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# THE MARKET THAT ANTITRUST BUILT: PUBLIC POLICY, PRIVATE COERCION, AND RAILROAD ACQUISITIONS, 1825 TO 1922

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*How do new business models emerge? Neoinstitutionalists argue that the process often begins when a policy shift undermines the status quo; groups then vie to define the best alternative. The authors explore the role of power in selecting between two alternative business models available to railroads from 1897, when antitrust laws banned the cartel—the prevailing model for managing competition. Predatory railroads prescribed several methods for destroying rivals. Financiers prescribed amicable mergers instead, and fought predation by threatening to withhold capital from predators. An analysis of the 167 rail acquisitions in Massachusetts between 1825 and 1922 confirms that the financiers succeeded. After antitrust laws were enforced, railroads left cartels to follow the business model of financiers rather than that of predators. This can be seen in the conditional variables that predict buying and selling. Thus public policy and power can shape key market features. It is ironic that this market, built by antitrust, became the prototype for the neoliberal ideal of the unregulated economy.*

**E**CONOMISTS and economic sociologists can diverge sharply in their assessment of antitrust policy. In economics, one camp portrays antitrust policy as reinforcing natural market characteristics, suggesting a singular ideal type of market. This camp, then, grapples with identifying market disturbances (i.e., unnatural characteristics) that require correction by antitrust laws (Adams and Brock 1991; Eisner 1991; High and Gable 1992). In economic sociology, an

emergent camp contends that antitrust and other policies actively constitute market characteristics. These sociologists suggest that markets may take a variety of different forms rather than conforming to a singular ideal type (White 1988; Zelizer 1988), and that antitrust policy contributes to this variety rather than serving merely to correct markets that have strayed from the ideal type (Dowd and Dobbin forthcoming; Fligstein 1990).

In studies addressing a century of economic history, economic sociologists show that antitrust policy played an important role in altering firms and their behaviors. Roy (1997) finds that by outlawing cooperation among firms, antitrust policy contributed to a massive wave of mergers between 1898 and 1903. Fligstein (1990) shows that by discouraging mergers among firms in the same broad industry, the Celler-Kefauver Act of 1950 spawned cross-industry acquisitions. Davis and Stout (1992) find that the Reagan administration's lax regulatory attitude facilitated mergers among the largest

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firms. More generally, Stearns and Allan (1996) argue that each of the four waves of mergers since 1900 followed a relaxation in antitrust enforcement. These analyses show that antitrust policy has served as an agent of change, influencing the historical propensity of firms to merge.

We explore how antitrust policy initially altered the business community's prescriptions for when to merge. That is, we attend not only to antitrust policy's effect on the *rate* of mergers, but also to its effect on the *logic* underlying mergers—we use the term “business model” to denote this underlying logic. We demonstrate that the onset of antitrust law sparked a new type of market—one that differed dramatically from its pre-antitrust counterpart in terms of the logic underlying mergers.

The Supreme Court first enforced antitrust law in 1897, rendering illegal the widely popular cooperative business model associated with the cartel (Chandler 1990; Kolko 1965; Ripley 1915). How was antitrust policy translated into a new business model? Previous analyses have largely been mute (but see Roy 1997). But the 1897 Supreme Court ruling set off a contest between two groups that advocated different models: predators and financiers. Predation in this era entailed driving competitors to bankruptcy and then acquiring the ravaged remains. This was regarded as highly profitable for the predator but as disastrous for financiers with stock in many firms that might become prey. We build on the neoinstitutional approach to power by showing how financiers used their clout to impose their preferred model, which called for amicable mergers when conditions encouraged ruinous competition. That model has since lost its connection to the power of financiers and has become part of economic common sense (Bain and Qualls 1987; Stigler 1955). We contend that this historical episode helped to make it so.

We review each business model, sketch its prescriptions for when to merge, and translate those prescriptions into hypotheses about the pattern of mergers. We review the roles of public policy and private coercion in suppressing the cooperative and predator models, respectively. Before presenting analyses, we enumerate control variables suggested by previous studies. We then

model acquisitions in 4,488 annual spells of data from Massachusetts railroads for the period 1825–1922, wherein 318 railroads were founded and 167 were acquired. We model both the decision to sell and the decision to buy, finding evidence that financiers successfully promoted their own business model. When railroads abandoned the buying and selling strategies associated with the cartel, in 1897, they embraced the strategies prescribed by financiers. Under the new model, the effects of concentration and profitability changed and assumed their modern forms: Firms engaged in acquisitions as the industry became more concentrated and they used excess profits to buy rivals.

### PUBLIC POLICY, PRIVATE COERCION, AND THE NEW INSTITUTIONALISM

How do public policy shifts, in general, result in new business models? Neoinstitutional studies suggest that new policies often outlaw existing models without offering alternatives, thereby leaving managers the task of devising new ways of doing business. For instance, regulation of the communications industry limited the holdings of broadcasters, but it was radio managers who devised the “network” model in which stations with different owners act in concert (Leblebici et al. 1991). Civil rights law made discrimination illegal, but it was human resource managers who advocated bureaucratic promotion systems to prevent supervisors from discriminating (Dobbin et al. 1993).

Institutionalists typically argue that managers promote new business models and strategies using network ties and rhetoric (Scott 1995). We argue, on the shoulders of Fligstein (1990) and Roy (1997), that managers also use *structural power*—“the ability to determine the context within which decisions are made by affecting the consequence of one alternative over another” (Roy 1997: 13). Fligstein explores how the *intrafirm* power of competing managerial groups shapes a firm's response to exogenous shocks, as when finance managers won leadership of large U.S. firms to champion diversification in response to the Celler-Kefauver Act. Roy examines *interfirm* power, as when

large turn-of-the-century manufacturing firms coerced their small competitors to sell out under threat of all-out war.

We explore a third kind of power—*inter-industry power*. Once antitrust policy outlawed cooperation among railroads, the prevailing wisdom was that predation would dominate the industry. Only the power of bankers could turn the tide: The banking industry as a bloc explicitly threatened to sanction railroads that practiced predation, effectively steering the railroad industry toward the model financiers preferred. As Wall Street took on its modern form in subsequent decades (Roy 1997), stockholders likewise embraced the logic of the financial model; they rejected all-out predation because it could damage *their* diversified holdings. The initial exercise of interindustry power thus helped to make the financier model the preferred model, thereby shaping the impact of antitrust policy.

Our analysis yields some important lessons for institutionalists in sociology and economics. First, the business model that reigns at any given time represents only one of several possible models that firms could have embraced. Second, the widespread adoption of a new business model is not reducible to simple optimization, wherein similarly situated firms respond as if by reflex to competitive and regulatory conditions. Instead, the adoption of a new business model is also a social process in which what is “optimal” for a given firm is shaped by the attempts of others to advance their respective interests via persuasion and coercion (DiMaggio and Powell 1983). Finally, policy shifts complicate the selection of new business models—they can unexpectedly alter the interests of firms and other economic actors (Amenta 1998; Dobbin 1992; Espeland 1998). Before the emergence of antitrust laws, for example, railroaders argued that it was in their interest to cooperate with competitors; after antitrust, the very same railroaders argued that it was in their interest either to ruin competitors or to sell before their competitors ruined them. Taken together, these lessons reveal that key characteristics of markets (e.g., strategies, optimality, interests) are not purely “natural,” as some economists are wont to argue, but are in part socially produced. Both public policy

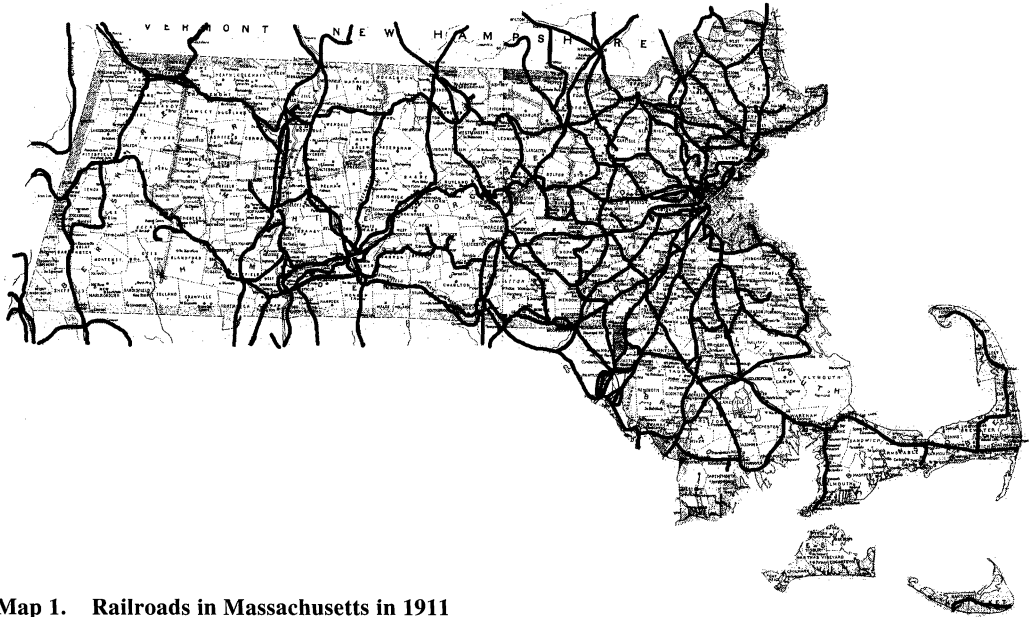
and structural power contribute to the variance in markets.

### THREE BUSINESS MODELS FOR MANAGING COMPETITION

As the nineteenth century unfolded, railroaders struggled to find a way to handle competition. Between 1825 and 1922, 318 railroad firms were established in Massachusetts, with as many as 80 operating at once (Dobbin and Dowd 1997). As the number of firms increased and as their respective mileage increased, so too did concern about competition. By 1865, for example, there were over 2,000 miles of track crisscrossing the state. The potential for competition can be seen in Map 1, representing Massachusetts rail lines (Massachusetts Board of Railroad Commissioners 1912). The various intercity routes had been established by separate companies, which soon offered joint service with connecting railroads. Intersecting railroads typically joined forces to serve pairs of cities, so that any two cities might be served by a dozen different sets of railroads. The competition that emerged was typical of network industries—shipping, canals, telegraph, telephony, air transport, and the Internet—in which firms join to offer service in particular areas. Competition was sometimes fierce, as railroads offered rates that barely covered the cost of fuel (Chandler 1977).

How should firms manage competition? Three different business models emerged. Under the cooperative model, cartels stabilize prices at levels that make all railroads profitable. Under the predator model, powerful railroads bankrupt their competitors and acquire their routes. Under the finance model, competing railroads that are subject to rate wars merge amicably before price-cutting destroys their value.

We argue that the cooperative model reigned before the enforcement of antitrust law in 1897 and that the finance model reigned after enforcement. The best evidence that the cooperative model was replaced by the finance model would be that railroads at first followed the cooperative model’s prescription for mergers and then followed the finance model’s. Thus, we articulate those prescriptions and translate them into testable hypotheses.



Map 1. Railroads in Massachusetts in 1911

### THE COOPERATIVE MODEL

Cooperation among firms marked the early U.S. railroad industry. Massachusetts rate agents had set prices together from the industry's earliest days, and by 1850 they had established associations, such as the Convention of Northern Lines and the New England Association of Railway Superintendents (Dunlavy 1993:173). When the economic downturn of 1873 caused informal cooperation to fall apart, railroads within Massachusetts and across the nation established formal cartels. Some cartels were simple price-fixing clubs, while others entailed the organized sharing (i.e., pooling) of traffic and/or profits. All of these cartels, however, involved cooperation among railroads to keep competition in check and to buoy profits for cartel participants (Chandler 1977; McCraw 1984).

During the 1870s, railroaders argued that their industry was naturally cooperative and that cooperation would characterize the modern economy. Amasa Stone, who ran railroads in Massachusetts, Connecticut, and the Midwest, argued that "the time will come when there will be little value in railroad property without general cooperation of competing lines" (quoted in Cochran 1965: 469). Albert Fink ([1880] 1979:22–23), who in 1874 had been architect of the main cartel

for East Coast–Chicago rail traffic, argued before Congress that the cartel alone could guarantee "the separate existence of a great number of competing roads" by checking predation and consolidation.

Fink and his compatriots linked the industry's propensity for rate wars to its cost structure, namely its high sunk costs and low marginal costs, and they saw cooperation as a natural solution to this propensity. Fink ([1876] 1979) described how railroad managers responded to competition: "The simple question requires to be answered, Will you carry freight and passengers for the *same* that other transportation lines charge, either by rail or river, or will you *not carry them* at all[?] . . . If the obtainable rate exceeds cost, no matter how little, it becomes his interest to accept the terms offered" (p. 54). Faced with stiff competition, railroads would join the war, dropping rates to below their actual cost but just above their marginal cost. The implication was clear: without cooperation, rate wars were inevitable.

Far from opposing the cartels that prevented cutthroat pricing, the states supported them. Like entrepreneurs and bankers, the states viewed the cartel as the way of the future—the incarnation of the modern economy. Massachusetts's railroad commissioners dubbed 1877 "the 'Pooling' year" and heralded the nearly universal spirit of

“yielding and harmony” that had overtaken the industry (Massachusetts Board of Railroad Commissioners 1878: 66). In 1878, the commissioners argued that “uncontrolled competition is but one phase in railroad development and must result in some form of regulated combination,” and they encouraged railroads to openly establish formal price-setting arrangements (Massachusetts Board of Railroad Commissioners 1878:80).

Prescriptions for acquisition were straightforward under the cooperative model. Cartel leaders counseled firms *not* to use their capital to acquire competitors with overlapping routes, because this would only lead them to duplicate existing capacity (Fink [1880] 1979). They counseled railroads to acquire other firms with which they shared connections, but only when those firms were already failing. In this way, railroads would gain depots at little cost (Cochran 1965: 139). They did not prescribe that railroads should acquire other lines as the industry became concentrated. Acquisitions, in other words, were not driven by the desire to create regional monopolies but by the chance failure of connecting firms.

**HOW PUBLIC COERCION UNDERMINED THE COOPERATIVE MODEL.** Railroads would discard the cooperative model, not because it proved inefficient or ungainly but because public policy—in the form of two congressional acts and one Supreme Court ruling—rendered it illegal. This policy shift launched what DiMaggio and Powell (1983) call “coercive isomorphism” and forced railroads to abandon their business model and alter their strategies.

The cooperative model was initially challenged by the Interstate Commerce Act of 1887, which governed railroads, and the Sherman Act of 1890, which governed industry more broadly. The Interstate Commerce Act was not passed with a new business model in mind, but because American ranchers and farmers opposed large combinations of firms, such as cartels, that sometimes charged exorbitant rates (McCraw 1984; Wilson 1980). They successfully depicted those combinations as undemocratic and railroading’s chiefs as “robber barons.” The Sherman Antitrust Act was built on the same rhetoric. In the words of Senator Sherman: “If we will not endure a king as

political power we should not endure a king over the production, transportation, and sale of any of the necessities of life. If we would not submit to an emperor we should not submit to an autocrat of trade” (quoted in Eisner 1991:49). Proponents of antitrust policy raised the specter of baronial power; they did not argue that antitrust would improve industrial efficiency. Only later were these two acts framed as means to sustain competition (Wilson 1980).

Railroads were loath to abandon cooperation and resisted both the Commerce Act and the Sherman Act. They fought the Commerce Act in the courts, winning 15 of the first 16 rate cases that reached the Supreme Court and sustaining hope that the act would be struck down (Stover 1970: 113). Meanwhile, J. P. Morgan and his compatriots restructured their cartels so as to circumvent the law—for instance, they designated a weak price leader in each region or introduced strategic price differentials (Bittlingmayer 1985; Chandler 1977:171; Cochran 1965: 171). Throughout the 1890s, the industry hoped Congress would go along with a collaborative system: “The prospect of legalization of pooling by Congress was bright” (Ripley 1912:434). But in 1897, the Supreme Court’s *Trans-Missouri* decision upheld the central tenets of the Interstate Commerce Act and the Sherman Act, which made collusion between competitors illegal and thereby outlawed cartels (Binder 1988).

The *Trans-Missouri* decision of 1897 eliminated the cooperative model without offering an alternative. Federal law prohibited cartels, but not until the Clayton Act of 1914 did it even begin to regulate mergers that were “intended to restrain trade” (Fligstein 1990:35). Thus, the Court set off a search for a new business strategy in railroading, and it left the door to mergers wide open.

Railroaders saw mergers as the solution to their problem, but they developed several different prescriptions for how mergers should proceed. Some of the big, east-west, cartels simply formalized their relationships—railroads holding one-eighth of U.S. mileage (25,000 miles) merged in the 16 months following June of 1899 (Ripley 1915). Roy (1997:5) suggests that *Trans-Missouri*-inspired manufacturing mergers

fed rail mergers by expanding the pool of capital in the stock market, the value of which rose from under 1 billion dollars in 1898 to over 7 billion in 1903. Massachusetts railroads were not part of the east-west merger bandwagon (Bittlingmayer 1985; Ripley 1915:470), but the court had undermined local cartels in Massachusetts and across the country and this set off a search for a new business strategy. Two models for merging emerged.

### THE PREDATORY MODEL

Predation flared up during the depression of 1873 and again, briefly, when the Commerce Act first challenged cartels in 1887 (McCraw 1984:51). The idea was to bankrupt your competitors, drive them from the market, and acquire the remains. Large railroads that stood to win regional monopolies favored predation. Small firms that stood to be driven to bankruptcy and forced to sell opposed it. Financiers who stood to lose the value of their diverse holdings in small firms fought predation fiercely.

Predation took three forms. The goal of each form was to bankrupt rivals (Cochran 1965:126). First, by 1870, William H. Vanderbilt was offering *covert rebates* to Rockefeller, Andrews, and Company in order to win all of the oil company's Lake Shore-New York traffic and, in turn, decimate rival roads. By 1876, rebating had become common in Massachusetts (Massachusetts Board of Railroad Commissioners 1877:65-66). George Watrous (Cochran 1965:165), who ran one of the main Boston-New York lines, described rebates as "sly arrangements for stealing business," but nonetheless he wrote in an internal memo: "I think we had better, notwithstanding my horror of rebates, bill at the usual rate, and rebate Mr. Cole 25 cents for each thousand bricks he ships" (quoted in Cochran 1965:500).

Second, Jay Gould's Erie Railroad tried *control of connecting lines* to destroy competitors. The idea was that if a firm held a monopoly on one leg of a trip, it could use the monopoly to deny business to other firms on another, competitive leg (Cochran 1965:163; McCraw 1984:51). Gould's first effort, at the end of 1868, failed because the

Pennsylvania Railroad and the New York Central, under Cornelius Vanderbilt, saw what he was doing and followed suit. But in the 1880s, Gould succeeded with a system between the Great Lakes, the West, and the Southwest. Copycats emerged in every region (Berk 1994; Chandler 1977:149-51). Vanderbilt was one of the first to try a variation—*competitive building*—in which his road built alongside an existing road on route A-B to connect with his monopoly on route B-C, with the aim of ruining the existing A-B road.

The queen of predatory practices was the simple *rate war*, in which a railroad reduced rates to below cost until rivals folded. Railroads learned an important lesson from the rate wars that broke out during the 1873 depression. If you bankrupted your competitors but did not buy them out, their receivers might operate without the constraint of having to pay off loans and bonds. As C. F. Adams (1893) lamented: "The effect of the crisis of 1873 was sharply to divide the railroad system . . . into two classes: the solvent roads and the insolvent roads. . . . Between the solvent roads and the roads thus bankrupt a new form of competition then developed itself. The bankrupt roads were operated not for profit, apparently, but to secure business; business at any price" (p. 149). It was dangerous to bankrupt your competitors if you did not follow through and buy them out (Roy 1997:100).

Proponents of predation told railroads to drive their competitors to bankruptcy and then buy them cheaply, but only if those competitors were weak, for healthy rivals might have the last laugh. Hence, Boston railroader John Murray Forbes described Jay Gould as "peaceable to the strong, not to the weak" (Cochran 1965:162). As Charles Perkins outlined the logic following the rate wars of the 1870s, weak firms "would cease to exist and be absorbed by those systems near at hand and strong enough to live alone" (quoted in Chandler 1977:159).

What would the pattern of acquisitions look like if the predatory model were dominant? Railroads in distress should be most likely to sell because the whole idea was to bankrupt rivals before buying them. Profitable firms should be the buyers, although because the strategy itself weakens profits

(Cochran 1965:137), we expect buyers to have only average profits. Firms in concentrated markets should be more likely to buy and to sell, for according to this model, predation only works when the number of viable competitors is limited—it can backfire when there are too many rivals to destroy.

### THE FINANCE MODEL

The finance model emerged in response to two developments. First, the Interstate Commerce Act and the Sherman Act undermined cartels without offering an alternative model for quelling ruinous competition. Supreme Court enforcement in 1897 brought the issue to a head. Second, the predatory model, which the largest railroads promoted as a solution to the policy shift, promised a winner-takes-all bonanza, but it destroyed the value of the railroads that became prey. As the president of a large Midwestern railroad wrote to the editor of the *New York Evening Post* in 1888: “The Interstate Law is responsible for the existing rate war. Pooling, or self-regulation, has been prohibited and nothing provided to take its place” (quoted in Cochran 1965:447). While both developments were problematic for small railroads, both were also problematic for financiers.

Financiers stood to lose their shirts if predation became widespread because they held stock in many small roads—the very roads that would likely be destroyed. They therefore argued against rate wars and the like from the 1870s, when predatory practices enjoyed their first wave. A financier might make money on one road that won a rivalry, but a pattern of predatory behavior would eventually destroy the value of his holdings. An industry leader said of the predatory practices of the 1870s: “count me out first, last and always. I object to murder in all forms and especially to suicide” (quoted in Cochran 1965:162). A financier could win a rate battle but could not win the war.

Financiers eventually developed their own business model for the railroad industry. They argued during the 1890s that, if antitrust policy were ever enforced, it would be best for mergers to occur on a friendly basis *before* predation destroyed the value of railroads. Their model yielded several prescriptions for acquisition.

The first set of prescriptions concerned concentration and drew on contemporary insights regarding antitrust policy. Charles Francis Adams—who had been Massachusetts’s first rail commissioner, a cartel administrator, and president of the Union Pacific—argued in 1893 that *if* antitrust law was enforced, consolidation was inevitable in locales in which high concentration was combined with a small number of railroads.

There are functions of modern life . . . which necessarily partake in their essence of the character of monopolies. . . . [W]herever this characteristic exists, the effect of competition is . . . to bring about combination and closer monopoly. The law is invariable. It knows no exceptions. . . . When the number of those performing any industrial work in the system of modern life is necessarily limited to a few, the more powerful of those few will inevitably absorb into themselves the less powerful. (C. F. Adams 1893:121)

Adams laid the foundation of the financier model by suggesting that, in such locales, railroads would inevitably merge, and they would do so to the benefit of large railroads. In the absence of cartels, as experience had shown, these large railroads would likely destroy their few rivals. Financiers set about trying to ensure that railroads merged amicably and that small firms were paid fair prices for their holdings. They prescribed that in such markets, where consolidation was inevitable and rate wars were likely, large roads should buy and small roads should sell before predation ensued.

The second set of prescriptions addressed profitability and was drawn from experience during the rate wars of the 1870s. In the absence of cartels, profitable firms should use spare cash to buy rivals. Moreover, to preclude rate wars, they should buy these rivals whether or not their rivals were profitable and whether or not their rivals had routes that the acquirer needed. As one railroad chairman reminded his president in 1878: “When we bought this Road it was understood that we did so to prevent competition,” not to make a line that duplicated existing service profitable in itself (quoted in Cochran 1965:64). A railroad president argued: “It seems pretty clear that we must in some way reduce the number of competitors” (quoted in Cochran 1965:139). Another



argued of the tradeoff between combining and facing a potential rate war: "It is better for the two to combine rather than to be combined against by acting separately" (quoted in Cochran 1965:166).

**HOW PRIVATE COERCION PROMOTED THE FINANCE MODEL.** What was in this model for large railroads that were not controlled by financiers? Most analysts argued that the big independents had everything to gain from acting as predators (Chandler 1977:136). By reducing profits for a short time, they would destroy and subsume rivals at little cost.

But financiers saw their own interests very differently. Whereas independents could prosper through predation, financiers could only lose money because predation destroyed the value of the small firms in which they held stock. Under high concentration, rate wars and predation seemed inevitable. As Chandler (1977) notes: "In the 1880s fixed costs . . . averaged two-thirds of total cost. . . . As long as a road had cars available to carry freight, the temptation to attract traffic by reducing rates was always there. Any rate that covered more than the variable costs of transport brought extra income. To . . . investors, the logic of such competition would be bankruptcy" (p. 134). Financiers fought to prevent independents from initiating rate wars.

Financiers promoted their own model by threatening to withhold capital—stock, bonds, and loans—from predators. This proved crucial because the independents would eventually need such capital for expansion and acquisitions. In the early 1890s, an influential group of banks led by J. P. Morgan announced that they would not countenance predation, and in particular they would refuse capital for the practice of competitive building. Speaking for the nation's leading banks, Morgan warned a national assembly of railroads that they would not back predators: "[T]hey will not negotiate, and will do all in their power to prevent negotiation of any securities for the construction of parallel lines, or the extension of lines not unanimously approved" by others in the rail industry (quoted in Chandler 1977:171; see also Roy 1997). The banking industry left no question in the minds of railroaders—it would punish roads that practiced predation.

Thus, while it would appear to have been in the interest of large independent railroads to engage in all-out war after the Court enforced antitrust law, we predict that financiers successfully quashed predation by threatening to withhold capital from predators.

### **THREE BUSINESS MODELS: PRESCRIPTIONS FOR ACQUISITION**

We argue that the cooperative model prevailed until antitrust law was enforced. Cooperation was sometimes interrupted by predatory practices, but it remained the dominant model. We further argue that when the Interstate Commerce and Sherman acts were enforced in 1897, quashing the cooperative model, financiers used their leverage over the industry to encourage firms to adopt the finance model rather than the predatory model.

These three business models offered very different prescriptions for acquisition. We expect that before 1897, acquisitions followed the prescriptions of the cooperative strategy, and that from 1897 forward, acquisitions followed the prescriptions of the finance strategy. We predict that in neither period did the predatory strategy dominate. The cooperative strategy dictates that industry concentration does not enter the equation; that one should buy regional railroads that are failing; that firms should not buy merely because they have profits to spend. Hence:

*Hypothesis 1:* When the cooperative model is dominant, (a) concentration will have no effect on buying or selling, and (b) profitability will show a negative effect on selling (because failing firms will seek to sell out) but will show no effect on buying (because profitable roads were not advised to buy rivals).

The predatory model suggests that you should destroy the profits of your rivals and then acquire them at fire-sale prices; that you should do this despite the fact that it will harm your own profitability; that you should do it when there are few viable competitors (e.g., when concentration is high) so that you will be sure to be the sole surviving firm. Under conditions of concentration, then, firms should sell out if they cannot become predators. Hence:

*Hypothesis 2:* When the predatory model is dominant, (a) concentration will encourage both buying and selling, and (b) profitability will show a negative effect on selling (because sellers will be victims of rate wars) but will show no effect on buying (because rate wars eat up profits).

The finance model suggests that when concentration threatens to lead to rate wars, you should acquire your rivals or sell out. You should do this in advance of rate wars, before the value of potential sellers is destroyed. Potential buyers should strike when they can, that is, when their profits allow them to. Buyers should target not the cheapest (failing) roads, but those whose routes make them likely rivals in rate wars.

*Hypothesis 3:* When the finance model is dominant, (a) concentration will encourage both buying and selling, and (b) profitability will have no effect on selling (because buyers will find all rivals attractive) but will encourage buying (because profitable roads were advised to buy rivals).

## ECONOMIC AND SOCIOLOGICAL RESEARCH ON ACQUISITIONS

We expect the effects of concentration and profitability to be conditioned by the business model in operation. Broadly speaking, these factors address industry competition. We treat other factors, which address organizational capabilities and environmental conditions, as controls. Many controls have been shown to be robust predictors. Financial economists consider whether firms have the resources to survive and whether they are capable of acquiring others (Scherer 1980). Agency theorists examine how acquisitions reflect the interests of managers (Jensen and Meckling 1976). Game-theoretic industrial organization economists specify the conditions that make it easy for some firms to buy and difficult for others to survive (Bain 1956; Bain and Qualls 1987; Coase 1988; Greer 1992; Stigler 1968). Economic sociologists emphasize such organizational factors as imitation and learning and such demographic factors as firm size and age

(Davis and Stout 1992; Ginsberg and Baum 1994; Stinchcombe 1965). These camps have theorized certain causes in different ways. Because our main purpose is to catalog controls, we do not arbitrate among interpretations. Some theories are symmetrical, in that they predict that a factor that decreases selling, increases buying. Other theories address only buying or only selling.

## CONCENTRATION AND SCALE ECONOMIES

Industrial organization economists argue that large firms have competitive advantages in industries characterized by economies of scale. That is, when large firms have lower unit production costs than small firms, small firms will have difficulty surviving. The disadvantage of being small, moreover, becomes more pronounced when a few large firms dominate production—when concentration increases (Bain and Qualls 1987; Greer 1992; Shepherd 1979). Consistent with the view that economies of scale elicit concentration, empirical studies show that, under concentration, production costs are lower for large firms (relative to small firms) (Demsetz 1977:21). Concentration increases acquisitions, then, as small firms sell to escape price competition and as dominant firms buy to augment their economies of scale.

*Hypothesis 4:* Across the period, concentration will have a positive effect on selling.

*Hypothesis 5:* Across the period, concentration will have a positive effect on buying.

Berk (1994) finds that economies of scale were not particularly salient in early railroading. His finding resonates with our account in that railroaders expected that after antitrust laws were enforced, concentration would increase mergers—not because of economies of scale but because concentration fosters predation.

## PROFITABILITY: FAILING FIRMS AND EXCESS PROFITS

Economists show that failing firms with little hope of returning to profitability are likely to sell off assets, thereby enabling

owners to move their capital to more profitable ventures. Failing firms are attractive targets because they can be bought cheaply. Agency theorists further suggest that unprofitable firms are attractive targets for managers who believe they can improve performance (Hindley 1970; Manne 1965; Marris 1964; Weir 1997). Competition for corporate control thus disciplines managers, as potential raiders monitor managers' results and remove those who are inefficient (Posner 1976:96).

When it comes to predicting who will buy, economists argue that firms with excess profits are most likely to acquire potential competitors. Managers may use profits to acquire competitors (rather than returning them to shareholders) for several different reasons (Jensen and Meckling 1976; Manne 1965; Roll 1986). The dominant argument is that firms use profits to buy competitors so as to quash price competition and increase profits (Stigler 1955).

*Hypothesis 6:* Across the period, profitability will decrease the likelihood of selling.

*Hypothesis 7:* Across the period, profitability will increase the likelihood of buying.

#### **DEMAND**

Financial economists find that the likelihood of acquisition is related to the condition of the economy. Firms seek to sell assets during economic downturns, when it is more difficult to turn a profit (Beckett 1986; Gort 1969). Prospective buyers may be discouraged by the scarcity of capital during downturns, but previous studies nonetheless show that firms are more likely to sell when the economy is faring poorly. Hence:

*Hypothesis 8:* Aggregate demand will be negatively associated with selling.

#### **CAPITAL AVAILABILITY**

Financial economists, industrial organization economists, and organizational sociologists (Golbe and White 1988; Haunschild 1993; Nelson 1959; Stearns and Allan 1996) expect that buyers are more likely to be on the prowl when capital is readily available. Some argue that prospective buyers find it easier to raise capital when the stock market

is high (Greer 1992). Because railroad capital was often raised in London (Ripley 1915; Tedlow 1991), we expect British economic conditions to best predict acquisitions. (In a prior study, we found that British capital availability best predicted railroad foundings [Dobbin and Dowd 1997].)

*Hypothesis 9:* Capital availability will increase the buying of firms.

#### **MERGER WAVES: SHOCK AND IMITATION**

Financial economists note that mergers occur in waves, or multiyear periods of high activity brought about by economic shocks. They typically measure shocks indirectly via industry mergers in the preceding year (Mitchell and Mulherin 1996; Town 1992). Sociologists sometimes attribute merger waves to bandwagons, and they likewise model waves with recent acquisitions (Haunschild 1993; Stearns and Allan 1996).

*Hypothesis 10:* Prior-year acquisitions will increase the likelihood that a firm will sell.

*Hypothesis 11:* Prior-year acquisitions will increase the likelihood that a firm will buy.

#### **CAPITAL ACCUMULATION AND THE COSTS OF PRODUCTION**

Industrial organization economists speculate that capital accumulation reduces production costs in industries like railroading that are characterized by high fixed costs (Tirole 1988:306). Firms with sizable capital investments (e.g., railroad tracks that span vast territories) are able to increase their production (e.g., freight carried) inexpensively relative to firms with smaller capital investments. As total capital accumulation rises, then, the failure rate rises. Industry capital accumulation should increase the likelihood that an incumbent will sell (Stackelberg 1952; Tirole 1988:306). Roy (1997:32) finds indirect support circa 1900: Across industries, few efficiency theories apart from that of capital intensity help to explain mergers. If Berk (1994) is right that economies of scale were not salient in early railroading, capital accumulation may in the present study rep-

resent the total industry resources available for acquisitions.

*Hypothesis 12:* Industry capital accumulation will have a positive effect on selling.

#### **ORGANIZATIONAL LEARNING**

Ginsberg and Baum (1994; see also Amburgey and Miner 1992) use learning theory to explain the finding that a firm that has bought once will buy again. Firms learn how to acquire through experience, and when firms face new challenges they tend to repeat earlier behavior (Cyert and March 1963). Whether previous acquisitions reflect learning per se or capture other unmeasured predictors, they serve as an important control.

*Hypothesis 13:* A firm's previous acquisitions will predict the likelihood of buying.

#### **SIZE OF FIRM**

Sociologists and economists have shown that large firms are more likely than small firms to be buyers (Haunschild 1993) and are less likely to be sellers (Barber, Palmer, and Wallace 1995; Palepu 1986). Large firms become buyers because they have the resources to buy. They are unlikely targets because of the capital required for purchase and because they have the resources to fend off unwanted buyers (Davis, Diekmann, and Tinsley 1994; Palmer et al. 1995). We expect this pattern to hold in railroading.

*Hypothesis 14:* Small firms will be more likely to sell.

*Hypothesis 15:* Large firms will be more likely to buy.

#### **THE LIABILITIES OF NEWNESS AND OLDNESS**

Ecologists (e.g., Baum 1996) embrace Stinchcombe's (1965:148) idea that new firms are susceptible to failure because they lack resources, experience, and connections. Some also find that old firms become ossified and have difficulty adapting to change (Barron, West, and Hannan 1994; Davis and Stout 1992; Greer 1992). We expect a U-shaped relationship between firm age and the likelihood of selling.

*Hypothesis 16:* Both young and old railroads will be susceptible to selling.

#### **NUMBER OF FIRMS AND NUMBER FOUNDED**

We introduce two new control variables: the number of firms in the industry and the number of firms founded in the previous year. When an industry contains many potential targets, the likelihood of any one firm being acquired should be lower. When there are many young and susceptible firms, the likelihood of buying should be higher.

*Hypothesis 17:* Railroads will be less likely to sell when there are many firms in the industry.

*Hypothesis 18:* Railroads will be more likely to buy after periods in which many firms are founded.

### **DATA AND METHODS**

#### **DATA**

We test the above hypotheses using longitudinal data on railroad acquisitions. We model both buying and selling. We have complete data on acquisitions from 1825, when Massachusetts's Granite Railway won the first charter granted in the United States, through 1922, when the state ceased publishing annual reports. We chose Massachusetts because its rail industry was mature long before antitrust law was enforced, and because the state collected exceptionally complete data. No other state collected detailed firm-level data before the Civil War. The federal government did not collect data until 1887, and it neglected small railroads (Fishlow 1966). Massachusetts's annual railroad reports are a gold mine of information. They contain financial records for several hundred railroads, covering the century during which America's modern regulatory regime emerged.

To code acquisitions, we first examined each of the state's annual railroad reports (Massachusetts, Committee on Railways and Canals 1838–1856; Massachusetts, Secretary of the Commonwealth 1857–1869; Massachusetts, Board of Railroad Commissioners 1869–1922). When these reports did not clearly identify which firm was the buyer

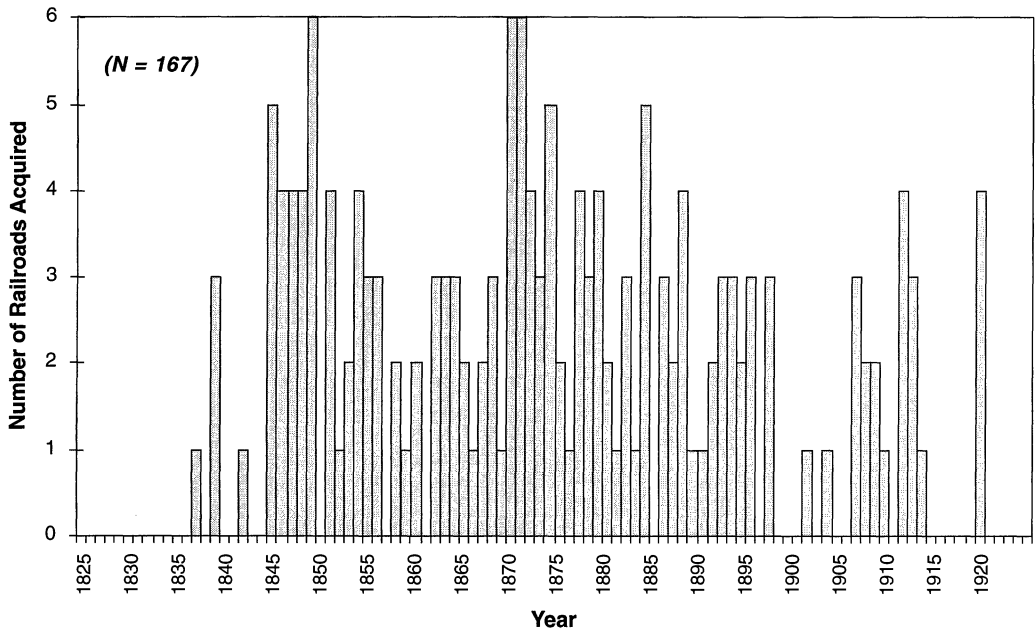


Figure 1. Railroad Acquisitions in Massachusetts, 1825 to 1922

and which the seller, we examined the revised charter in the commonwealth's annual *Acts and Resolves of the General Court* (Massachusetts, General Court 1825–1922). Finally, we cross-checked information on early acquisitions in Poor's (1860) *History of the Railroads and Canals of the United States of America*. Between 1825 and 1922, 318 railroads won charters in Massachusetts and 167 were acquired.

#### DEPENDENT VARIABLES

We model two events: becoming a buyer and becoming a seller. A firm can buy many times. In statistical parlance, a firm remains at risk of buying until it goes out of business or is bought itself. A firm can sell only once—once acquired, a railroad is no longer at risk of being acquired.

The 318 railroads in our population yield a total of 4,694 annual spells (railroad-by-year observations). In the models, we lose 206 spells due to missing data for independent variables. These missing data, in turn, constrain the number of acquisitions we analyze—we model 155 of the 167 instances of selling. Figure 1 represents the number of firms acquired in each year from 1825 through 1922.

For two reasons, we model somewhat fewer instances of buying than of selling. First, if a firm buys multiple railroads in a single year, we code this as a single event because these acquisitions typically flowed from a single decision. We err on the side of caution here, because coding multiple events would tend to improve the fit of our models. Second, in a few cases, the buyer was a non-railroad group or a railroad from another state. We omit these cases, because we do not have antecedent covariates for buyers not in the population. These two exclusion rules leave us with a total of 115 instances of buying, and we lose one additional event because of missing data for independent variables.

#### INDEPENDENT VARIABLES

We collected data on independent variables from the Commonwealth's annual reports, except where otherwise noted. Each of the independent variables is measured annually, that is, each varies over time. For each hypothesis, we report the measure that showed the strongest effects.

*Market concentration* entails two components: the total number of firms, and the market share of each of those firms. The Herfindahl index has become the gold stan-

dard in industrial organization studies because it simultaneously measures both components by summing the squared market share of each firm (Greer 1992:177). Its formula is given by:

$$\text{Herfindahl Index} = \sum_{i=1}^N (S_i)^2,$$

where  $S$  represents the percentage share of individual firm  $i$ , and  $N$  is the number of firms in the market. We use the index to replicate its use in previous studies of mergers. In the present study, the Herfindahl index taps "market share" via the percentage of the industry's gross income earned by each railroad. Zero denotes perfect competition and the maximum value (10,000) denotes perfect monopoly (Tirole 1988:221). We divide the index score by 100 to constrain the range to 0–100.

*Profitability* is often measured as market-to-book-value (market value of all stock/book value of assets) or as return on equity or assets (net income/market value of all stock or net income/book value of assets). Railroading predated the rise of Wall Street, hence data on the market value of stock are not available. Data on assets are missing for over 30 percent of cases. We instead use return on revenues, or what is sometimes called "profit margin" (net income/gross income). We ran models using return on assets, and the results were substantially similar to those reported below.

We represent the policy environment with three variables. A binary variable for the 1897–1922 period captures the effects of the enforcement of *antitrust law*. An interaction between that binary variable and the concentration index allows us to examine the effects of concentration with and without antitrust laws. Similarly, an interaction between the binary variable and profitability allows us to examine the effects of economic performance with and without antitrust laws.

We measure *demand* with Gross National Product (GNP) and with Gross State Product (GSP), collected from federal and state censuses and from cliometricians (Gallman 1966). We interpolated values for missing years and standardized via the wholesale price index series contained in Davis (1972). GSP outperforms GNP in the models.

In studies of the merger waves of the 1960s and 1980s, *capital availability* is often measured by interest rates or bond rates (Haunschild 1993:577). These measures are not available for the nineteenth century, but population ecologists have found a robust alternative—the number of months of recession or growth in a given year (see Hannan and Freeman 1989). We use the number of months the economy was stable or expanded, with periods of war set to 0 because capital flows are constrained in wartime. We calculate measures for both the United States and Britain based on data published by Thorp (1926).

Researchers have measured *merger waves* with recent acquisitions in the industry. We follow that practice, using total previous-year acquisitions of Massachusetts railroads (Crook 1996; Palmer et al. 1995).

*Capital accumulation* is the log of cumulative capitalization, in constant dollars, of all Massachusetts railroads.

Others have operationalized *organizational learning* using the cumulative number of acquisitions the focal firm made in previous years (Ginsberg and Baum 1994). We use a time-varying count of the number of acquisitions the firm has made to date.

*Size* is usually measured with assets, although it has been measured with a number of different variables that represent productive capacity. Because we have incomplete data on assets, we use an alternative measure of productive capacity—the *miles of track a railroad operates*. Track represents the lion's share of each railroad's assets, and it performed better in the analyses than did alternatives such as gross revenues. We drew on Poor's (1860) manual of American railroading to supplement mileage figures found in individual company reports. Figure 2 presents the number of track miles and the number of firms operating in each year.

*Liabilities of newness and oldness* have previously been operationalized with organizational age. We follow Davis et al. (1994) in using the natural logarithm of age, and we include a squared term to represent "oldness." In models of sellers, these variables should produce a U-shaped curve in which age (ln) is negative and age-squared is positive.

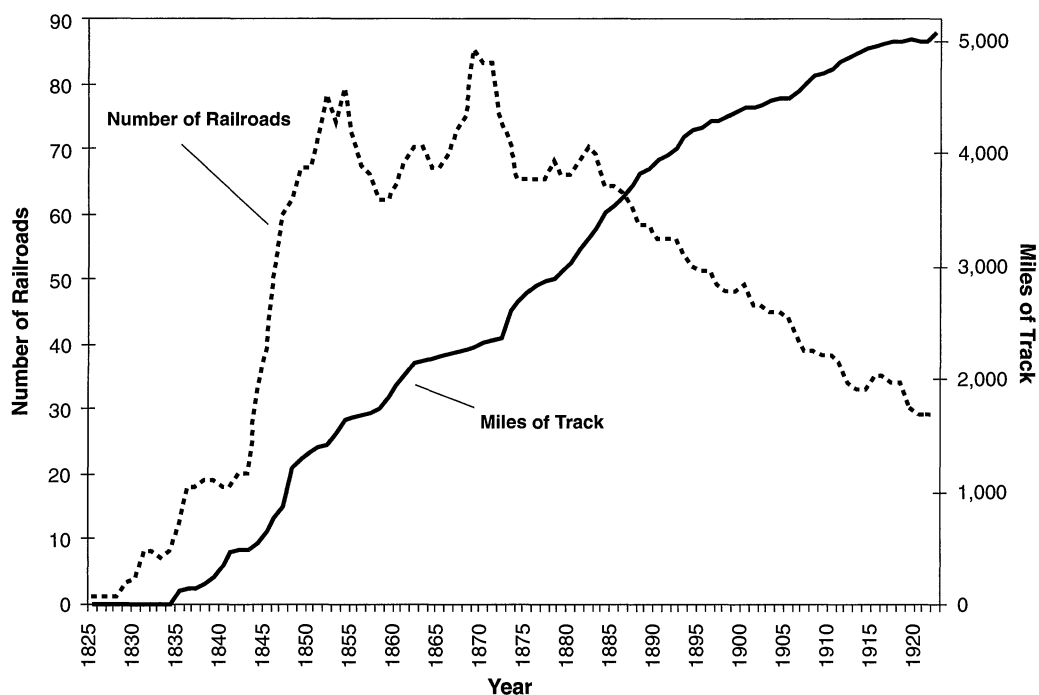


Figure 2. Number of Railroad Companies and Miles of Track: Massachusetts, 1825 to 1922

*Number of railroads* and *number of foundings* are simply the raw number of railroads surviving and the number founded in the previous year. We estimated effects of total foundings over the previous three and five years, but these measures did not improve performance.

#### METHODS

We use event-history methods to model railroad acquisitions, employing the GENMOD procedure in SAS (Allison 1995). We model the probability ( $P$ ) that an acquisition event (selling or buying) occurs for individual railroad ( $i$ ) in year ( $t$ ); The hazard of the acquisition event is expressed by the following transformation:  $\log[-\log(1 - P_{it})]$ . The complementary log-log model facilitates longitudinal analysis of binary dependent variables, and it handles multiple events within a single time period. We evaluate the impact of independent variables with the following formula:  $100[\exp(\text{coefficient}) - 1]$ . This formula details the percent change in the hazard of selling (or buying) that is prompted by a one-unit increase in a given variable.

We assess the interactions of antitrust enforcement (*Anti*) with, respectively, concentration (*Conc*) and profitability (*Prof*) via multiplicative terms (*Anti*  $\times$  *Conc* and *Anti*  $\times$  *Prof*). The inclusion of these multiplicative terms yields an equation that dramatically diverges from an equation that lacks such terms (Friedrich 1982). For the sake of comparison, consider an equation that lacks these multiplicative terms:

$$\log[-\log(1 - P_{it})] = b_0 + b_1 \text{Conc} + b_2 \text{Prof} + b_3 \text{Anti} + \varepsilon. \quad (1)$$

Equation 1 represents an additive model: The impact of a given variable is not shaped by the value of the other variables. Now consider an equation that includes the multiplicative terms:

$$\log[-\log(1 - P_{it})] = b_0 + b_1 \text{Conc} + b_2 \text{Prof} + b_3 \text{Anti} + b_4 (\text{Anti} \times \text{Conc}) + b_5 (\text{Anti} \times \text{Prof}) + \varepsilon. \quad (2)$$

Equation 2 represents an interactive model: The impact of a variable that comprises a multiplicative term (e.g., *Conc*) is conditioned by the value of the other variable in that term (e.g., *Anti*).

Regarding the conditional impact of concentration and profitability, the  $b_1$  and  $b_2$  coefficients in equation 2 express their respective impacts when the binary antitrust variable equals 0 (Friedrich 1982). We illustrate by inserting the 0 value into equation 2:

$$\begin{aligned} \log[-\log(1 - P_{it})] &= b_0 + b_1 Conc \\ &+ b_2 Prof + b_3(0) + b_4(0) Conc \\ &+ b_5(0) Prof + \varepsilon, \\ \log[-\log(1 - P_{it})] &= b_0 + b_1 Conc \\ &+ b_2 Prof + \varepsilon. \end{aligned} \tag{3}$$

A combination of coefficients details the respective impact of concentration and profitability when the antitrust variable equals 1 (Friedrich 1982). Inserting the 1 in equation 2 yields:

$$\begin{aligned} \log[-\log(1 - P_{it})] &= b_0 + b_1 Conc \\ &+ b_2 Prof + b_3(1) + b_4(1) Conc \\ &+ b_5(1) Prof + \varepsilon, \\ \log[-\log(1 - P_{it})] &= (b_0 + b_3) \\ &+ (b_1 + b_4) Conc \\ &+ (b_2 + b_5) Prof + \varepsilon. \end{aligned} \tag{4}$$

The combination of  $b_1$  and  $b_4$  coefficients, then, denotes the impact of concentration during antitrust enforcement, while the combination of  $b_2$  and  $b_5$  coefficients represents the impact of profitability during antitrust enforcement.

Regarding the conditional impact of antitrust enforcement, the  $b_3$  coefficient in equation 2 depicts its impact when the concentration and profitability variables both equal 0 (Friedrich 1982). Inserting the 0 values into equation 2 yields:

$$\begin{aligned} \log[-\log(1 - P_{it})] &= b_0 + b_1(0) + b_2(0) \\ &+ b_3 Anti + b_4 Anti(0) \\ &+ b_5 Anti(0) + \varepsilon, \\ \log[-\log(1 - P_{it})] &= b_0 + b_3 Anti + \varepsilon. \end{aligned} \tag{5}$$

Given that concentration never equals 0 in the present study (i.e., perfect competition never obtains), the  $b_3$  coefficient lacks substantive meaning (Friedrich 1982). Nevertheless, we can investigate its impact at *observed* ranges of concentration, such as concentration's average value (31.9) during antitrust enforcement:

$$\begin{aligned} \log[-\log(1 - P_{it})] &= b_0 + b_1(31.9) \\ &+ b_2 Prof + b_3 Anti + b_4 Anti(31.9) \\ &+ b_5 (Anti \times Prof) + \varepsilon, \end{aligned}$$

$$\begin{aligned} \log[-\log(1 - P_{it})] &= [b_0 + b_1(31.9)] \\ &+ [b_2 Prof + b_5(Anti \times Prof)] \\ &+ [b_3 + b_4(31.9)] Anti + \varepsilon. \end{aligned} \tag{6}$$

The combination of  $[b_3 + b_4(31.9)]$  thus shows the conditional impact of antitrust enforcement at the average value of concentration.

For the purposes of conducting tests of significance for interactions, we construct standard errors for each combination of coefficients. For example, the standard error for the  $b_1$  and  $b_4$  combination is given by the following formula:

$$\begin{aligned} \text{Standard error } (b_1 + b_4) Conc &= \\ &[\text{var}(b_1) + (1)^2 \text{var}(b_4) \\ &+ (1) 2 \text{cov}(b_1, b_4)]^{1/2}, \end{aligned} \tag{7}$$

where var is the value of the variance, cov is the value of the covariance, and 1 is the value of the antitrust variable (Friedrich 1982). The standard errors for the other combinations are obtained by substituting appropriate values into this formula.

Multiplicative terms are linear combinations of their constituent variables; correlations are thus typically high within such combinations, but not between them (see Appendix A). In the present data, concentration has a correlation of .63 with antitrust  $\times$  concentration but a correlation of .17 with antitrust  $\times$  profitability, while profitability has a correlation of .81 with antitrust  $\times$  profitability but a correlation of .08 with antitrust  $\times$  concentration. Multicollinearity here results from a conditional relationship and, thus, "does not 'distort' the . . . coefficients in an interactive model as compared with an additive model" (Friedrich 1982:803). Nonetheless, we attend to the likelihood-ratio tests of nested models to evaluate whether multiplicative terms significantly improve model fit.

We present three nested models for buying and three for selling. First, we examine factors that previous studies have identified (e.g., firm size [miles of track] and age). Second, we add the antitrust enforcement variable in order to inspect its additive im-



pact. Third, we add the interactions of antitrust enforcement with both concentration and economic performance. We report identical models for sellers and buyers despite the fact that some causal factors have been linked to only one outcome. We do so for the sake of simplicity and because previous analysts have treated all of these variables as controls (e.g., Davis et al. 1994). In all models, we measure the effect of end-year values on the likelihood of an event in the subsequent year, thus ensuring that causal variables are measured prior to outcomes.

## FINDINGS

Our findings support a wide range of hypotheses developed in studies of twentieth-century mergers and acquisitions. They also support our contention that under antitrust laws, financiers' threat to sanction predators succeeded in popularizing the finance model. Before 1897, the predictors of merger are compatible with the cooperative model: Failing firms were likely to be acquired, but profitable firms were no more likely to buy; concentration did not increase acquisitions. After 1897, the predictors of merger are compatible with the finance model, but not with the predatory model. Both models suggest that firms should both buy and sell as concentration increases, and this is what we find. But the predatory model suggests that buyers should engage in rate wars, reducing their own profits and bringing potential targets to the verge of bankruptcy. Thus, profitability should have no effect on buying and a negative effect on selling, but this is not what we find. The finance model suggests that profitable firms should use their excess capital to buy rivals before rate wars break out—profitable firms should be buyers but failing firms should not be singled out as targets. Thus, profitability should have a positive effect on buying and no effect on selling, and this is what we find.

## SELLERS

Our analyses of sellers support several hypotheses (see Table 1). In Model 1, demand, capital accumulation, and liability of newness show effects. But for the period as a

whole, neither concentration nor profitability shows the effects that economists expect.

GSP, our measure of demand, has a strong negative effect: Railroads are most likely to sell in a weak economy, when turning a profit is relatively difficult. (GSP performed better than GNP in all models.) The log of accumulated capital demonstrates a positive effect and shows that railroads are likely to sell as the industry's capital investment grows. Logged age reveals a strong, negative effect: New railroads are most likely to sell, all else being equal. Age-squared did not show the expected effect, which would have supported the liability of oldness thesis, hence we omit it from reported models. Our control for the pool of potential sellers, the number of railroads, attains significance only in Model 3. When there are many potential targets, the likelihood of any one railroad being bought declines.

Two controls that typically predict selling fail. First, we do not find that industry-wide acquisitions in one year affect selling in the next year. Economists treat this variable as a proxy for economic shocks, and it may fail in our models because GSP and capital availability adequately capture shocks. Second, we do not find that small railroads—those with few miles of track—are more likely to sell. Previous studies have had mixed findings for this measure; the measure may fail in our case because big railroads were attractive targets.

Three controls that had been linked only to buying also fail in the seller models: capital availability, the firm's previous acquisitions, and the number of newly founded firms. Here we report British capital availability—rather than U.S. capital availability—because the British measure nearly achieved significance in models for buyers while the U.S. measure failed entirely. Most capital came from Britain.

The antitrust variable is added in Model 2. It does not have a significant impact on selling and does not improve the fit of the model ( $\chi^2 = .0016$ ; d.f. = 1). Otherwise, Model 2 mirrors Model 1

In Model 3, we add two interactions. The individual coefficients for concentration, profitability, and antitrust enforcement now represent conditional rather than additive effects; hence, their respective coefficients di-

**Table 1. Estimates of Factors Affecting the Selling of Railroads: Massachusetts, 1825 to 1922**

Variable	Model 1	Model 2	Model 3
Intercept	-27.312** (7.236)	-27.319** (7.232)	-27.526** (7.672)
Concentration index	.004 (.011)	-.004 (.011)	-.016 (.019)
Profitability	-.131 (.093)	-.130 (.094)	-.431** (.130)
Antitrust enforced, 1897-1922	—	.017 (.418)	-3.022** (1.168)
Antitrust × concentration	—	—	.095** (.034)
Antitrust × profitability	—	—	.500* (.233)
Gross State Product	-.110** (.036)	-.110** (.038)	-.111** (.041)
British capital availability	.013 (.016)	.013 (.016)	.014 (.016)
Prior-year acquisitions (in state)	-.080 (.057)	-.080 (.057)	-.085 (.057)
Capital accumulation (log)	3.381** (.957)	3.381** (.957)	3.472** (1.058)
Previous acquisitions	.014 (.058)	.014 (.058)	.004 (.058)
Miles of track	-.004 (.003)	-.004 (.003)	-.004 (.003)
Age (ln)	-.522** (.095)	-.523** (.096)	-.502** (.096)
Number of foundings	.013 (.022)	.013 (.022)	.007 (.022)
Number of railroads	.012 (.008)	.012 (.008)	-.016* (.008)
Log-likelihood	-635.03	-635.03	-628.07
Number of spells	4,488	4,488	4,488
Number of events	155	155	155

Note: Standard errors are in parentheses.

\* $p < .05$  \*\* $p < .01$  (one-tailed tests)

verge from those in previous equations (Friedrich 1982). The inclusion of both interactions significantly improves the fit of the model ( $\chi^2 = 13.9$ ; d.f. = 3). We also found significant improvements in fit when adding only one interaction at a time. Thus, the interactive model is clearly superior to the additive model.

Three control variables—demand, accumulated capital, and age—still show significant effects in Model 3. The number of railroads now produces a significant coefficient. In the presence of both interactions, then, an

increase in the number of railroads reduces the likelihood that a given firm will sell. The remaining variables performed much as they did in the previous models.

Model 3 offers strong support for the conditional impact of concentration on selling. Its insignificant coefficient ( $-.016$ ) reveals that concentration has no impact on selling before antitrust enforcement (i.e., when the antitrust dummy equals 0). The combination of coefficients shows that, in the wake of antitrust enforcement, concentration has a significant impact ( $-.016 + .095 = .079$ ; s.e.

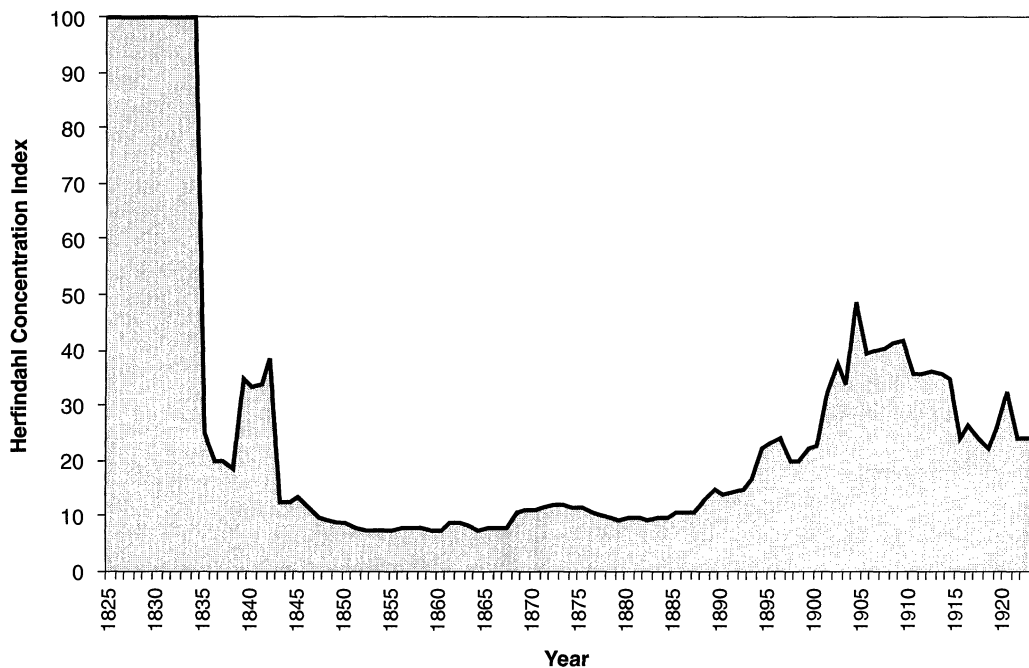


Figure 3. Concentration among Massachusetts, Railroads, 1825 to 1922

= .029;  $p < .01$ ). Each one-unit increase in concentration increases the hazard of selling by 8.2 percent [ $100(\exp(.079) - 1)$ ].

Model 3 also offers strong support for the conditional impact of profitability on selling. Its significant coefficient ( $-.431$ ) shows that low profitability encourages selling before antitrust enforcement. Indeed, each one-unit increase in profitability reduces the hazard of selling by 35 percent [ $100(\exp(-.431) - 1)$ ]. The combination of the profitability and antitrust  $\times$  profitability coefficients shows no significant impact in the aftermath of antitrust enforcement ( $-.431 + .500 = .069$ ;  $s.e. = .195$ ;  $p > .05$ ). Unprofitable firms are more likely to sell before antitrust enforcement, but no more likely to sell after antitrust enforcement.

Model 3 also provides conditional effects for the antitrust enforcement variable. Its significant coefficient ( $-3.022$ ) demonstrates that antitrust enforcement reduces selling when concentration and profitability both equal 0. This negative coefficient lacks substantive meaning, however, because concentration never attains this value. We assess antitrust enforcement at values that are observed between 1897 and 1922 (see Figure 3). When concentration equals 19.9 (the

minimum), the conditional impact of antitrust enforcement is  $-1.133$  ( $s.e. = .555$ ;  $p < .05$ ). When concentration equals 31.9 (the average), its conditional impact equals .005 ( $s.e. = .496$ ;  $p > .05$ ). When concentration equals 48.8 (the maximum), its conditional impact equals 1.609 ( $s.e. = .786$ ;  $p < .05$ ). That is, at the highest level of concentration, antitrust enforcement increases the hazard of selling by nearly 400 percent. As concentration values increase, the impact of antitrust enforcement likewise takes a positive trajectory. This is consistent with the interaction described above—after antitrust enforcement, increasing concentration positively affects the likelihood of selling. Thus, antitrust enforcement per se did not prompt a bandwagon effect in Massachusetts, as it did outside of New England (Ripley 1915); it did, however, trigger the positive impact of concentration.

In Figure 3, we see that concentration rises before 1897. The analyses show that this rise did not increase selling. Concentration continues to rise after 1897, and then it does increase selling. It declines toward the end of the period, as railroads divided traffic more evenly. In diagnostic runs, we omitted the early years of railroading, when concentra-

tion was very high because of small numbers. The results remained substantially the same.

Model 3 supports our core hypotheses. We predicted that the cooperative model would cause concentration to have no effect on sellers and profitability to have a negative effect, and this was the pattern up to 1897. The predatory and finance models both prescribe selling under concentration, and this is what we find from 1897 forward. However, the models carry different predictions about profitability. Under the predatory model, firms should be driven to bankruptcy and should sell when their ledgers are written in red. Under the finance model, sellers should not be in particularly dire financial straits, and this is the pattern we find.

### BUYERS

Our analyses of buyers likewise support diverse theories (Table 2). In Model 1, previous acquisitions, miles of track, and number of foundings affect buying. When we examine the entire period, concentration and profitability do not show the effects expected by economists.

Our measure of British capital availability nearly achieves statistical significance ( $p = .09$ ), suggesting that it may stimulate acquisition as it does the founding of railroads (Dobbin and Dowd 1997). Railroads experienced in acquiring are likely to buy, as suggested by learning theorists. Railroads with many miles of track are likely to buy, as are established roads. Liabilities of newness are evident, in that railroads are likely to buy as the number of new railroads rises. The merger wave thesis, as operationalized by prior-year acquisitions, fails as it did for sellers—probably because we have superior measures of economic shocks. Three variables that were expected to affect only prospective sellers—demand (GSP), capital accumulation, and total number of railroads—do not show effects on buyers.

We add the antitrust enforcement variable in Model 2. Its impact is both significant and negative: The onset of antitrust enforcement reduces the hazard of buying by 85 percent [ $100(\exp(-1.906) - 1)$ ]. Its inclusion significantly improves the fit of the model ( $\chi^2 = 12.32$ , d.f. = 1). However, we caution that the negative effect is additive. In fact, its in-

teractions with concentration and profitability positively affect buying during antitrust enforcement. The effects of the remaining variables resemble those found in the previous model.

In Model 3, with interactions, individual coefficients for concentration, profitability, and antitrust enforcement represent conditional effects. The interactions significantly improve the fit of the model, ( $\chi^2 = 11.22$ ; d.f. = 2). Each also significantly improved model fit when entered alone. The interactive model, then, is notably superior to its additive counterpart. The effects of control variables are virtually unchanged.

Model 3 clearly demonstrates the conditional impact of both concentration and profitability on buying. Before antitrust enforcement, concentration has no effect on the likelihood of buying ( $-.030$ ;  $p < .01$ ). In the aftermath of antitrust enforcement, however, concentration has a sizable effect ( $-.030 + .155 = .125$ ; s.e. = .044;  $p < .01$ ): Each one-unit increase in concentration increases the hazard of buying by 13 percent [ $100(\exp(.125) - 1)$ ]. Profitability shows a similar pattern: Its effect before antitrust enforcement ( $-.234$ ) is not significant, but its effect after antitrust is significant ( $-.234 + 1.410 = 1.176$ ; s.e. = .637;  $p < .05$ ). During antitrust enforcement, a one-unit increase in profitability increases the hazard of buying by 224 percent [ $100(\exp(1.176) - 1)$ ]. Firms that had the cash to buy, bought.

Model 3 also depicts the conditional impact of antitrust enforcement on buying. It shows a negative effect ( $-7.506$ ) at concentration's theoretical minimum of 0. At concentration's observed minimum of 19.9, the impact of antitrust enforcement is  $-4.421$  (s.e. = 1.053;  $p < .01$ ). At concentration's mean of 31.9, antitrust enforcement's impact drops to  $-2.561$  (s.e. = .755;  $p < .05$ ). At concentration's maximum of 48.8, antitrust enforcement's impact (.059) becomes both positive and nonsignificant (s.e. = 1.060;  $p < .05$ ). Thus, as concentration rises, the impact of antitrust enforcement veers toward positive values and insignificance. This is consistent with the conditional impact of concentration described above. Indeed, during the antitrust era, the rise of concentration from its average (31.9) to its maximum (48.8) raises the hazard of buying by over

Table 2. Estimates of Factors Affecting the Buying of Railroads: Massachusetts, 1825 to 1922

Variable	Model 1	Model 2	Model 3
Intercept	-3.741 (8.418)	-4.408 (8.101)	-2.252 (8.678)
Concentration index	-.021 (.020)	-.004 (.015)	-.030 (.027)
Profitability	-.173 (.212)	-.155 (.264)	-.234 (.266)
Antitrust enforced, 1897-1922	—	-1.906** (.555)	-7.506** (1.925)
Antitrust × concentration index	—	—	.155** (.052)
Antitrust × profitability	—	—	1.410* (.683)
Gross State Product	-.056 (.043)	-.038 (.042)	-.040 (.047)
British capital availability	.032 (.019)	.035 (.019)	.033 (.019)
Prior-year acquisitions (in state)	.013 (.066)	.009 (.067)	.002 (.069)
Capital accumulation (log)	-.105 (1.125)	-.031 (1.080)	-.221 (1.158)
Previous acquisitions	.178** (.029)	.185** (.031)	.192** (.031)
Miles of track	.001** (2e <sup>-4</sup> )	.001** (3e <sup>-4</sup> )	.001** (3e <sup>-4</sup> )
Age (ln)	.244 (.136)	.260 (.139)	.273* (.141)
Number of foundings	.081** (.026)	.084** (.026)	.076** (.027)
Number of railroads	-.001 (.010)	-.004 (.010)	-.011 (.010)
Log-likelihood	-469.20	-463.04	-457.42
Number of spells	4,488	4,488	4,488
Number of events	114	114	114

Note: Standard errors are in parentheses.

\* $p < .05$  \*\* $p < .01$  (one-tailed tests)

200 percent (16.9 × 13 percent). Thus, rather than spurring a flurry of acquisitions, antitrust enforcement initiated the positive impact of concentration.

Model 3 provides impressive support for our central hypothesis. Antitrust enforcement catalyzed two merger strategies: Buy as industry concentration increases (to preclude rate wars) and buy with excess profits (to dampen competition).

We explored the robustness of these conditional effects. First, while multicollinearity is expected (and unproblematic) for vari-

ables in the multiplicative terms (Friedrich 1982), high correlations among other variables merit inspection. Appendix A shows that correlations among our control variables are well within the normal range. We nevertheless reran the analyses, systematically excluding each control variable with a correlation of .60 or more. The conditional results remained significant and substantively identical: Multicollinearity does not distort the coefficients of control variables.

Second, we explored whether the conditional effects of concentration and profitabil-

ity are merely the result of industry maturation, by controlling for age. The conditional effects remained significant. Third, we explored whether it was passage, and not enforcement, of antitrust law that brought the changes we observe. We replicated the final model for each outcome, but broke the time period at 1887 rather than at 1897. This produced a significantly poorer fit in each case, confirming that the enforcement of antitrust was the key change. Finally, to better replicate previous studies, we replaced "profit margin" with a measure of return on assets. This caused us to lose over 30 percent of our cases, decreasing the number of spells to 3,128. While a number of controls were rendered insignificant, the coefficients for our key interaction terms were substantially similar, except that in the model for buyers, the profitability  $\times$  antitrust interaction did not achieve significance.

## CONCLUSION

### *THE VIEW FROM ECONOMIC SOCIOLOGY*

Economic sociology's principal insight is that rational behavior is socially produced. That is, rational behavior is learned rather than innate, with the learning process influenced by persuasion, networks, and power (Dobbin and Baum 2000). Not only do we learn rational behavior, but what this behavior entails can (and does) vary by context. By contrast, the leading, atomistic view in economics glosses over context. Price theorists treat rational behavior as innate and uniform rather than as learned and varying by context (Adams and Brock 1991). The difference in perspective is reflected in method: Micro-economists rely on methodological individualism; sociologists rely on what might be called methodological historicism. Instead of looking for universal behavioral laws, economic sociologists look for the social conditions that spawn particular behavioral patterns, and they make comparisons across time or space to show that milieu matters. While our study is no exception, we do take pains to control for the causes of acquisition posited by economists.

We conduct a sort of natural experiment in observing the effect of new antitrust laws on acquisitions among railroads. Previous

sociological studies have demonstrated that the vigor of antitrust regulation affects the level of mergers. They thereby show the efficacy of policy, but they do not necessarily contradict the view of institutional economists who see property rights—the government's rules of the game—as affecting firm strategy (North 1990). We go two steps further. We show, first, that the introduction of antitrust laws led not merely to a change in the level of mergers but to a change in the logic that informed such mergers. Railroads followed a new prescription for when to merge, and this can be seen in a change in the conditional variables that predict merger. Second, we show that coercion influenced which of two broad logics would prevail after antitrust laws made cooperation illegal. Structural power mattered a great deal in the development of this new strategy.

Industrial organization economists tend to see new market regulations as having direct behavioral implications for firms (Eisner 1991; High and Gable 1992). Managers respond, as if by reflex, to the incentives produced by policy. Economic sociologists tend to see new policies as framing the social selection of a dominant business model from among several viable alternatives. At the heart of this process are power and persuasion, submission and imitation. We build on this approach by showing that a new policy led to a new business model. It did so not because hundreds of railroad managers responded identically to a policy stimulus, but because one group used interindustry power to promote its preferred response. Railroaders saw at least two viable responses to antitrust law, and a power play by financiers determined which of these would dominate.

### *ANTITRUST, FINANCIER POWER, AND A NEW BUSINESS MODEL*

By the late 1880s, major industries in the United States and Europe had organized to stabilize prices and protect their members. America's railroads were not alone—industries ranging from sugar to steel rails, from salt to cast iron pipe, created cartels, pools, and trusts to fix prices and coordinate output. Many of America's leading lights, including John B. Clark (1887), Charles

Francis Adams (1893), and Henry Carter Adams ([1886] 1954), heralded cartels as the way of the future. Cooperation became the dominant business strategy in railroading and in much of manufacturing.

When Congress undermined the cartel with the Interstate Commerce Act and the Sherman Act, industry leaders argued that it was in the interest of big, independent railroads to become predators. Financiers countered with a new model: Firms that were in danger of becoming entangled in rate wars should merge amicably. This new model contained prescriptions for merger that survive today. On the one hand, firms should use excess profits to buy their rivals, so as to dampen competition. To do so would have been irrational under the reign of the cartel. On the other hand, firms should buy other railroads as the regional market becomes concentrated, because rate wars break out under concentration. Under the cartel, concentration did not stimulate rate wars or mergers.

Power ultimately quashed predation when financiers threatened to cut off predators' access to capital. Because their banks controlled not only stock trades but bonds and loans, financiers held considerable sway over even the most stubbornly independent railroads. We find that, on the whole, railroaders succumbed to this pressure—they began buying, and selling, under the conditions prescribed by financiers. They continued to do so despite the occasional rate war, as in 1909 when the Boston and Maine raised its cannons for a bloody four-month battle (Ripley 1912:439).

#### **POWER IN INSTITUTIONAL THEORY**

Our findings build on the structural theory of power that Fligstein (1990) and Roy (1997) have developed in their studies of business strategy. Fligstein finds that following antitrust amendments circa 1950, finance managers used persuasion to promote their own strategy of diversification. Power resided in a network of management professionals with a common interest. Roy finds that when antitrust law was first enforced, large manufacturers and their backers coerced small firms to merge: Coercion was firm-to-firm and direct. We find coercion at

the industry-to-industry level: The banking industry used a blanket threat to quash the predatory strategy in railroading.

To be sure, rhetoric and imitation helped to diffuse the finance model. As Meyer and Rowan (1977) might have predicted, industry leaders such as C. F. Adams enumerated the benefits of the financier strategy and the dangers of predation. Imitation was at the heart of the process, as minor firms followed industry leaders (Haveman 1994). But we have shown that interindustry power, in the form of an explicit threat, appears to have been the deciding factor in the struggle between two new business models.

The finance model turned out to be something of a self-fulfilling prophecy, for the process we describe helped to expand the model's constituency by expanding the number of like-minded investors. Friendly mergers in railroading and manufacturing circa 1900 produced a huge boom in the stock market as privately held firms became publicly traded (Roy 1997). Because firms bought their rivals at fair market prices, ownership was increasingly spread across many investors. Predation, by contrast, would have bankrupted rival owners and thereby concentrated ownership. Under the finance model, then, more and more firms had large numbers of shareholders. More and more investors were diversified, and they favored amicable over predatory mergers because predation threatened the value of the small firms in their portfolios.

Thus America came to prefer the financier strategy. Predation was for big firms that were independent of the control of financiers and investors, and the merger wave and consequent growth of the stock market meant that there were fewer and fewer large independents—in sharp contrast to Britain, where the family-held firm still dominated (Chandler 1990), and to France, where the small independent firm would survive into the 1960s (Kogut 1999). In the United States, the model preferred by a small group of financiers became the model preferred by all. The success of this model can be seen in the literature on twentieth-century mergers, which confirms that under conditions of concentration, profitable firms use excess capital to buy competitors with the aim of precluding price wars (Bain

and Qualls 1987; Greer 1992; Weir 1997). This was simply not the case before antitrust laws were enforced.

### HOW ANTITRUST BECAME INVISIBLE

What is perhaps most striking about our story is the remarkable role antitrust played in constituting the modern market. That role had become all but invisible. Antitrust enforcement extinguished a form of industrial cooperation that was widely viewed as the way of the future, and it spawned a new business model. In railroading, antitrust enforcement altered the logic not only of acquisitions but of market entry (Dobbin and Dowd 1997). Under the new thinking, upstarts invited rate wars. In consequence, while existing companies continued to build new lines, market entry by new firms all but stopped.

Despite much evidence that antitrust law revolutionized America's industrial environment, it plays at best a supporting role in theories of industrial organization. Antitrust policy has faded into the background in large measure because we buy into the rhetoric that was built for it. The architects of antitrust policy sought to prevent the rise of aristocratic power in American industry—they did not have a new model of the modern economy in mind. But antitrust law coincided with unrivaled growth. It was soon described not as a form of state intervention to prevent concentrated power but as a pro-growth policy. Adam Smith had argued in *The Wealth of Nations* that policies that reinforce natural economic laws lead to growth; policies that contravene natural laws lead to failure. This popular vision of the relationship between state and economy, in which economic laws precede human society and dictate public policy, colored America's perception of antitrust policy. Antitrust policy was soon cast not as a protection against the rise of baronial economic power, but as the foundation of a true market economy. It was transformed from an intervention into the human-made incarnation of the natural laws of the market (Dowd and Dobbin forthcoming).

How different American economic history might be if the Supreme Court had, in 1897, done what 15 of its decisions over the previous decade suggested it would do: strike down the Interstate Commerce Act and the

Sherman Act. Would cartels have been revived? Would the merger wave in manufacturing and interstate railroading have been avoided? It seems possible. As Chandler (1990) argues of railroading:

If interfirm agreements on rates, allocation of traffic, and pooling of profits had been legally enforceable in the courts, as they were in other countries, a powerful incentive for system-building . . . by acquisition, merger, and new construction would have disappeared. (P. 57)

Would the American economy have nonetheless achieved the rapid growth that ensued over the next decades? It seems possible. With cartels in place, America had seen remarkable growth between the 1870s and the 1890s, as had her two closest rivals, Britain and Germany. And evidence from diverse American industries suggests that post-1897 acquisitions would not improve productivity (Roy 1997, chap. 2). How different the world might be today if the largest and most prosperous economy in history had completed its industrial revolution with cartels and trusts intact.

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## Appendix A. Correlations for Variables in the Analyses

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1) Concentration	1.00	—	—	—	—	—	—	—	—	—	—	—	—	—
(2) Profitability	.01	1.00	—	—	—	—	—	—	—	—	—	—	—	—
(3) Antitrust enforced	.58	.09	1.00	—	—	—	—	—	—	—	—	—	—	—
(4) Antitrust × concentration index	.63	.08	.96	1.00	—	—	—	—	—	—	—	—	—	—
(5) Antitrust × profitability	.17	.81	.31	.29	1.00	—	—	—	—	—	—	—	—	—
(6) Gross State Product	.52	.14	.79	.77	.24	1.00	—	—	—	—	—	—	—	—
(7) British capital availability (log)	.01	-.02	.06	.05	.01	.03	1.00	—	—	—	—	—	—	—
(8) Prior-year acquisitions	-.34	-.07	-.38	-.34	-.13	-.34	.08	1.00	—	—	—	—	—	—
(9) Capital accumulation (log)	.20	.18	.65	.63	.20	.89	.01	-.20	1.00	—	—	—	—	—
(10) Previous acquisitions	.10	.06	.20	.21	.09	.21	-.01	-.07	.21	1.00	—	—	—	—
(11) Miles of track	.09	-.03	.16	.19	-.01	.17	.01	-.06	.17	.48	1.00	—	—	—
(12) Age (ln)	.30	.31	.55	.54	.33	.59	-.04	-.22	.57	.46	.32	1.00	—	—
(13) Number of foundings	-.35	-.11	-.42	-.41	-.13	-.51	.17	.52	-.44	-.13	-.11	-.40	1.00	—
(14) Number of railroads	-.70	.01	-.49	-.48	-.16	-.40	-.02	.34	-.09	-.07	-.07	-.19	.14	1.00

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