’” firms created “to take advantage of the small refiner exemptions,” which “would purchase inexpensive, low-octane gas from foreign markets and blend in just enough high-octane leaded gas to stay within the small-refiner exemption.”486

Removing lead produced “a desperate search for ways to maintain the octane level of [refiners’] gasoline pool.”487 The prevailing solution was “to crank up the severity of the cat reformer, making higher octane reformate,” but this reduced the volume of gasoline produced and pushed refiners to look for lead substitutes that would

478 This paragraph is based on 2 BRADLEY, supra note 73, at 1150-56.
481 The authority was phrased broadly, however, allowing EPA to control the use of additives on environmental grounds generally. See 42 U.S.C. 7574(c)(1)(A) (2000).
482 In 1971, the newly formed EPA announced consideration of restrictions on lead as an additive. 36 FED. REG. 1486 (1971). In 1972, the agency proposed regulations, 37 Fed. Reg. 11786 (1972), and in 1973, EPA exercised its Clean Air Act § 211(c)(1)(A) authority to require a series of lead additive reductions beginning January 1, 1975 to a final level of no more than 0.5 grams per gallon by January 1979. 38 Fed. Reg. 33,734 (1973). Refiners challenged EPA’s actions and lost, Amoco Oil Co. v. EPA, 501 F.2d 722 (D.C. Cir. 1974), although the challenge resulted in a less restrictive phase-out schedule. 2 BRADLEY, supra note 73, at 1252-1253. This relaxation resulted from the delay in investment needed to convert refineries to unleaded production caused by the regulatory uncertainty resulting from the litigation; in addition, unleaded production reduced the volume of gasoline produced from each barrel of crude and the government feared shortages. 2 BRADLEY, supra note 73, at 1254-1255; Manke, American Response, supra note 383, at 34 (“[h]igher operating costs, stemming from larger crude oil requirements and the multimillion-dollar capital investments needed to modify a large refinery to produce unleaded gasoline, entail that unleaded gasoline is substantially more expensive to manufacture than leaded gasoline.”).
487 LEFFLER, supra note 38, at 141.
Some refiners resorted to an alternative additive, methylcyclopentadienyl manganese tricarbonyl (MMT), previously approved by EPA, to boost octane. However, under the 1977 Clean Air Act Amendments, “which may well have been enacted with MMT in mind,” refiners were not allowed to market gasolines for catalytic converter-equipped vehicles that were not substantially similar to the gasolines used to certify the vehicle, hampering MMT use. In late 1978, EPA restricted refiners’ use of MMT, but approved the use of methyl tertiary-butyl ether (MTBE) as an octane boosting additive a few months later, a decision with important consequences, discussed below.

The interaction of the environmental regulation with the 1970s economic regulations also caused problems for refiners. Pricing rules did not allow refiners to fully pass the additional costs of producing unleaded gasoline through to consumers, and so “[b]ecause the premium was less than the added costs associated with producing unleaded gasoline, most oil companies chose to go slow in expanding their unleaded gasoline capacity.” As a result, there were periodic shortages of unleaded gasoline in the 1970s, prompting EPA to slow down the lead phase out.

The lead ban revealed the fragility of refining infrastructure. Regulations raising costs combined with price controls to reduce the returns to refining, lowering the incentive to invest in capacity. Small refiners, as seemingly happened in virtually every instance, lobbied for and received (for a time) special treatment, further harming the development of an efficient refining sector. As had happened with earlier regulatory constraints, a combination of external events and policy responses mitigated the problem. Both lower than expected demand and delays in the lead phase out ameliorated the capacity crunch and EPA used an innovative quasi-market mechanism to reduce the compliance costs of the lead phase out, allowing refineries to trade lead credits, and so bought off the small refiners.

A second formulation requirement began in the late 1980s. Through 1987, regulators had not seen volatility in gasoline as an air quality problem. But when the summer of 1988 delivered “some of the worst ozone excursions on record,” research fingered high volatility gasoline as a contributing culprit. States began the trend toward fuel controls to address the ozone issue.

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488 LEFFLER, supra note 38, at 141.
489 McGarity, MTBE, supra note 480, at 296. See also Reitze, Fuels, supra note 147, at 506-507.
490 Id. at 296.
491 Id. The agency is currently reviewing the safety of MMT. See http://www.epa.gov/otaq/regs/fuels/additive/mmt_cmts.htm (last visited June 20, 2006).
492 McGarity, MTBE, supra note 480, at 297.
493 Manke, American Response, supra note 383, at 35.
494 Id. at 35.
495 Id, at 35.
496 NAS, OZONE-FORMING POTENTIAL, supra note 137, at 108. One problem was that EPA allowed vehicles to be certified with lower volatility gasoline than was used in practice, leading to higher emissions than anticipated. See Reitze, Fuels, supra note 147, at 515-516.
497 Id, at 35.
498 Reitze, Fuels, supra note 147, at 516 (describing efforts of Northeast States for Coordinated Air Use Management, an eight state coalition, and a subgroup of the coalition to impose volatility requirements in
Following state actions, EPA set upper RVP limits for summer gasoline nationally in 1989, and then “substantially expanded” its involvement after the passage of the 1990 Amendments, which mandated the federal reformulated gasoline (RFG) program. Unfortunately, in 1990 “little was known about the effects of fuel composition on vehicle emissions,” making the regulatory effort an educated guess at best.

Perhaps the best example of the consequences of the lack of knowledge, Congress required adding oxygenates to gasoline in order to reduce emissions in carbon monoxide nonattainment areas as “a relatively minor and late-arriving aspect” of the 1990 Clean Air Act Amendments. The requirement appears to have been the result of a coalition of farm state senators and passed without considering the environmental impacts of any of the additives, including MTBE. “As the new bill was being debated on the floor of the Senate, Senators Tom Harkin (D-Iowa), Tom Daschle (D-S.D.) and Bob Dole (R-Kan.) introduced an amendment under which refiners would have to reduce the ozone forming potential of the gasoline sold in the nine most seriously polluted ozone nonattainment areas by 15% while adhering to a 2.7% oxygen requirement and keeping aromatics below 25%,” a measure seemingly designed to boost demand for ethanol and one that raised the level of government involvement in fuel design to new heights. The later discovery of MTBE’s serious environmental problems led Congress to substitute ethanol as the oxygenate of choice.

The 1990 Amendments allowed EPA to impose a baseline set of requirements for gasoline, including mandating reformulated gasoline (“RFG”) to help meet federal standards for ground level ozone. The first set of RFG requirements were applied in 1995, with a second, tighter phase following in 2000. EPA initially required the RFG formulations in nine metropolitan areas, although others were added later. States were allowed to add more areas to the RFG program, although EPA could delay “opt-ins” if RFG supplies were insufficient. In 1992 and again in 1996, California promulgated its own regulations, which were even more stringent than the EPA’s requirements.

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1989.) Before the 1990 Amendments, California refiners led a push toward “cleaner” fuels out of concern that the state not mandate a mixture of 85% methanol and 15% gasoline and ultimately introduced a wide range of fuels built around the addition of MTBE. McGarity, MTBE, supra note 480, at 305-306.
500 NAS, OZONE-FORMING POTENTIAL, supra note 137, at 109.
501 Id.
502 PEARSON, supra note 126, at 83.
503 42 U.S.C. 7545(m), 7512a(b)(3).
504 McGarity, MTBE, supra note 480, at 306.
505 Id. at 309. See also Reitze, Fuels, supra note 147, at 526-528 (describing interest group maneuvering over oxygenates).
506 McGarity, MTBE, supra note 480, at 309.
507 Reitze, Fuels, supra note 147, at 528 (noting that rulemaking ultimately had “a tilt away from a fuel neutral approach to one that carved a place for ethanol.”)
508 The 1990 amendments specified a wide range of characteristics of “base” gasoline, 42 U.S.C. 7581(4).
509 42 U.S.C. 7545. The initial nine were Baltimore, Chicago, Hartford, Houston, Los Angeles, Milwaukee, New York City (including suburbs in other states), Philadelphia, and San Diego. Reitze, Fuels, supra note 147, at 524, n. 307.
The initial specification for RFG gasoline required an oxygen content of at least two percent by weight, a benzene content of no more than one percent by volume, no lead or manganese, a year-round average NOX emission level of a 1990 summer baseline gasoline, and reduced toxic air pollutant and volatile organic compound emissions. The federal RFG program set different targets for northern and southern states, reflecting “the historical industrial practice where southern gasoline had lower RVP than northern gasoline to compensate for higher ambient temperatures.” The federal RFG requirement thus produced three fuels: a “northern” RFG, a “southern” RFG, and uncontrolled gasoline used outside the areas where states or EPA mandated one of the RFG gasolines.

These regulatory requirements produced several changes in gasoline refining. The 1989 standard was primarily met by reducing the butane content of gasoline, which required compensating for the loss of octane from butane removal through increased catalytic cracking and alkylation of gasoline. The 1992 RVP standards were met by increasing downstream processing of gasoline and blending lower RVP components with higher octane. Both of these steps required “large capital investments.”

Even implementing a comparatively simple regulatory program like this required some sophisticated regulations. For example, one concern was that the blendstocks removed from the RFG fuels would be used in gasolines for non-RFG areas, increasing the volatility of gasolines there and causing new problems. As a result, EPA adopted “antidumping” rules to prevent the gasoline components not used in RFG from being blended into gasolines outside the RFG mandated areas. These rules used baselines individualized for each refiner. Moreover, the 1990 CAAA oxygenate requirements necessitated waivers in part because of limited time to build the “new oxygenate production, storage, and transportation facilities,” as well as the constraints on the ability to buy oxygenates for storage.

A second set of constraints on refiners came from EPA’s order under the 1990 Amendments that transportation fuels, including gasoline, have dramatically reduced sulfur content. These restrictions reduced the permissible sulfur content in highway diesel. Combined with the shift in crude supplies to heavier, sour (e.g. higher in sulfur)

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512 See Reitze, Fuels, supra note 147, at 532-36 (describing initial regulations)
513 NAS, OZONE-FORMING POTENTIAL, supra note 137, at 116-117.
514 EPA, Profile, supra note 67, at 91. Because n-butane also raises the average octane, however, a substitute was needed to maintain the blend’s octane level. Needless to say, refineries also found themselves with seasonal surpluses of n-butane. GARY & HANDWERK, supra note 61, at 8-9.
515 EPA, Profile, supra note 67, at 91.
516 Id.
517 NPC, 1990s, supra note 63, at 13 (“It is illegal to dump undesirable gasoline components from RFG into conventional gasoline for other areas of the country. Starting January 1, 1995, refiners, blenders, and importers will be required to comply with regulations that will prohibit any increase in VOC, NOX, CO, or TAP emissions over 1990 levels in gasoline sold outside the RFG program cities.). See also Reitze, Fuels, supra note 147, at 536-537.
518 Reitze, Fuels, supra note 147, at 536. 40 C.F.R. §80.91.
519 NPC, 1990s, supra note 63, at 6.
520 Calvert, Heywood, Sawyer, & Seinfeld, supra note 127, at 42 (Reducing sulfur content both lowers sulfur oxide emissions and makes catalytic reduction of HCs, CO, and NOX more efficient).
521 Reitze, Fuels, supra note 147, at 507-512. 40 C.F.R. §80.195 et seq. contain the gasoline sulfur requirements.
crudes, this required refiners producing fuel for the U.S. market to make substantial capital investments.522

Beginning in 1998, EPA imposed additional requirements on fuels. In that year, EPA began to require refiners to use a more complex model of fuels’ emissions properties.523 Furthermore, after 1990, EPA regulated deposit control additives in fuel. “The details of the regulations and procedures did not emerge for several years, and led to an interim stage of certification of four types of detergent additive: polyalkylamines, polyetheramines, polyalkylsuccinimides and polyalkylaminophenols.” 524 The key is that as the regulations became more complex, EPA’s involvement in fuel design steadily increased. Moreover, boutique fuel requirements are not simply a matter of the government specifying a particular set of gasoline characteristics. The technique used to add one required ingredient may affect the completed fuel’s characteristics in other dimensions.525

The formulation restrictions did not stop with those imposed by EPA. Through various State Implementation Plans (SIPs), state and local governments also imposed restrictions on gasolines sold in their jurisdictions.526 Although there is no comprehensive list of formulations mandated by all levels of government, there appear to be at least seventeen different formulations – a major increase from the single standard (the lead standard) in place in the mid-1980s.527 In addition, some state and local governments have imposed “biofuel” requirements.528

These requirements have three primary effects on gasoline markets. First, the fuel requirements may isolate particular geographic markets from the overall gasoline market, making it harder to bring new supplies to a region or uneconomical to shift supplies out of a region.529 Second, as noted earlier, additional capital investment may be needed to

522 See note 167 supra.
523 Blackmore, supra note 87, at 248 (describing model).
524 Id. at 248.
525 For example, EPA was concerned about potential abuse of the process of adding oxygenate to gasoline downstream of a refinery. This practice, called ‘splash blending,’ involves mechanical mixing of finished gasoline or gasoline blending stock having front-end volatility set at a typical warm season value (RVP of 7 to 8 psi) with a liquid oxygenate (such as ethanol). Splash blending, unlike refinery-performed match blending that renormalizes product output to the required properties of an RFG, can change the proportional constituents of a gasoline by diluting (replacing) their mass and volumetric share in each gallon. It also has the potential to increase the quantity of total fuel that evaporates from vehicles if the fuel’s resulting RVP is significantly higher. EPA sought to obviate this possibility by requiring the type of oxygenate that can be added be stipulated at the refinery and thus maintain RVP integrity.

NAS, OZONE-FORMING POTENTIAL, supra note 137, at 126-127. The problem was ultimately solved by EPA’s ‘in situ’ sample audits, which led most refiners blending at refinery. Id. at 127.
528 See, e.g., HAWAII REV. STAT. 486J-10 (requiring 10% ethanol content for all unleaded gasoline sold after April 2, 2006).
529 For example, if a boutique fuel is more costly to create than conventional gasoline, refiners may be unwilling to divert supplies of it to meet a shortage in an area that does not require the boutique fuel. There is evidence that boutique fuels are more costly to produce than standard gasolines. See Jennifer Brown, Justine Hastings, Erin T. Mansur, & Sofia B. Villas-Boas, Reformulating Competition? Gasoline Content
produce the boutique fuels, limiting the number of current plants able to produce a particular fuel, creating an incentive to exit a market, and creating a barrier to entry. Econometric investigations into these requirements, comparing prices and price volatility between matched pairs of boutique and non-boutique cities, found that not only is there evidence that boutique fuel requirements raise the cost of gasoline, but that the price impact varies with the geographic isolation and degree of competition in the relevant market.\footnote{Id. at 4-5.} Third, they alter the path of technological change, diverting investment away from improving production processes to meet regulatory requirements.\footnote{One summary of industry trends concluded: air pollution “has driven the direction of our technological development.” Jones, supra note 39, at xxiii.}

Additional strong evidence indicates that the boutique fuel requirements, where they occur together with limited refinery capacity and pipeline connections to other regions, affect prices. After examining regional prices, the FTC found that differences in price variability across regions began appearing in 1992 and have increased since 1995.\footnote{FTC, GASOLINE PRICE CHANGES, supra note 9, at 88-89.} The agency concluded that “[t]he timing of price changes . . . tells us something about the way the refining and distribution network is “able to provide adequate quantities of boutique fuels, as long as there are no disruptions in the supply chain.” See H. Josef Herbert, Gas Blends Don’t Raise Prices, Associated Press (June 23, 2006) quoting the EPA report. We have not yet seen the EPA report but the quote suggests the agency focused on the wrong question. It is precisely when there are disruptions in the supply chain that a broad, deep market makes a difference.} The FTC study found evidence of a boutique fuel price effect in California, it did not in the Gulf Coast, where the agency concluded that the larger amount of refinery capacity in the Gulf Coast region and greater interconnection of that region with other areas reduced the impact of disruptions at any particular facility.\footnote{Id. at 94.} The FTC found similar results in the East Coast, Rocky Mountain, and Midwestern states.\footnote{Id.}

The increasing difference between U.S. market and non-U.S. market gasolines represents another instance of boutique fuel requirements. Low sulphur requirements in the United States for both gasoline and diesel limit the types of oil that many refineries can process to make products for the U.S. market.\footnote{NPC, ADEQUACY, supra note 37, at 37 (“European conventional gasoline does not meet U.S. specifications for either conventional or reformulated gasoline. Adjusting European gasoline to U.S. quality would require some upgrading with an associated cost increase.”)} This limits the possibility of

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importing gasoline from some foreign refineries, reducing those refineries’ ability to supply gasoline when there are spot shortages.538

As discussed earlier, running a modern refinery is essentially a complex optimization problem in which refiners must solve the problem of creating the highest value mix of end products by managing the streams of intermediate products manufactured at different stages.539 The boutique fuel requirements thus increase the number of constraints in the optimization problem. If the constraints are binding (and they are meaningless if they are not), then the constraints have costs.540

The market fragmenting nature of the various boutique fuel requirements is easy to grasp: by making gasoline sold in Phoenix different from gasoline sold in Tucson, boutique fuel requirements limit the depth of markets by preventing owners of Phoenix-formulated gasoline from selling their gasoline in Tucson and vice versa. Indeed, boutique fuel requirements are government-mandated versions of what sellers of branded gasoline spend considerable resources unsuccessfully attempting to persuade gasoline consumers to believe: that a gallon of a particular gasoline differs significantly from a gallon of another gasoline.541 What is less obvious is the impact of the broader fuel formulation requirements. The ultra-low sulfur and other wider restrictions all reduced refinery capacity by helping push marginal refiners out of the marketplace and raising the barriers to entry by increasing the capital requirements for entry.542

There are two main consequences of fragmenting the gasoline market. First, markets function best when they are deep rather than shallow.543 That is, when a market has many participants and the materials traded in the market are relatively standardized, there are many potential providers of the goods to each potential buyer. Antitrust law recognizes the inherent advantages of markets with many buyers and sellers. This basic premise undergirds virtually all economic discussions of the efficiency of competitive markets. The classic example of a deep market’s efficiency is the market for widely traded public company stocks (e.g. Microsoft) or commodities like gold, silver, and pork bellies. Attempts to exercise market power in such deep markets fail because opponents of any attempt to exercise market power can easily profit by applying price pressure

538 Behrens & Glover, supra note 10, at [12-13] (“Foreign refiners typically manufacture products designed to sell in the international market, not the special product ‘boutique fuels’ demanded by a significant share of the U.S. market.”)
539 See A. Ogden-Swift, Control and Optimization, in 2 MODERN PETROLEUM TECHNOLOGY 181, 181 (Alan G. Lucas, ed. 2000) (“Refinery planning and scheduling, optimization, process control and monitoring are essential to achieving [maximum profits]. Typically savings from improvements in these areas exceed $20 million per year for a world-scale refinery by choosing the best feedstocks, the best way to operate the refinery, effective control at the best point, and efficient detection and management of abnormalities.”).
540 See Jones, supra note 39, at xxi (“The development of products that meet the required quality standards has not generally been unduly difficult; where problems have arisen they have frequently arisen from the need to ‘trade off’ one characteristic against another.”)
541 This seemed to have worked well early on: a 1947 government study noted that “strong consumer tendency to deal regularly at particular stations where the desired brand is sold” and “the general preference of consumers for branded gasoline.” USDOC, War and Postwar, supra note 39, at 28.
542 NPC, ADEQUACY, supra note 37, at 99.
543 Some analyses have found this to be key in gasoline markets. See, e.g., Marshall C. Howard, Interfirm Relations in Oil Products Markets, 20 J. MARKETING 356, 361 (1956) (“The greatest source of interfirm friction and competition is price policy of both suppliers and their market outlets when product is in ample supply.”)
against the would-be monopolist. Extending a market makes it deeper by bringing additional participants into the market reducing the scope of a market has the opposite effect. There is evidence of a negative impact in the case of boutique fuel regulations.

Second, boutique fuel requirements defeat the market forces promoting standardization in gasoline. Standardization is an important means of deepening a market. Standardizing a good allows buyers to make low cost comparisons between goods offered by different sellers, facilitating price competition. In gasoline markets, for example, government regulations require the posting of octane numbers for fuel and the method used to calculate the octane number in order to facilitate consumer comparison of different sellers’ products. EPA has (commendably) taken a number of steps to reduce the impact of boutique fuel requirements. These merely mitigate the extent of problem caused by multiplying fuel formulation requirements without addressing the underlying issue. EPA’s mitigation efforts actually undercut the regulatory certainty necessary to induce investment into expanding refinery capacity significantly because they signal that investors cannot rely on a stable regulatory environment.

Boutique fuels are a special case of interference with standards. Consumers are not allowed to choose the fuel they will use, except in border regions between areas with different fuel requirements. These fuels prevent arbitrage across geographic markets, preventing market forces from reducing price differentials. Arbitrage produces price convergence with startling effectiveness.

544 EDWARD CHANCELLOR, DEVIL TAKE THE HINDMOST, A HISTORY OF FINANCIAL SPECULATION 252 (1999) (discussing Hunt brothers attempt to corner the silver market).

545 A GAO study concluded that “[f]or the boutique fuels – which are sold only in certain cities in the East Coast and Gulf Coast regions, or in California – increased market concentration led to higher wholesale prices than for conventional gasoline. This difference likely stems from the limited availability of the boutique fuels, which can only be produced by a few refiners.” GAO, Mergers, supra note 68, at 79.

546 Firms that are able to convince consumers that their products differ significantly from competitors’ products are able to charge a price premium because consumers’ differentiation between the products reduces competition. For example, Coca-Cola is able to sell its soda for a higher price than store brands because consumers distinguish Coke from store brand colas. To protect this product differentiation, Coca-Cola spends a considerable amount on advertising aimed at maintaining a brand image. See Coca Cola Company 2005 Annual Report (available at http://www2.coca-cola.com/investors/pdfs/form_10K_2005.pdf at 70 (last visited July 13, 2006)) (reporting advertising expenditures of $2.5 billion for 2005). Similarly, “green” energy providers are able to charge above market rates for energy produced by “sustainable” methods to consumers who prefer to consume power that is not produced with non-renewable energy, even though the electricity itself is indistinguishable from power produced by plants using non-renewable energy. Michael Evan Stern & Margaret M. Mlynczak Stern, A Critical Overview of the Economic and Environmental Consequences of the Deregulation of the U.S. Electric Power Industry, 4 Env’tal Lawyer 79, 148 (1997) (noting that green and “dirty” energy cannot be distinguished).

547 Octane numbers can be determined by various methods. See GARY & HANDWERK, supra note 61, at 15.


549 See EPA, Task Force, supra note 475, at 11-12 (listing efforts to mitigate problems). Congress has also expanded EPA’s authority to grant waivers when necessary to reduce disruptions. See EPAct sec. 1541. While waivers in an emergency are useful, they do not address the underlying structural problems and do not relieve price impacts from non-emergencies.

550 Arbitrage is an attempt to profit by exploiting price differences in different markets.

551 Indeed, one rationale for the adoption of the euro was that it would facilitate price comparisons and produce arbitrage opportunities across the countries adopting it. José Maria Gil-Robles, The Euro will be one of the worlds most stable currencies, available at http://www.context-europe.org/ca181.html (last
When an imbalance between supply and demand across different geographic markets causes price differentials, for example, opportunities for arbitrage exist and attract the attention of entrepreneurs. Responding to a higher price for a good in Phoenix than in Tucson, entrepreneurs will buy the good in Tucson and bring it to Phoenix. This will increase demand in Tucson, creating market pressure for higher prices there. It will increase supply in Phoenix, creating market pressures for lower prices there. Ordinarily, the prices in Tucson and Phoenix will converge. In general, price differentials will likely persist only where transactions costs limit opportunities for arbitrage. Even where such transactions costs exist, however, there are market pressures to reduce the cost of delivering gasoline from Tucson to Phoenix and allow the Tucson gasoline source to undercut the Phoenix price. Where boutique fuel requirements fragment markets sufficiently to cause price differentials, such individual efforts at arbitrage are also likely to occur—which reduces the effectiveness of the boutique fuel requirement.

2. Obstacles to Refinery Capacity Growth

As we have seen, there have been periods of rapid (sometimes too rapid from the industry’s point of view) expansion of refinery numbers and capacity in response to demand and regulatory stimuli. The post-war refinery crunch quickly yielded to considerable expansion in the 1950s, when entry into gasoline retailing was “relatively easy,” and the perverse incentives of the 1970s brought numerous plants online (including some of dubious efficiency) with little lead time. But remarkably, no new refinery has been built in the United States since 1976. Rather than build new refineries, refiners have expanded existing facilities, meeting the increase in U.S. demand for transportation fuels without domestic greenfield projects.

What accounts for the difference between “easy” entry in the 1950s and a completely stalled new construction program since 1976? For starters, the refining business has not drawn investment because its economics are unattractive. For example,
after the oil price shocks in 1973 and 1979, demand for refined petroleum products fell and “[r]efinery expansion plans were consequently curtailed and plans for ‘green field’ refineries abandoned, particularly in Europe and North America.”\(^557\) Similarly, in the 1990s, “some firms divested refineries because of high operating costs and low returns. For companies acquiring these refineries, it was more cost effective to acquire an existing refinery than to build one, especially given the high cost and stringent environmental requirements for refinery construction in the United States.”\(^558\) Low interest by investors offers a partial explanation, but the industry’s massive investments in compliance with new environmental regulations and expansion of existing refineries demonstrate that considerable capital has flowed into the industry despite the unfavorable economics. Thus, investor interest cannot entirely explain the absence of new refineries because there has been billions in refinery investment over the past thirty years. Put simply, firms had a choice between expanding existing facilities and building new ones and, since 1976, they have chosen the former.

Land use restrictions provide a more likely explanation for the thirty year lull in refinery construction. The rise of land use regulation, other environmental restrictions, and popular resistance to the “local refinery” limited expanding capacity as early as the 1970s.\(^559\) For example, by 1974, state level restrictions in California and Delaware posed significant barriers to refinery construction.\(^560\) At the federal level, environmental regulations have restricted new refinery construction. For example, the Clean Air Act, which was passed in 1970, requires that new refineries meet stringent emissions standards. This has led to significant capital expenditures for new refineries, and has made it more cost effective to acquire existing refineries. Land use restrictions have also played a role in the lack of new refinery construction. For example, the siting of refineries is often restricted by local governments, who may be concerned about the environmental impact of new refineries.

\(^557\) Jones, supra note 39, at xviii.

\(^558\) GAO, MERGERS, supra note 68, at 42. Refiners also contend that they have not been able to build new refineries because of the combination of high capital costs, regulatory costs, and low returns. One reason is the protectionist impact of air pollution regulations that require new plants to secure off-setting emissions reductions but grandfather existing facilities. 2 BRADLEY, supra note 73, at 1266. GAO, MERGERS, supra note 68, at 42. A 1974 report by the National Petroleum Council reached similar conclusions. It found, based on a survey of refineries that refiners expected to spend on environmental regulatory compliance an amount ($3.3 billion in 1970 dollars) an amount that could have paid for 1.3 to 2.2 MMB/CD refinery capacity. NPC, FACTORS AFFECTING, supra note 61, at 35-36. Emissions controls on refineries have led to massive capital and operating cost expenditures. 2 BRADLEY, supra note 73, at 1250-1251. Of course, many of these same problems would also afflict expansions of existing facilities, but do not seem to have stopped that process, and critics of the industry remain skeptical. Environmental pressure groups, for example, argue that refineries are deliberately restricting the expansion of capacity, through mergers and closure of refineries. See Public Citizen, Myths and Facts about Oil Refineries in the United States, available at http://www.citizen.org/cmem/energy_enviro_nuclear/electricity/Oil_and_Gas/articles.cfm?ID=11829 (last visited July 15, 2006) (arguing that “[o]il companies have exploited their strong market position to intentionally restrict refining capacity by driving smaller, independent refineries out of business.”) After reviewing data on mergers, the GAO concluded that “anecdotal data” exists to support the idea that mergers “have had some impact on barriers to entry in the U.S. petroleum industry.” GAO, MERGERS, supra note 68, at 64. There is little question that many refinery owners have reduced capacity by closing plants. The dispute is over their motivation in doing so – refiners contend that the plants closed have been uneconomical to operate, in part because of the costs of capital requirements. An alternative explanation for some of the closures is the impact of antitrust regulators’ insistence on divesture of particular refineries as a condition of approval of mergers. For example, vertically integrated oil companies reduced refining capacity by closing or selling unprofitable refineries (sometimes as a result of FTC pressure in mergers), which reduces their capacity and reduces their ability to supply unbranded gasoline.

\(^559\) NPC, FACTORS AFFECTING, supra note 61, at 5 (“Despite the rigorous standards for both water and air quality that refineries must meet now and in the future, resistance still exists in many areas of the country to constructing plants, even with appropriate environmental equipment.”)

\(^560\) Id. at 42.
legislation protecting coastal areas has restricted the availability of considerable land with access to tankers for crude supply.561

Throughout the industry’s history, neighbors to potential refinery sites have objected to their construction. For example, Standard Oil’s attempts to build a refinery to process the sulfur-laden Lima oil field’s production in Chicago produced opposition from neighbors of the proposed plant “on account of the odor from Lima crude and the fire hazard,” and played a part in the ultimate location of the refinery in Whiting, Indiana, “a desolate spot on the sand dunes along the southern shore of Lake Michigan.”562 Today, of course, “desolate spots” for construction close to oil supplies are harder to find than they were in the early twentieth century and even the most desolate spot may have environmental restrictions that impede construction of a refinery.

The FTC analysis of the industry concluded that “[i]n general, the FTC has not found entry to be likely in petroleum refining; the sheer complexity of entry (both inherent and due to environmental restrictions) is a significant barrier to timely entry.”563 Furthermore, the agency found that both high sunk costs and environmental regulations present significant deterrents to entering the refining business. “These entry-deterring factors have become more formidable since the 1980s, as refineries have become more capital-intensive and environmental regulations have become more restrictive.”564 Indeed, the 2005 FTC review of gasoline pricing concluded that “costly and extensive permitting and licensing requirements mandated by various federal, state, and local environmental and other laws, as well as community opposition” “likely” induced U.S. refiners to expand by increasing capacity at existing refineries rather than construct new ones.565 The GAO also sympathized with complaints over barriers to entry. It concluded that the refining sector “is characterized by pervasive barriers to entry, including large capital investment requirements at the refining level, and regulatory and permitting impediments at the refining and wholesale/retail levels.”566

The ongoing effort to build a refinery near Yuma, Arizona, illustrates the obstacles and difficulties facing refinery construction. In 1999, Arizona Clean Fuels initially sought567 to build a $2-3 billion refinery568 in Maricopa County, but Maricopa’s emissions restrictions and ozone noncompliance led the company to shift to Yuma

562 GIDDENS, supra note 37, at 10.
563 FTC, MERGERS, supra note 5, at 33.
564 Id. at 197.
565 FTC, GASOLINE PRICE CHANGES, supra note 9, at 50.
566 GAO, MERGERS, supra note 68, at 66.
567 Oil Refinery Permit Takes Next Step for Approval, YUMA SUN (February 5, 2005).
568 Initial estimates put the refinery cost at $2 billion. See T.M. Schultz, Surprise! Refinery eyeing Yuma County, YUMA SUN (October 31, 2003). By 2005, however, news stories estimated the cost at over $3 billion. Blake Schmidt, Refinery Price Tag at $3 Billion, YUMA SUN (September 15, 2005); Jonathan Athens, Refinery Awaits Green Light from Mexico, YUMA SUN (October 14, 2005) (noting estimate of $3.2 billion). A new refinery on the east coast is also estimated to cost a similar amount. See NPC, OBSERVATIONS, supra note 13, at I-20. Purchases of refineries value them at approximately 25%-33% of new construction cost, according to an industry study. Id. at I-21.
In addition to obtaining state and federal approval for the emissions permit, the refinery needed local zoning changes. All of these involved multiple public hearings and lengthy review by various bodies. The company estimated that it needed “two dozen” permits to build and operate the refinery. Opponents also unsuccessfully sought a referendum on the zoning changes. The six years of permitting efforts through fall 2005 cost the company $30 million without producing a single physical act toward construction.

The capital investment needed to produce boutique fuels provides yet another entry barrier. Meeting the new fuel formula specifications “required substantial investments,” environmental-regulation-related investments in domestic refineries reached at least 25% of total refinery investment during the 1990s, with industry groups estimating it accounted for $102 billion in 2004 dollars, up to half of the oil industry’s total environmental expenditures. Many smaller refineries closed in the 1990s in part because they lacked the capacity to meet the new fuel requirements and their owners declined to invest in the upgrades needed to provide that capacity. Significant investments were required in the 1990s, in particular to enable production of the 1992 RFG gasoline. “Some recent [refinery] closures have been related to the large investments required to meet new fuel specifications.” The FTC Mergers report noted, for example, that an Illinois refinery closed in 2001 rather than make a $70 million investment to meet new product specifications. “Refinery environmental investments, which peaked near $3.3 billion in 1992 ($3.9 billion in 2002 dollars) accounted for about 25% of total domestic refinery capital investment during the 1990s.”


\[571\] Tammy Krikorian, *EPA: No Objection to Refinery Permit*, YUMA SUN (March 22, 2005).

\[572\] Jonathan Athens, *Refinery Foes Form Battle Plan*, YUMA SUN (December 3, 12004); Jonathan Athens, *Board of Supervisors Unanimously Approves Land Use Change for Proposed Oil Refinery in East Yuma County*, YUMA SUN (December 14, 2004) (noting that opponents “in a surprise move” abandoned their plan to seek a referendum).


\[574\] FTC, *GASOLINE PRICE CHANGES*, supra note 9, at 57.

\[575\] Id. at 52. See also FTC, *MERGERS*, supra note 5, at 184 (“the large capital investments required under recent environmental regulations may disadvantage small refineries, which lack economies of scale relative to larger ones.”).

\[576\] FTC, *MERGERS*, supra note 5, at 69 (“Total environmental capital investments peaked at $4.8 billion in current dollars ($5.7 billion in 2002 dollars) in 1993 with the implementation of new product standards for gasoline, improvements to retail station tankage, and other pollution control measures.”)

\[577\] Id. at 186.

\[578\] Id.

\[579\] Id. at 69.
expenditures hit a new peak in the 1990s around the introduction of the 1992 gasoline formulation requirements.\textsuperscript{580}

Thus it seems likely that the combination of refinery economics’ unattractiveness, capital-intensity, economies of scale, fuel specification and locational regulatory requirements provide significant barriers to entry for the refining industry. Together, these factors may well form a greater barrier to entry than the sum of their parts. For example, the “relatively low refinery profitability” not only deters investment in the capital-intensive business, but magnifies the hurdle posed by the required regulatory investments. Moreover, some of these barriers apply to expanding existing refineries into new boutique fuel product lines.

The undeniable reality remains that the number of domestic refineries has steadily fallen, even as capacity has grown, leaving relatively little slack in the system if a refinery shuts down for unplanned maintenance or to weather a hurricane.\textsuperscript{581} Planned maintenance can be a problem as well, since major maintenance is typically planned up to a year in advance\textsuperscript{582} and so may coincide with unplanned events (weather, etc.) that cause supply disruptions. Even the impressive capacity growth of the past thirty years, partially caused by the rise in utilization rates, has reduced system flexibility by leaving little unused capacity available to make up for unplanned closures.\textsuperscript{583}

3. Crowding Out Investment

Refineries pollute the air, emitting a variety of air pollutants through their operations, including “fugitive emissions of the volatile constituents in crude oil and its fractions, emissions from the burning of fuels in process heaters, and emissions from the various refinery processes themselves.”\textsuperscript{584} As a result, refineries are heavily regulated as stationary sources under the Clean Air Act.

Controlling some of these emissions is relatively straightforward, if costly. Simply replacing floating roof tanks with less leaky alternative storage containers,\textsuperscript{585} and fixing leaky pipes and valves reduces pollution and can improve a refinery’s bottom line: “Studies have shown that 70% of all emissions from a process unit originated from about 1% of the leaks’ sources.”\textsuperscript{586} Although “[s]imply tightening of valve seals can often eliminate leakage once detected” and only a few valves are the source of most leaks,\textsuperscript{587}

\begin{footnotesize}
\begin{enumerate}
\item Id. at 82, Figure 3-9.
\item As happened with the Katrina-related reduction in capacity in the Gulf Coast region refineries.
\item NPC, OBSERVATIONS, supra note 13, at II-4.
\item FTC, GASOLINE PRICE CHANGES, supra note 9, at 76 (“high utilization rates can also contribute to price volatility and periodic supply problems. When unexpected gasoline supply disruptions occur or gasoline demand increases unexpectedly, then high refining utilization rates can mean that no or little extra refining capacity is available to remedy a supply shortage or satisfy an increase in demand.”).
\item EPA, Profile, supra note 67, at 38 (Fugitive emissions occur throughout refineries and arise from the thousands of potential fugitive emission sources such as valves, pumps, tanks, pressure relief valves, flanges, etc. While individual leaks are typically small, the sum of all fugitive leaks at a refinery can be one of its largest emission sources. Fugitive emissions can be reduced through a number of techniques, including improved leak resistant equipment, reducing the number of tanks and other potential sources, and, perhaps the most effective method, an ongoing Leak Detection and Repair (LDAR) program.”).
\item Martin, supra note 37, at 201.
\item Id.
\item Id.
\end{enumerate}
\end{footnotesize}
identifying which of the thousands of valves in a refinery are the one percent causing the problem is time consuming and costly.

In addition to investments in pollution control, refineries face market and regulatory pressures to invest in expanding capacity, adding the capability of processing cheaper heavy-sour crudes, and upgrading equipment to produce the new fuel specifications. In particular, meeting fuel standards requires expensive investments in upgrading refining equipment, and refineries undoubtedly will continue to have to make those investments to meet the new fuel specifications and reduce pollution from operations. Moreover, there are important scale economies to operating groups of refineries as a unit, creating an incentive to combine refineries through acquisitions, and Wall Street, if not the FTC, views regional capacity concentration positively.

There are thus pressures on refiners to invest significant capital in multiple areas: mergers and acquisitions, reducing refinery emissions, new processing equipment for heavy crudes, new processing equipment for the new fuel formulations, and expanding capacity. These pressures mount in the context of a highly cyclical business, with low returns in some years, albeit at least partially offset by high returns in others. In recent years, returns were below zero in 1992, near zero in 1995, and reached record levels in

\[588\] Stock analysts favor companies with the ability to refine cheaper heavy-sour crudes. See, e.g., S&P Stock Report: ConocoPhillips (April 8, 2006) at 2 (citing “considerable ability to refine heavy-sour crude feedstocks” as a positive attribute); Morningstar, ConocoPhillips (March 29, 2006) at 2 (ConocoPhillips “is well positioned to benefit from a trend toward wider spreads between the cost of lighter, higher-quality oil and heavier, lower-quality feedstock.”) Compare Morningstar, Sunoco (March 2, 2006) at 1 (noting Sunoco is relatively less attractive because it “is unable to add a significant amount of heavy sour crude conversion capacity like many of its peers.”). But see Morningstar, Valero Energy, (March 15, 2006) at 1 (“We think Valero’s heavy sour crude refining capacity provides a nice short-term competitive advantage, but not a sustainable one.”).

\[589\] Standard & Poor’s stock analyses of refining companies sees increasing restrictions on fuel composition as improving returns in refining. See, e.g., S&P Stock Report: Frontier Oil (April 8, 2006) at 3 (“we expect increased fuel demand amid tightened sulfur regulations for gasoline and diesel fuel, the phase-in of ethanol and the elimination of MTBE as a gasoline blending component to support above mid-cycle refining margins in 2006 and 2007.”) But see Morningstar, Marathon Oil (February 28, 2006) at 1 (noting refining and marketing “are brutally competitive areas where companies have to resort to being price-takers.”)

\[590\] FTC, MERGERS, supra note 5, at 182 (“Downstream processing units also have been important in allowing refineries to meet new environmental regulations for fuel products.”) In one case, the FTC even found that synergies from a merger “were likely to contribute significantly to the continued viability of the acquired refinery in light of the upcoming investments needed to satisfy regulatory requirements for cleaner-burning fuels.” FTC, MERGERS, supra note 5, at 35.

\[591\] See, e.g., Morningstar, Valero Energy, (March 15, 2006) at 1 (“We expect capital spending to remain high over the next couple of years as the firm finishes making capital improvements to comply with the new Environmental Protection Agency clean-air regulations and adds capacity.”)

\[592\] FTC, MERGERS, supra note 5, at 185 (“The advantages of multi-refinery operation in allowing a firm to exchange intermediates probably have become more important since the mid-1980s because of the larger number of environmental mandates for gasoline specifications.”).

\[593\] See Morningstar, Sunoco (March 2, 2006) at 1 (refining is “an economically unattractive and cyclical industry”).

\[594\] See, e.g., Morningstar, BP PLC ADR: Headwinds for Major Oil Companies (March 29, 2006) at 1 (“Refining and marketing activities . . . have less attractive economics [than exploration]. The industry has historically been plagued by periods of excess capacity that lead to weak – or even negative – gross profits.”)
The cyclical nature of the business raises the cost of capital by making investors more reluctant to purchase equity. For example, Morningstar’s spring 2006 reports on the major U.S. refiners argue that their stocks are heavily overpriced, a whopping 36% for Marathon Oil, the second largest independent refiner and 69% for Valero Energy, the largest independent refiner.\footnote{596}{596} Investing in emissions control and boutique fuel processing restricts refiners’ ability to invest in increasing capacity. That is, the opportunity cost of the environmental spending reduces capacity expansion. Investment in upgrading refineries to meet environmental requirements and add the capacity to produce boutique fuels, which the American Petroleum Institute (API) estimates at $47 billion in the last decade, may be crowding out investment in upgrading capacity. As API’s Edward Murphy noted, such investment “is going to cost you money and the only thing you will get is cleaner air and less emissions – which are good – but no new capacity.”\footnote{597}{597} U.S. refining capacity has grown exclusively through increasing capacity in domestic refineries (rather than from new refineries) for the past thirty years, a trend likely to continue,\footnote{598}{598} which suggests that the industry’s ability to keep pace with demand will be reduced by the capital needed to meet regulatory requirements. Furthermore, these regulatory-related investments impede the industry’s ability to make domestic refineries more flexible in their inputs, such as adding more heavy crude processing capacity. The ability and incentive to invest in innovation are also crowded out: “Almost all that is changing today is driven by environmental regulation, causing refiners to tweak the existing processes. The technology introduced in the last 15 years has been centered on catalyst improvement, not new processes.”\footnote{599}{599} Finally, as noted earlier, at least some boutique formulations reduce the yield of gasoline from a given barrel of crude.

If refineries in the United States cannot meet domestic demand, of course, the U.S. might be able to import gasoline from foreign refineries.\footnote{600}{600} European refineries often produce a surplus of gasoline, primarily because of Europe’s greater demand for diesel fuel for passenger vehicles and, to be sure, the U.S. has imported significant amounts of gasoline from Europe in the past decades.\footnote{601}{601} Some refineries outside the United States have significant cost advantages because of lower labor and regulatory

\footnote{595}{FTC, Mergers, supra note 5, at 72 (1992, 1995 figures). See. e.g., Morningstar, Tesoro (March 2, 2006) (noting “refiners have been riding a cyclical high and raking in the profits” and that Tesoro’s “gross refining margins increased more than 75% from 2003 to 2005”); Morningstar, ConocoPhillips, (March 29, 2006) at 2 (“ConocoPhillips is reaping the benefits of refining margins that are well above historical averages.”)}
\footnote{596}{Calculated by comparing the “fair price” with the “current price” (price as of the report date).}
\footnote{597}{Jad Mouawad, US: No New Refineries in 29 Years, N.Y. Times (May 9, 2005) available at www.corpwatch.org/print_article.php?id=12227.}
\footnote{598}{FTC, Mergers, supra note 5, at 197 (supply increments expected to come from expansion of existing refineries and increased reliance on imported refined products rather than new refineries).}
\footnote{599}{Leffler, supra note 38, at 51 Jones, supra note 39, at xxi (noting that regulatory product specifications are one of the factors which “has a significant influence on the prioritization of technological development within the industry.”).}
\footnote{600}{Gasoline imports rose during the 1990s, from 4.7% of supply in 1992 to 9.7% in 2004. FTC, Gasoline Price Changes, supra note 9, at 59. The FTC expects imports to grow further in the future. FTC, Mergers, supra note 5, at 61.}
\footnote{601}{See Alexei Barrio Nuevo, Europe Drives Up Gas Exports, Keeping U.S. Pump Prices Low, WALL ST. J. (October 28, 2002).}
costs. For example, in the early 1970s – and so before much of the Clean Air Act’s impact – refineries in the Caribbean already had a forty to sixty cent per barrel cost advantage over U.S. Gulf Coast refineries.\textsuperscript{602} In some cases, these cost advantages can make imports of gasoline competitive despite the increased transportation costs. Boutique fuel specifications, however, reduce the ability of foreign refineries to export gasoline or blendstocks to the U.S. market.\textsuperscript{603} There is thus some question about whether imports of gasoline and blendstocks will be able to expand significantly if U.S. refinery capacity growth begins to lag demand growth.

4. Cumulative Market Impacts

These regulatory market externalities have weakened the gasoline market’s competitive forces. Consequently, the market is slower to adjust to supply disruptions, less likely to produce arbitrage opportunities, and more insulated from market pressures for innovation. While the refining industry is competitive when market concentration is measured against a national market, with relatively low standard measures of concentration,\textsuperscript{604} the same is not true of specific markets. For example, the California market, separated from the rest of the country by both geographic isolation and the CARB boutique fuel specifications, is quite concentrated. Indeed, before the CARB specification, the standard measure of market concentration (HHI)\textsuperscript{605} fell from 1,434 in 1985 to 1,184 in 1990, but rose again to 1,475 in 2003 after the CARB specification was introduced and would have been significantly higher had the FTC not forced divestitures of several refineries during mergers in that period.\textsuperscript{606}

While there are reasons to be skeptical of the FTC’s analyses of market competitiveness, the issue is not whether any particular energy company merger should proceed. Rather the point is that more sophisticated analyses of the gasoline market, which pay attention to fuel specifications and pipeline connections, suggest that the market is less competitive than the national statistics indicate. Because much of the data necessary to evaluate the competitiveness of submarkets is proprietary and unavailable to the public, we cannot directly test this hypothesis. The available evidence, as described above, comports with our analysis.

Why does this matter? The total impact of the various environmental regulations described above is more than the mere sum of the parts. These regulations, together with the other industry and general economic trends noted earlier, suggest that the United States depends on a smaller number of larger refineries clustered in fewer geographic

\textsuperscript{602} NPC, FACTORS AFFECTING, \textit{supra} note 61, at 6-7.

\textsuperscript{603} \textit{See, e.g.,} Morningstar, \textit{Valero Energy}, (March 15, 2006) at 2 (“the limitation of refined product imports because of new EPA regulations” makes domestic refiners’ stocks more attractive).

\textsuperscript{604} FTC, MERGERS, \textit{supra} note 5, at 191.

\textsuperscript{605} Herfindahl-Hirschman Index is a “commonly accepted measure of market concentration. It is calculated by squaring the market share of each firm competing in a market, and then summing the resulting numbers. The HHI number can range from close to zero to 10,000.” \textit{See} Investopedia.com at \texttt{http://www.investopedia.com/terms/h/hhi.asp} (last visited July 15, 2006).

\textsuperscript{606} FTC, MERGERS, \textit{supra} note 5, at 196. For example, the FTC calculated that the Exxon/Mobil and Chevron/Texaco mergers would have produced a HHI of 2,377 for the CARB market in the absence of the divestitures. \textit{Id.} at 197. \textit{See also} Keith Leffler & Barry Pulliam, Preliminary Report to the Attorney General Regarding California Gasoline Prices chart 7 (Nov. 22, 1999), at http://caag.state.ca.us/piu/gasstudy/gasstudy.htm (noting that the seven largest refiners of California gasoline had a total market share of 95% in the late 1990s.)
locations and connected by fewer pipelines than it would without these policies. Of course, environmental regulations are hardly the only cause of this situation. Indeed, we contend that the current situation stems from bad policies and industry trends spanning the entire twentieth century. However, on the margin, environmental regulations have exacerbated these other trends, leaving the U.S. dependent on a refinery infrastructure more vulnerable to natural disasters, terrorist attacks, and industrial accidents than it would have been if different environmental policies had been pursued.

C. Incentives for Fragmentation: Gasoline and the Structure of the Clean Air Act

Two structural features of the Clean Air Act frame the context in which regulators design the programs they implement. First, the Act establishes national ambient standards. These standards are generally to be achieved through “State Implementation Plans” (“SIPs”), largely drafted by state environmental agencies. The state agencies must demonstrate through EPA-approved emissions models, that their SIPs’ combined restrictions will yield compliance with the national ambient standards and other requirements of the Clean Air Act. Thus, states must achieve the relevant ambient standard by effectively allocating the emissions among the sources (including new sources) within each state’s jurisdiction. The ability to allocate additional emissions is valuable, because a state that cannot provide for emissions from new or expanding sources will be shut off from economic growth.

Second, mobile and stationary sources are treated differently by the Clean Air Act. Stationary sources are subjected to national technological requirements as well as highly specific operating restrictions included in the SIPs. As significant stationary emissions sources, refineries are heavily regulated under the Clean Air Act and emissions controls erect more barriers to entry, blocking new refineries.

Until the 1990 Clean Air Act Amendments, mobile source pollution control primarily involved EPA regulating tailpipe emissions when new cars left the factory. States enjoy limited authority over vehicle emissions systems, largely to prevent fragmenting the automobile market. Consequently, the improvements in mobile source

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607 This paragraph draws on Andrew P. Morriss, Bruce Yandle, and Andrew Dorchak, Regulation by Litigation: The EPA’s Regulation of Heavy Duty Diesel Engines, 56 ADMIN. L. REV. 403, 408-409 (2004) (describing basic framework of Clean Air Act regulation).
609 See Morriss, Yandle, and Dorchak, supra note 607, at 415-421 (overview of EPA modeling).
610 States cannot allow deterioration of better-than-standard ambient conditions to the ambient standard and there are qualifications necessary with respect to toxics pollutants as well. These are beyond the scope of this Article.
611 Morriss, Yandle, and Dorchak, supra note 607, at 408-409.
612 Id. at 412.
613 See NPC, ADEQUACY, supra note 37, at 41 (“The ongoing requirement for environmental expenditures coupled with the need to make significant improvements in product quality changes will result in capital expenditures by the industry approaching the maximum historical levels.”)
614 Calvert, Heywood, Sawyer, & Seinfeld, supra note 127, at 37-42 (noting that most of the improvement in mobile source emissions from 1970 to 1990 came from measures in the design of engines and exhaust systems).
615 Morriss, Yandle, and Dorchak, supra note 607, at 412-413.
emissions were largely driven by EPA action, with California contributing through its unique authority to impose additional exhaust system controls.

Although states may also impose transportation controls, these are politically unpopular and have rarely been used. Instead, states more commonly adopt inspection and maintenance (“I&M”) programs, which are also unpopular and rarely effective. As a result, the primary politically feasible means to reduce mobile source emissions available to the states today is regulation of gasoline blends sold within the state.

In the late 1980s and early 1990s, EPA faced an increasingly serious regulatory problem with respect to ozone. “Of the 29 urban areas required by the Clean Air Act Amendments of 1990 to submit State Implementation Plans, 27 were unable to submit plans that showed attainment by the mandated date of 1998.” This sparked interest in new methods of regulation, including a focus on fuel composition. The ozone problem proved difficult to solve technologically, because ozone production by its precursors depends on a variety of conditions. Moreover, the scant knowledge about actual fleet emissions “leads to substantial uncertainties in the calculations of emissions.” Nevertheless, the 1990 Amendments required states to revise their SIPs to bring ozone nonattainment areas into attainment by statutory deadlines and set interim targets. In addition, states could “opt in” to the mandatory RFG program as one means of reducing ozone precursor emissions. EPA could still require delays in such opt-ins, however, if delays would help maintain sufficient supplies of RFG gasoline for the mandatory markets. Because of the political unpalatability of serious I&M programs and driving restrictions, states had few options beyond boutique fuel requirements.

616 Id. at 412-413.
617 See Todd A. Stewart, E-Check: A Dirty Word in Ohio’s Clean Air Debate, 29 CAP. U. L.REV. 265, 285-296 (2001) (describing battles over I&M program in Ohio). Nonetheless, even ineffective I&M programs generate credits in EPA’s mobile source models. On the ineffectiveness of I&M programs, see NAS, OZONE-FORMING POTENTIAL, supra note 137, at 96 (“I&M can, in principle, detect a malfunctioning control system. In practice, however, the test has been too simplified in most locations to detect more than a few possible malfunctions.”)
618 Little attention was paid to this until the 1990 Clean Air Act Amendments authorized fuel regulation.
619 NAS, OZONE-FORMING POTENTIAL, supra note 137, at 17.
620 Id. at 18 (“With the persistence of the ozone-pollution problem comes the need to develop new and innovative approaches to lowering ozone-precursor emissions. The federal RFG program is but one example of a new approach that is being promulgated to address this need.”).
621 See NAS, OZONE-FORMING POTENTIAL, supra note 137, at 23 (“the rate of ozone formation is a complex and variable function of the concentrations of VOC and NOX as well as meteorological conditions. As a result, establishing the relative benefits of VOC and NOX emission controls can be a difficult and challenging task.”); Id. at 23-29 (explanation of NOX/VOC interaction); Id. at 69 (“not only does ozone formation respond differently to different VOC species, but it will often respond differently to the same compound in different locations or during different episodes at the same location.”).
622 Id. at 66.
623 NPC, 1990s, supra note 63, at 9 (“States are to use the existing State Implementation Plan (SIP) process to impose the necessary measures to bring their nonattainment areas into compliance by [the 1990 Act deadlines]. States with moderate, serious, severe, and extreme ozone nonattainment areas must achieve interim reductions in VOC emissions of 15 percent by 1996 and 3 percent per year thereafter until attainment is reached.”).
624 Id. at 12 (Los Angeles, San Diego, Houston, Chicago, Milwaukee, Baltimore, Philadelphia, NY and Hartford.)
625 Id. (On application of a governor, another area can opt in to RFG effective 1/1/1995 but EPA can delay it for up to 3 years if there is insufficient domestic capacity for RFG production.). Refiners were concerned
Moreover, both federal and state environmental regulators must balance allocating emissions among stationary and mobile sources. Permission to emit is valuable, and emissions allocated to one source are unavailable for use by another. A state seeking new industry must allocate the new polluters sufficient permits to emit. But if the state’s emissions are fully allocated, it must reduce existing emissions in order to permit a new source. Similarly, a state under an obligation to reduce emissions to meet its NAAQS obligations must allocate reductions among existing sources, imposing costs on those ordered to cut emissions. In the absence of markets, this can occur in only two ways: (1) the state must reduce an existing stationary source’s emissions, taking a valuable right away from an existing source, or (2) the state must acquire emissions credits by altering EPA’s calculation of mobile source emissions by adopting more stringent emissions controls, imposing gasoline formulation requirements, transportation controls, or an I&M program. Transportation controls and I&M programs impose direct, politically unpopular costs on automobile owners. Emissions controls, on the other hand, raise the cost of new cars in a way that is hidden from car buyers, formulation requirements raise the price of gasoline (as we discuss below), while hiding the cost of the measure from consumers. Predictably, regulators find these latter two methods more politically acceptable than the former two.

The structure of the Clean Air Act’s regulatory apparatus made gasoline regulation almost politically irresistible by 1990. Prior regulatory efforts had focused elsewhere, making additional regulation of tailpipe emissions, for example, even more costly as regulations moved up the marginal cost curve. The need to allow for new emissions from stationary sources created pressure to gain emissions reductions from mobile sources and fuel regulation was the most politically attractive of the available options. Fuel regulation avoided imposing costs on the auto manufacturers, imposed primarily hidden costs on consumers, and offered refiners the prospect of a level playing field surrounded by a regulatory fence that could deter would-be competitors through higher capital costs.

The fuel requirements also give regulators something to “sell” in the political marketplace. As the fuel mandates become increasingly complex, and are largely buried in the details of poorly indexed and massive SIPs,626 it seems likely that they will evolve toward specifications designed to take account of the capacities of incumbent refineries in particular markets purely through technical dialogues between regulators and refineries. Political pressures can accelerate this trend; recall how quickly the energy regulations on price mutated in the 1970s.627 As gasoline formulation requirements proliferate and

about opt-ins, telling the NPC’s consultant that there was “a need for cautious management of opt-ins” and that they saw “the potential for uncontrolled actions by state and local governments seriously crippling the industry’s ability to meet compliance requirements.” Id. at 7.

626 See Morriss, supra note 608 (discussing SIP’s massive size and complexity).
627 LANE, supra note 292, at 55-56 (“The FEA and DOE amended the regulations through formal rulemaking over 200 times in the seven years following their formal promulgation in January 1974, and many of the changes were complex, multi-part amendments. . . . In addition to the regulations themselves, the various administrators of the regulations issued dozens of formal rulings on such complex matters as the definition of “property” and the “refiner price formula.” Furthermore, the Office of General Counsel provided over 2,800 formal interpretations of the rules to various individual firms. Finally some 1,600 final decisions regarding exceptions, appeals, and other petitions for special relief or redress were issued by DOE’s Office of Hearings and Appeals (OHA) and its predecessor offices.”).
become more complex, they can hardly avoid the political imperatives to evolve in a similar way.

Refiners and automobile manufacturers both share some but not all interests. Both have an enormous investment in the future of internal combustion engine-powered automobiles. Auto makers and gasoline refiners have long recognized this interdependency and have attempted cooperative efforts on a number of occasions to address emissions. Yet each prefers that the other incur the costs of environmental regulations on auto emissions. For example, an analysis of a joint oil/auto company emissions control project in Europe noted disagreements over the proper allocation of pollution control responsibilities, with the oil industry arguing “that if they have to make the precise fuels the car industry wants the fuel will be so expensive that ‘you will have to buy it in little bottles in the pharmacy.”

Of course, government policies have rarely been explicitly aimed at causing market fragmentation. Yet the market appears fragmented, with the federal government rejecting the conclusion that gasoline markets are national, and the FTC looking at transportation costs and refinery capacity for specific blends as factors in defining regional markets. A partial explanation may lie in the opportunity for a “bootleggers and Baptists” coalition inherent in the environmental regulatory scheme. As economist Bruce Yandle explained in formulating the theory, a “bootleggers and Baptists” coalition is analogous to the combination of interests supporting laws barring alcohol sales on Sunday. Bootleggers support such laws because it restricts the competition offered by legal sellers of alcohol. Baptists support the laws because of their general opposition to alcohol sales. While the bootleggers and Baptists disagree over the appropriate policy

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628 Ford and Mobil formed the Inter-Industry Emission Control Program (IIEC) in 1967 in response to pressures to improve air quality. Its objective was to both “develop a powerplant and emission-control system that not only lowered emissions,” and improve “fuel economy, vehicle driveability, and vehicle durability.” J. ROBERT MONDT, CLEANER CARS: THE HISTORY AND TECHNOLOGY OF EMISSION CONTROL SINCE THE 1960s (2000) at 5. The project had an initial budget $7 million and three year plan. By 1971 it included 13 companies, including 6 oil companies and 7 car companies (only Ford of the Big 3). Id. at 45. A second stage began in 1974 and was completed in 1977, spending a total of $32 million spent (total) during the two stages. Id. at 46. GM “elected not to be a partner in IIEC, preferring to develop emission control technologies using its own internal resources, including personnel and facilities. Chrysler also did not join the IIEC program, electing to rely on internal resources and considerable support from its supplier base. Concerns relating to antitrust laws perhaps were an additional factor in these decisions.” Id. at 47.

In 1989, “the auto and oil industries initiated the Auto/Oil Air Quality Improvement Research Program (AQIRP) . . . The purpose of AQIRP was to develop data on potential improvements in vehicular emissions and air quality that could be realized through the use of RFG, various alternative fuels, and the development of automotive technology.” NAS, OZONE-FORMING POTENTIAL, supra note 137, at 110. AQIRP involved 3,000+ emissions tests, 26 reformulated fuels, 2 reference gasolines, 20 1989 cars and light duty trucks, 14 older vehicles from 1983-1985. Id. at 133.

629 A report on negotiations over the final report of the joint oil-auto program to develop technological data to inform regulators in the EU illustrate the tradeoffs between emissions controls based on fuel changes and those based on engine changes resulted in “a win-lose situation” where improvements for one meant a loss for the other, the discussion was “physically, mentally and morally very hard,” and the competition between the two industries was compared to European warfare.” TAMINIAU, supra note 38, at 217.

630 Id. at 202 (footnotes omitted).

631 FTC, MERGERS, supra note 5, at 23-24.

Market Fragmenting Regulation

concerning many aspects of alcohol – Baptists would be more likely to support harsher penalties for bootlegging, for example, while bootleggers would not – their interests overlap with respect to Sunday liquor laws. Not only is their coalition larger than either group individually, but the Baptists provide a crucial legitimate rationale for the laws benefiting the bootleggers.

In the case of gasoline markets, the bootleggers are the stationary sources and automobile manufacturers, while the Baptists are the environmentalists, whose faith includes a creed that largely rejects the power of market incentives to improve environmental quality without detailed government regulations. Both auto makers and stationary sources have a strong interest in seeing air quality improvements “purchased” through regulations on someone else. Thus, shifting the cost of controlling emissions to drivers and refiners appeals to both groups. Doing so directly, however, has the potential to provoke a political response, while regulating fuel content in a manner that conceals the cost to the public through “clean fuel” mandates is less likely to draw opposition. Although refiners currently bear the brunt of the costs imposed through fuel regulations; their reward is a regulatory “fence” around the industry that prevents new entry, allowing them to pass along the costs of the massive investments necessary to meet the new fuel specifications.

III. Conclusion & Recommendations

While the specifics of the fragmented gasoline markets described above rest on a regulatory history unique to the United States, other countries are following the U.S. lead in modifying fuel composition for environmental reasons. To be sure, most industrialized nations have had distorted energy markets since World War II, with each choosing to warp its markets in its own fashion, making the problem of regulatory externalities a general one. Indeed, the tempest in gasoline markets threatens to worsen as five related regulatory and market conditions loom on the horizon.

1. Refineries are becoming more complex and costly as refining technology evolves to meet the combined demands of regulators and modern engines.

2. The number of refineries is declining, even as their individual capacity increases. As a result, gasoline supplies are more vulnerable to unplanned outages at refineries.

3. The pipeline interconnections between refineries and markets are insufficient to support a national market.


634 One example is the effort by the automobile industry to reduce fuel volatility. See NPC, ADEQUACY, supra note 37, at 93 (automobile and oil companies disagree about the “vehicle performance benefits of lower DI gasoline.”)

635 See, e.g., Id. at 37 (“some costs [of fuel regulations] may not be apparent to consumers. Examples include the fuel economy loss from oxygenate addition to gasoline and the shareholder value lost from low capital returns to the industry.”)

(4) Fuel requirements hinder the cross-region sale of boutique gasoline blends.

(5) Reduced inventories leave little slack in the system for unplanned refinery shutdowns.

The confluence of these conditions leaves the gasoline market vulnerable to hurricanes, accidents, crude supply interruptions, terrorists, and dictators. These vulnerabilities, in turn, jeopardize market stability, threatening consumers with price hikes and fuel shortages. This is not a doomsday scenario, merely recognition of the compounded problems confronting the nation’s gasoline markets.

As we have discussed, these problems have long, complicated histories. Recall that much of America’s energy policy flows from its own blend of political, industrial, and regulatory interests. The Arab oil embargo in the early 1970s combined with the advancing environmentalism and helped undermine industry efforts to develop new technologies or build new refineries. As regulators convinced the industry and environmental advocates that market barriers best served the country’s economic and ecological interests, the economic regulatory schemes became politically entrenched despite their subsequent failure. These then exacerbated the burden of increasingly stringent environmental regulations adopted through the 1980s and 1990s.

Gasoline formula regulation is, we have argued, an artifact of both the structure of the Clean Air Act and the long history of gasoline regulation. The regulations fragmented the market and effectively de-commodified gasoline. Fuel composition regulations can also reduce gasoline supply by making it uneconomical to convert portions of a barrel of crude into gasoline. The costs might be worthwhile if they yielded commensurate benefits. Unfortunately there is little evidence that they do. Doubt remains as to whether all of the touted gains from boutique fuels are even realized. Removing pollutants like lead and sulfur from the fuel supply provide net environmental benefits, assuming the octane enhancers that replaced lead are not later found to be the cause of worse problems. But with respect to the volatility and other more recent specifications met by altering the blendstocks used to formulate particular gasoline blends, the gains are offset by emissions from the substitute uses of the displaced blendstocks. Although EPA attempted to prevent “dumping” of high volatility blendstocks and refiners can alter the mix of hydrocarbons produced in refineries to some degree, there remains an empirical question about whether these changes improved environmental quality.

Moreover, mandating fuel blends ignores the fact that most mobile source emissions come from a fraction of the total vehicle pool. Altering fuels affects all vehicles, and it remains an open question whether doing so is a cost-effective way to address a problem primarily caused by a small minority of vehicles. Consider as well that customizing petroleum blends is also a way for refiners to distinguish their products.


638 See NPC, ADEQUACY, supra note 37, at 99 (“For a 50ºF DI reduction, 10 to 15% of the heavier gasoline molecules must be removed and either cracked to lighter molecules or replaced [which the NPC believes would cause] . . . a gasoline volume loss of as much as 10-15%.”)

639 Calvert, Heywood, Sawyer, & Seinfeld, supra note 127, at 40.
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Some refiners are already trying to distinguish their gasolines on the basis of environmental quality.\(^{640}\) To the extent that market fragmentation restricts such competition, it potentially forestalls market forces that promote environmental quality.\(^{641}\)

Having acknowledged such problems and traced their heritage, policy makers should begin to consider ways to mitigate future disruption and damage. One lesson from the tortured history of gasoline regulation is that sending regulators home might be the simplest way to avoid further problems. In the most general terms, of course, the gasoline market must slowly be defragmented as consumers, producers, and policy makers treat gasoline as a true commodity in need of a deep and broad market. To accomplish this, we do not advocate installing another layer of top-down, federal agency micromanagement. Although we recognize the entrenched political interests involved, the solution need not have only a governmental solution; the government’s abysmal record in anticipating fuel trends counsels against relying on central planning solutions.\(^{642}\) Furthermore, the dangers of federally mandated technical specifications are apparent from the record. By creating incentives to shift pollution reductions to fuel specifications at the time when the refining industry became most susceptible to market fragmentation, Congress and EPA have vastly complicated the gasoline market. If Congress had instead focused on creating incentives for emissions reductions, rather than specifying technologies, gasoline refiners and auto manufacturers would have been drawn to work together to develop methods of capturing those incentives.

But there are lessons as well for those unwilling to rely on markets alone. Rather than focus on new federal solutions, the gasoline market’s regulatory schemes should be streamlined to minimize their arcane complexity, and harmonized with consistent, long-term policy agendas to limit regulators and market forces working at cross-purposes. In light of the five conditions listed above, we recommend removing barriers to expanding and diversifying refinery capacity and making clean fuels more desirable to producers and consumers alike.\(^{643}\) For example, there are moves to standardize elements of refinery design through the use of off-the-shelf components rather than custom ones in reducing costs.\(^{644}\) Fragmenting the market for gasoline reduces the opportunities for such standardization. Regulators could “fast track” approval of designs based on such components, encouraging the trend.\(^{645}\)

Encouraging investment that deepens the market can also help. Valero, a major U.S. refiner, made significant investments in the ability to process lower quality “sour” crudes in recent years, investments that paid off by allowing Valero to buy cheaper

\(^{640}\) Jones, *supra* note 39, at xxi (“Where companies have sought to distinguish the quality of their fuels in recent years it has . . . [been] more usually on the basis of environmental quality.”).

\(^{641}\) See 2 BRADLEY, *supra* note 73, at 1264-1268 (discussing anti-environmental impacts of environmental regulation).

\(^{642}\) Petroleum demand forecasting in particular is remarkably imperfect. Both OPEC and the International Energy Agency failed to foresee the rate at which world demand for oil grew in 2004, for example, estimating a 1.5% increase in demand when actual demand grew by 3.3%, more than twice forecasts. FTC, *GASOLINE PRICE CHANGES*, *supra* note 9, at 26.

\(^{643}\) The best incentive is to remove the disincentives and to allow market processes to work. Politically, of course, a laissez faire approach to energy issues seems unlikely. The most we can realistically hope for is a set of policies that do relatively little harm.

\(^{644}\) Jones, *supra* note 39, at xx.

\(^{645}\) The permitting process takes significant time. See, e.g., NPC, *ADEQUACY*, *supra* note 37, at 134 (6-18 months necessary for permit applications and state agency review); 136-140 (describing process times).
More refiners might be following Valero’s path but for the expense of regulatory compliance. Unfortunately, fuel regulation and political interests have diverted investment away from technology that could improve environmental quality and funneled it toward into technology like ethanol and MTBE that have dubious environmental virtues at best.\(^{647}\) Not only is such investment a waste, but continuing such regulatory diversions threatens the overall market. An important step would be to eliminate the ethanol mandate and replace it with a performance standard. Similarly, adopting a strategy similar to that used in the lead phase-out for sulfur reductions, rather than imposing a uniform sulfur standard in a short period as EPA has done, could spur both technological developments to reduce sulfur and increase refining capacity by allowing refineries to adapt more economically to the requirements.\(^{648}\)

Finally, deregulatory and market-based steps should be taken to allow investors to build and expand refineries and pipelines. Recent damage from Gulf Coast hurricanes should prompt the industry and regulators to consider the strengths and weaknesses of the fuel-transportation infrastructure, with an emphasis on new and secure methods of transport designed to withstand multiple emergency refinery closings. EPA’s shift away from allowing refineries to trade off pollution increases from expansions against offsetting reductions from the same plant and the New Source Review litigation\(^ {649}\) against refineries slow increases in capacity through expansion of existing refineries’ capacity.\(^ {650}\) Refiners have identified court challenges to permits by interest groups as a significant barrier to expansion of refinery capacity\(^ {651}\) and such challenges could certainly be resolved more quickly. Likewise, more attention needs to be paid to the rigidity of boutique fuel requirements that prevent blends in one city from being moved to another during a crisis.

Most importantly, empirical questions can often be answered, if anyone cares to spend the time and money on research to do so. There have been some efforts at such research. Concerns over regulation prompted many firms in the auto and refining industries to join together to examine the technical details of the fuel-engine interaction and its impact on emissions. Fourteen oil companies, together with the Big Three U.S. auto makers, formed the Auto/Oil Air Quality Improvement Research Program (AQIRP) in 1989 “to develop data on fuel/vehicle systems” to study emissions, with modeling focused on ozone and economic analysis of alternatives.\(^ {652}\) The participants ultimately

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\(^{647}\) There is a tendency by agencies to not recognize opportunity cost of the cost of compliance. For example, one FTC report concluded that the additional costs of producing boutique fuels “made the countervailing savings that refineries found through technological and other advances even more important in keeping the price of gasoline relatively low during the 1990s.” FTC, GASOLINE PRICE CHANGES, supra note 9, at 58. This ignores the fact that these savings are not the result of the regulation and thus would have been implemented regardless of the increased costs. Such savings thus are not “countervailing” but merely fortuitous.

\(^{648}\) See NPC, ADEQUACY, supra note 37, at 27.

\(^{649}\) See, e.g., Id. at 140-141 (discussing NSR issues).

\(^{650}\) Id. at 27.

\(^{651}\) Id. at 118 (discussing impact of environmental justice litigation).

\(^{652}\) MONDT, supra note 628, at 199; Blackmore, supra note 87, at 247. The program involved Chrysler, Ford, and GM plus Amoco, Arco, Ashland, BP, Chevron, Conoco, Exxon, Marathon, Mobil, Phillips,
spent $40 million on the program. The AQIRP research produced data suggesting that the impact of gasolines’ composition varied considerably across vehicle types and ages. It also showed that at least some changes traded decreases in one pollutant for increases in another, while others had unambiguously positive impacts on emissions. Encouraging such research through clear restrictions on antitrust actions against companies that undertake them could vastly expand our knowledge of how fuel composition affects the environment.

There are clear relationships between fuel properties and engine emissions (as well as between fuel properties and other aspects of engine performance). In the absence of regulation of gasoline composition, how might these be addressed? A hint of this alternative future lies in the ASTM fuel specification (D4814) created in 1988 and modified in 1994 by the private standards organization. This specification includes multiple classes of fuels. The trend in the U.S. is away from using it due to Clean Air Act fuel requirements, but the reliance on a private standards organization is an alternative path for resolving the conflict between the gasoline refiners and auto manufacturers over responsibility for emissions reductions. Market-based measures also have the potential to produce innovative contractual measures that improve air quality. Creative contracting is important, both for consumers of fuels such as trucking companies and airlines and for refiners seeking stable long term supplies of crude. Thus, given the dangers of a highly fragmented boutique gasoline market with depleted refinery capacity and low inventories, market-driven incentives should be developed to ameliorate future risks and economic disasters. In the mean time, burdensome economic and environmental regulatory entanglements should be loosened to spark innovation. To borrow a line from country singer Terri Clark, “Let ‘em go ‘cause I don’t need strings, just give me a road and a little gasoline.”

Shell, Sun, Texaco, and Unocal. PEARSON, supra note 126, at 83. This cooperation was motivated in part by fear that alternative fuels (e.g. methanol) would be mandated based on their perception as “clean” fuels. PEARSON, supra note 126, at 82.

653 Id. at 85.
654 Id. at 87 (“Reduction of gasoline aromatics content from 45% to 20% produced the interesting result of hydrocarbon emissions being reduced by some 6% for current vehicles and increased by 14% for older vehicles. Nitrogen oxides were reduced by 11% in older vehicles, yet there was no significant effect in current vehicles.”)
655 Id. at 88 (“Reducing gasoline olefin content from 20% to 6% increased hydrocarbons by 6% and decreased nitrogen oxides by 6% for both current and older fleets.”).
656 Id. (Reducing sulfur from 450 ppm to 50 ppm reduced hydrocarbon emissions by 18%, carbon monoxide by 19%, nitrogen oxides by 8%, and air toxics by 10%).
657 Blackmore, supra note 87, at 246 (6 vapor pressure classes and 5 vapor lock classes).
658 See Morriss & Dudley, supra note 306, at 355-356 (discussing potential roles of private standards setting organizations).
659 See, e.g., FTC, GASOLINE PRICE CHANGES, supra note 9, at 30 (describing importance of futures contracts as hedges against price increases and for refiners’ planning).
660 Terri Clark, A Little Gasoline, on Fearless, (Mercury Nashville 2000).