

REGULATORY UNCERTAINTY AND INVESTMENT: EVIDENCE FROM ANTITRUST ENFORCEMENT

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What Explains Changes in Business Investment?

Business investment is volatile and hard to explain. Factors that should affect investment as a matter of theory have little influence in practice, and even ad hoc empirical studies have had at best fair to middling success.

The investment literature follows a well-trodden path. High on the list of possible factors that should drive investment activity are easily measured variables related to the cost of investment or the demand for goods. In theory, interest rates should matter, as should the price of capital goods. Tax policy affecting investment should also matter. The logic in all three cases—interest rates, the price of capital goods, and tax policy—is compelling. The lower the cost of new investment and the higher the expected returns, the more business will invest. Similarly, actual consumer demand and company profits should matter. It seems plausible that a company or industry with strong demand or a company awash in cash flow would invest more. Another plausible line of inquiry holds that investors' demand for assets should matter. It focuses on the stock market value of corporations divided by their book value (Tobin's q), on the theory that stock valuations in excess of replacement cost will induce new investment. In practice, however, all of these approaches leave a good deal of the fluctuation in business investment unexplained.

What's missing? Arguably, politics is missing. In particular, political uncertainty poses substantial risks to investment. That uncertainty can take various forms. In extreme cases, a shift in the political climate will threaten property rights, the enforceability of contracts, the

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repatriation of profits, and the integrity of the monetary standard. These are of course not mere theoretical possibilities. Revolution, expropriation, inflation, and exchange controls do take place. It bears emphasis that a catastrophe does not have to take place. Even a substantial but unrealized probability of a major change will cause business to wait and see. Fears and not just actual events matter.

Economic activity in the United States would seem at first glance to be immune from political uncertainty, but it is not. Even the comparatively placid U.S. political landscape has generated risks for business. In the case of specific American industries, such as pharmaceuticals, shifts in the regulatory framework, or even threats of shifts, may affect investment, and indeed they have. Other U.S. policies, such as environmental and labor law, may affect investment across a number of industries. Though a possible shift to a new regime may not be catastrophic, the intervening uncertainty often takes its toll. The prospect of change often represents danger as well as opportunity, and even a small but non-negligible likelihood of disaster will have chilling effects on business investment. Wait-and-see is often an option, and frequently a good one.

Though largely ignored in the business cycle literature, the idea that political uncertainty affects the business climate is not new. The founder of American business cycle research, Wesley Clair Mitchell (1913), attributed the 1911–12 recession to uncertainty about the legal status of the corporation during the heyday of trust-busting. Kenneth Roose, in his study of the 1930s' depression and slow revival, finds that "the timing of investments may be affected by uncertainties arising from noneconomic [i.e., political or social] sources" (Roose 1954: chap. 4). He mentions a variety of political and regulatory factors—securities legislation, the National Labor Relations Act, Roosevelt's attempt to restructure the Supreme Court, and the New Deal's shifts on monopoly policy (from supporting business combinations in the NIRA to opposing them with Thurman Arnold's celebrated trust-busting). Friedman and Schwartz (1963: 495–96) mention Roose's treatment approvingly and expand on it. Recent theoretical work on "irreversible investment under uncertainty" provides formal underpinnings to this line of reasoning.

Though intriguing, the notion that uncertainty may affect investment and output over time has generated relatively little empirical work, perhaps because of the difficulty of measuring uncertainty. A number of studies undertaken so far use stock volatility as a proxy for uncertainty, but interpretations of that proxy have varied. Few studies look at the effects of political or regulatory uncertainty.

In this paper, I use antitrust enforcement as a measure of policy

uncertainty. At the dawn of the 21st century, this choice may be puzzling. Against the background of actual American experience in the 20th century, it is not. Over the last 100 years, the Sherman and Clayton acts served as important economic levers. They constituted the federal government's de facto corporation policy—the federal response to the rise and growing power and wealth of the modern corporation, or as some observers contend, America's answer to socialism. In fact, early commentators referred to a single “trust and corporation problem.” Tellingly, the Federal Trade Commission (FTC), founded in 1914, replaced the Bureau of Corporations. To this day, antitrust policy influences merger, stock ownership, expansion by internal growth, and a broad variety of business practices. Antitrust policy has a long and volatile record, its prohibitions have often been unclear, it has been enforced at one time or another against every major industry group, though especially in manufacturing, and its enforcement has often had a substantial political component.

Episodes of enforcement in specific industries were also often accompanied by related policy controversy, as illustrated by experience in pharmaceuticals, steel, oil, and automobiles. Episodes of enforcement directed at industry in general often accompanied initiatives in other, related areas. For example, the forceful use of antitrust under Roosevelt, Taft, and Wilson was linked in time, and arguably politically, with the passage of the federal income tax. Two decades later, the revival of antitrust in the late 1930s under Thurman Arnold coincided with the New Deal's broader attack on business and America's “Hundred Wealthy Families.” Based on its own power to shape and, often, reshape business organization and conduct, and on the sorts of other government actions that often accompany it, antitrust enforcement offers a possible measure of uncertainty-causing economic policy.

Capital markets also support the view that antitrust enforcement matters, either by itself or as a proxy for a broader regulatory equilibrium. A growing body of evidence suggests that trust-busting hurts stock prices. Confirming episodes include Theodore Roosevelt's attack on Standard Oil, which coincided with the Panic of 1907; Taft's assault on U.S. Steel and other large corporations in 1911; the lax and then strict antitrust policy under Coolidge and Hoover, which coincided with the boom and crash of the 1920s; the revival of antitrust in the late 1930s, which occurred at the same time as the October 1937 crash; and the bear market during Kennedy's 1962 showdown with Big Steel (Bittlingmayer 1992, 1993; Heath 1969). Additional evidence comes from the shift in antitrust enforcement in the 1980s and

1990s, which coincided with a long-term merger and stock market boom. The stock market offers signals, perhaps noisy ones, but signals nonetheless, of changes in systematic risk and projected future cash flows. Hence, the record from the stock market is consistent with the view that unsettled antitrust and related loose policy canons increased uncertainty and lowered expected returns.

Clearly, other policies and other dangers also matter. Uncertain monetary policy or high inflation may hamper financial intermediation and the financing of new investment; taxation of corporate income or assets lowers investment returns; and threatened expropriation or forced sales to the state may affect investment. I focus on U.S. federal antitrust enforcement because it has a long history, because it affects important aspects of business behavior and can serve as a rough indicator of business policy, because the policy has been volatile and its implications uncertain, and because enforcement by means of lawsuits allows the generation of crude but serviceable measures of policy.

This paper proceeds in first reviewing some major developments in antitrust and focusing on experience in four major industry groups: primary metals, vehicles, pharmaceuticals, and petroleum. My aim is to bring alive controversies that may be mere history today, but that deserve our attention as long as economists use data from the 20th century. I also hope to illustrate the connection between antitrust and related policy controversies. Next, I present the theoretical links between investment and antitrust and other sorts of regulation, emphasizing both what might be termed the static effects of antitrust enforcement, as well as recent advances in our understanding of how uncertain policies might affect investment. The empirical section presents the formal statistical model and results using panel data for 21 major industry groups over the 1947–91 period. The variables are plant and equipment investment, GDP, and case filings against exchange-listed firms, all at the industry level. The statistical results are based on a version of widely used investment models, augmented with measures of antitrust enforcement. The specification offers two further innovations. First, I do not use lagged capital stock as an explanatory variable because this is likely to be a seriously flawed measure and because doing so amounts to using a lagged dependent variable. In its place, I use levels of lagged industry GDP (value-added). Second, I reject first-difference methods for dealing with autocorrelated residuals because of the severe bias those methods impart in the presence of measurement error. In their place, I estimate coefficients using original levels of variables and employ bootstrap methods to assess the significance of coefficients.

Antitrust Enforcement and Related Policies

American antitrust enforcement is directed at a number of offenses: mergers, price fixing, and other forms of alleged collusion such as patent licensing, vertical restraint, and monopolization. Legal standards and prosecutorial zeal have fluctuated over time for each type of offense. Large, single-firm monopolization cases, like those filed against IBM and Microsoft, are probably the most controversial and least stable (Kovacic 1989).

For most of the 1947–92 period, four statutes formed the backbone of federal antitrust. The 1890 Sherman Act prohibits “every contract, combination or conspiracy in restraint of trade” and makes it illegal to “monopolize or attempt to monopolize.” The common-law language provides little concrete guidance, and the actual influence of the law depends on a complex, unstable, and politically sensitive interaction of courts, Congress, and the executive branch, in particular the use of prosecutorial discretion. Largely in response to early court interpretations and complaints from all quarters about enforcement (too much for some, too little for others), the 1914 Federal Trade Commission Act and the Clayton Act created a second, nominally independent enforcement agency (the FTC), and prohibited price discrimination and other practices, as well as stock acquisition and interlocking directorates where the effect was “substantially to lessen competition.” A long line of criticism regards the FTC as a rogue elephant: ungainly, unfocused, and prone to sporadic, fruitless, and controversial campaigns and conflict with business, the courts, and Congress. The 1950 Celler-Kefauver amendment closed the “asset loophole” for mergers, but ultimately had the effect of strengthening merger policies overall.

Other changes occurred in the 1970s. Congress raised the penalties for criminal convictions from a maximum of \$50,000 and one year in jail to \$1 million and three years in jail in 1974, and it granted to states the right to bring suits on behalf of their residents in 1976. Mandatory pre-merger notification in 1976 under the Hart-Scott-Rodino Act was probably the most far-reaching change. Earlier administrations had instituted pre-merger clearance on an administrative basis, but the practice offered little practical protection. Coolidge’s antitrust authorities gave administrative approval to mergers as well as association agreements, but Hoover’s attorney general renounced the policy in October 1929 and prosecuted some of the arrangements approved earlier. Eisenhower’s antitrust authorities issued provisional opinions, but reserved the right to sue later (Kovaleff 1980: 71). Acquiring firms simply took their chances in the 1950s and 1960s, and many suits were filed against mergers that had taken place five or ten years

earlier. As a result, an increase in merger case filings exposed all firms that had completed a merger within the last decade or longer—essentially all Fortune 500 companies and more—to the possibility of a divestiture suit. The current regime of legislatively enacted pre-clearance under Hart-Scott-Rodino, though lacking explicit safeguards, has largely eliminated that danger.

Figure 1 shows the number of federal antitrust cases filed against exchange-listed firms over the 1947–91 period for all industries, while Figure 2 shows the record separately for durable, nondurable, and nonmanufacturing sectors. Figure 3 shows the budget appropriations for the two agencies, the Department of Justice (DOJ) and the FTC, which has consumer protection as well as antitrust duties.

The statistics deserve some background. The low level of enforcement during the Korean War is consistent with experience during World War I and II: an administration with an anti-business stance restrains enforcement as part of a *quid pro quo* for business's help with the war effort (see Himmelberg 1976, Hawley 1966). The sharp increase in filings in 1956 followed two years of deliberation by the Eisenhower administration. The *Report of the Attorney General's*

FIGURE 1
ANTITRUST CASES FILED INVOLVING AT LEAST ONE
EXCHANGE-LISTED FIRM, 1947–91

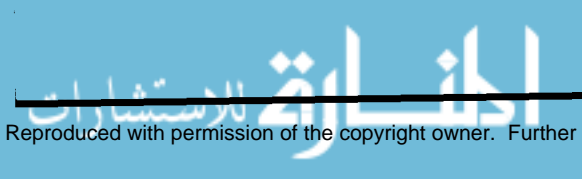
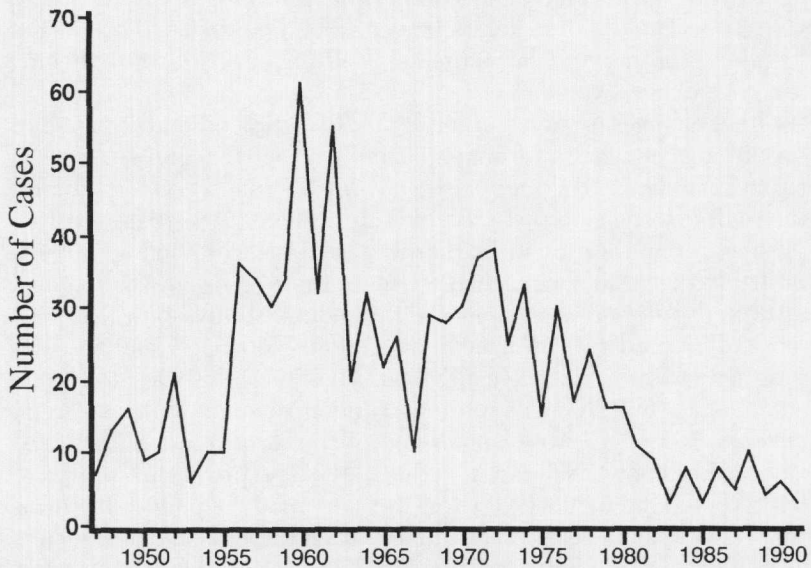
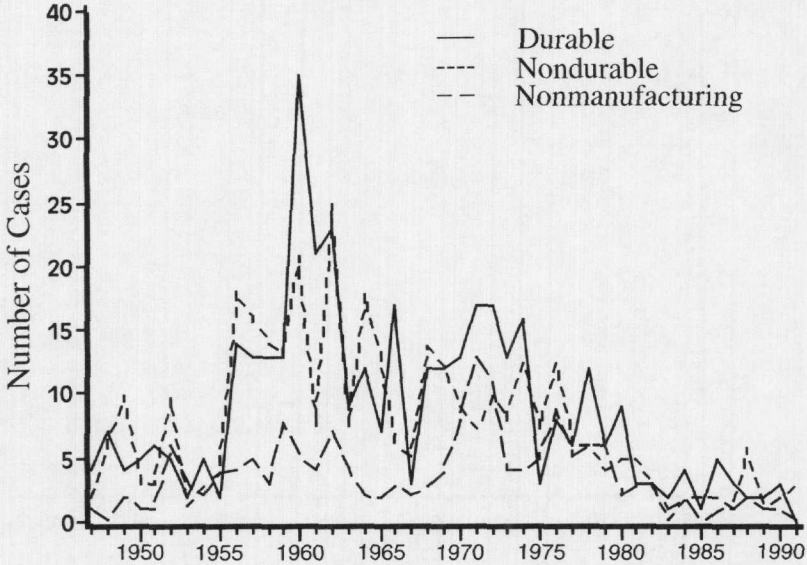


FIGURE 2
ANTITRUST CASES AGAINST EXCHANGE-LISTED FIRMS
BY SECTOR, 1947-91

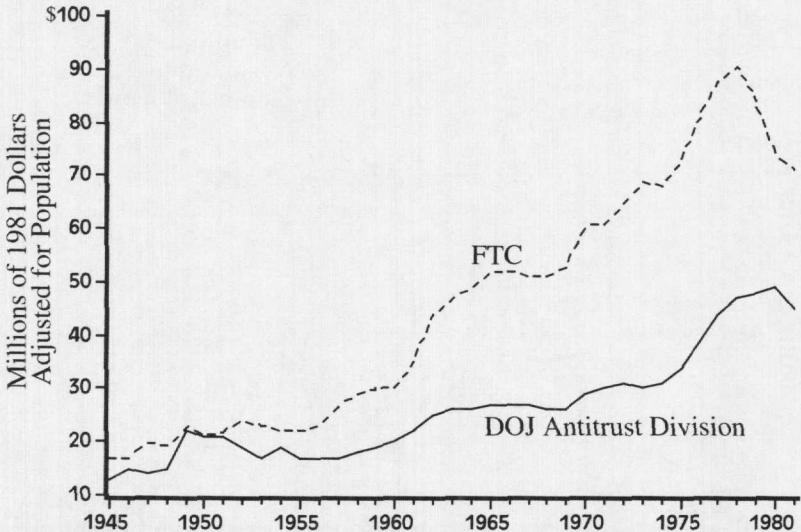


National Committee to Study the Antitrust Laws, issued in 1955, called for aggressive enforcement. Committee members included Morris Adelman, Milton Handler, Alfred Kahn, Eugene Rostow, and George Stigler. The Supreme Court aided the cause of aggressive antitrust by finding in June 1957 that even the unamended Clayton Act applied to vertical and not just horizontal merger, and deciding in December 1958 that the Bethlehem-Youngstown merger violated the Clayton Act (Kovaleff 1980: 17-34, 71-90).

The second increase in filings followed these favorable court decisions and the appointment of Robert Alan Bicks as antitrust chief in April 1959. According to Kovaleff (1980: 114-15), Bicks pursued more vigorous merger enforcement, claiming he wanted to prevent future concentration by applying the law vigorously even in sectors not already concentrated. An October 1959 filing went even further. It sought to divest GM of an earth-mover manufacturer acquired in 1953, although GM had only been a "potential competitor." Filings involving exchange-listed firms increased from 34 in 1959 to 61 in 1960.

The Kennedy administration initially maintained a strong antitrust

FIGURE 3
BUDGET APPROPRIATIONS FOR THE DEPARTMENT OF JUSTICE
AND THE FEDERAL TRADE COMMISSION, 1945-81



NOTE: Budget appropriations are adjusted for inflation and population aged 16 and older (1981=1).

SOURCE: Shughart (1990: 84, Table 4.1; 90, Table 4.3). DOJ data appeared in the U.S. Budget. Shughart obtained the FTC data from the agency.

posture, appointing a lieutenant of Estes Kefauver to chair the FTC, and an outspoken anti-business advocate to head the antitrust division. A November 1961 speech by the attorney general also signaled a tough stance. However, the 1962 stock market decline and the continuing low levels of investment led to some early attempts to mend fences with the business community. One result was the 1962 investment tax credit. The antitrust chief was also promoted to the FCC in May 1963, in a move interpreted as signaling a less aggressive policy. Figure 3 shows that the appropriations increased in the early 1960s, but remained constant until the early 1970s. Enforcement data show that the Johnson administration continued to scale back enforcement, a factor that may have helped lay the basis for the 1960s merger wave. Cases filed against listed firms reached their lowest level in over a decade in 1967.

Under Nixon and Ford, antitrust authorities kept up the pressure, and budget data show an increased flow of resources to both agencies. In addition to filing a steady stream of merger cases involving large

firms, the authorities sued to alter business practices and, in some cases, the structure of entire industries. Industries subject to these sorts of cases included soft drinks (1971), ready-to-eat cereals, aircraft, network television, automobiles (1972), steel, rubber, wall-board, petroleum (1973), sugar (1974), airlines (1975), folding cartons, and automobile distribution (1976). The November 1974 suit against AT&T marked the re-emergence of the large-firm divestiture case. As Figure 1 makes clear, however, filings decreased markedly under Carter, and especially under Reagan and Bush. Overall antitrust appropriations reached their peak under Carter, however. This divergence in the two measures may have reflected the demands of high profile cases such as those against AT&T and IBM. Alternatively, it may have reflected a conflict between the desires of Congress and the executive branch.

The scaled-back enforcement under Reagan laid the groundwork for the 1980s wave of mergers and restructurings. That wave was at least in part a corrective for a poorly functioning corporate control mechanism. However, it also generated a political reaction. Comparatively lax merger enforcement and lack of federal corporate control regulation opened the door to state level anti-takeover legislation.

This thumbnail sketch of antitrust does not do justice to the rich contextual nature of antitrust in practice. Four short histories of enforcement in specific sectors offer more detailed context and support for the claim that antitrust enforcement against a firm or industry is linked with enough dangers to influence investment, either by its direct effects or in conjunction with accompanying policy controversies.

Primary Metals

Big steel was the focus of several highly visible antitrust enforcement actions. Bethlehem Steel announced its intention to acquire Youngstown steel in mid-1954, and the Eisenhower cabinet itself looked into the deal in a secret session. The merger was formally announced in December of 1956, and the resulting legal case decided two years later (Kovaleff 1980: 79–81). When the creeping inflation of the late 1950s and early 1960s offered a chance to convert a monetary policy problem into a monopoly policy problem, both the Eisenhower and Kennedy administrations made steel the focus. A lengthy, 116-day steel strike in 1959 resulted in scheduled wage increases over the next three years. At the urging of vice president Nixon, the steel industry absorbed the 1960 increase in wages, and did so again in 1961. (It was a time-honored practice. Stigler (1952: 162) wrote: “The

steel industry . . . what with congressional review of prices and presidential coercion of wages, is drifting rapidly into a public utility status.”) However, major steel firms finally raised prices in April 1962, following labor negotiations mediated in part by the administration. Kennedy viewed the increase as a breach of faith and denounced it passionately. Defense Secretary Robert McNamara directed defense contractors to purchase steel from producers who had not raised prices, and Robert Kennedy’s Department of Justice used FBI agents to collect information, subpoenaed documents from the steel companies, and ordered a grand jury investigation. The DOJ also filed a criminal price-fixing case. Senator Kefauver held monopoly investigations on the industry, and his subcommittee voted to cite the steel companies for contempt of Congress for refusing to produce cost records (Heath 1970: chap. 8; Rowan 1964: chaps. 6–8). This development is reminiscent of the post-World War I period, when the Wilson administration attributed the rise in the “cost of living” to monopoly. Other primary metals industries attacked during this period include copper and other non-ferrous metals.

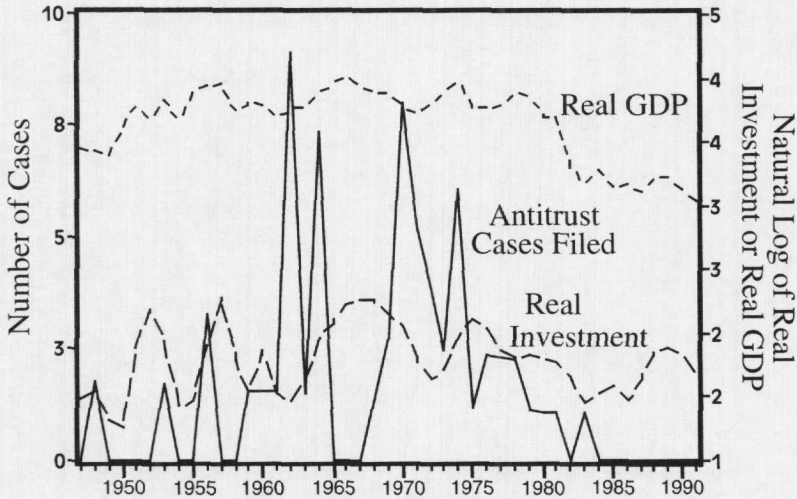
The second major steel-industry initiative began in 1969, the first year of the Nixon administration, when the DOJ attacked LTV’s conglomerate acquisition of Jones & Laughlin Steel on the grounds that LTV was a “potential competitor” in steel. It also filed separate suits in 1969 and 1970 against at least five major steel companies for “reciprocal purchase agreements.”

Figure 4 shows the number of cases filed against exchange-listed firms in the primary metals industry (iron, steel, and non-ferrous metals), as well as industry GDP (or value-added) and investment (adjusted for inflation and population aged 16 and older). The data show low investment in 1950, 1954–55, 1959–63, and again in 1970–73, despite largely unchanged output. These periods of low investment occurred when the industry was under fire.

Vehicles

Eisenhower was concerned in 1954 about the monopoly power of General Motors and directed that government purchases of vehicles not contribute to concentration in the industry. The major case of the 1950s stemmed from the 1949 suit filed by the DOJ to divest DuPont of its holdings of General Motors stock. The government lost at the district level in 1954, but the Eisenhower administration appealed the case, ultimately winning at the Supreme Court in 1957. The antitrust case soon became wrapped up with other issues. The government conditioned the proposed consent on a favorable capital gains treat-

FIGURE 4
ANTITRUST ENFORCEMENT, OUTPUT, AND INVESTMENT:
PRIMARY METALS INDUSTRY, 1947-91

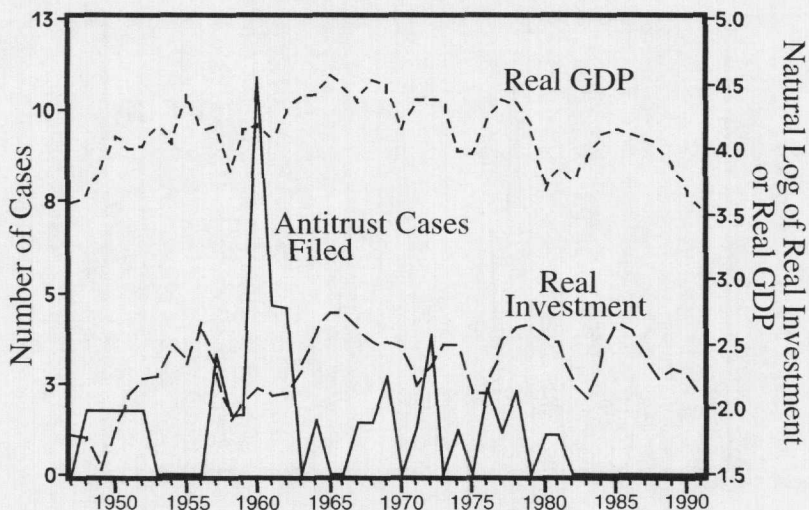


NOTES: Antitrust cases filed (—) refers to the number of cases involving at least one exchange-listed firm. Output (---) refers to the natural log of real GDP for the indicated industry group. Investment (— · —) is measured by the natural log of real investment in plant and equipment in the selected industry group. All variables are adjusted for population aged 16 and older (1987=1).

ment of GM shares (then held by DuPont) that were to be dispersed to DuPont shareholders, but the IRS decided that the distribution of GM stock, held for as long as 30 years at that point, would be taxed at the higher dividend rate. The tax question was appealed to the Supreme Court, and ultimately resolved in favor of DuPont shareholders by legislation. These events illustrate how an antitrust initiative can generate broader uncertainty for business and investors.

The prelude to the next round of enforcement is marked by the 1960 spike in enforcement shown in Figure 5, which was generated by a flurry of automotive parts cases involving listed firms. In April of 1961, the Kennedy administration filed a criminal merger suit against GM for its acquisition of two locomotive divisions 30 years earlier. It sued Chrysler the same month for abuse of power in distribution, GM again in October, and Ford for its Autolite acquisition in November. The DOJ also filed parallel civil charges to the locomotive case in 1963. No discussion of the 1950s and 1960s is complete without mention of the rumored, but never filed divestiture suit against GM.

FIGURE 5
 ANTITRUST ENFORCEMENT, OUTPUT, AND INVESTMENT: MOTOR
 VEHICLES INDUSTRY, 1947-91

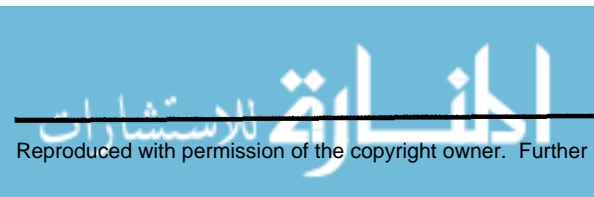


NOTE: See the notes to Figure 4 for a description of the relevant variables.

In addition, the DOJ filed against the major auto companies in January 1969 for allegedly suppressing smog innovations during the late 1950s and early 1960s by means of a cross-licensing agreement for smog control technology. This last case illustrates another instance in which an unrelated policy issue, smog control, is linked with antitrust enforcement.

Pharmaceuticals

Highly publicized monopoly investigations of the drug industry began in 1959 under Senator Kefauver, who recommended shortening patent life from 17 to 3 years and establishing government licensing of drug firms. An antitrust case filed in August of 1961 claimed that the three major producers of antibiotic “wonder” drugs maintained unreasonably high and noncompetitive prices. In the wake of the thalidomide tragedy (which struck Europe but not the United States) and some maneuvering by the White House to delete provisions shortening the patent life of drugs, Congress passed the 1962 amendment to the Food, Drug, and Cosmetic Act. According to Peltzman (1973), the number of “new chemical entities” declined steadily from their 1959 peak until 1962 and remained well below

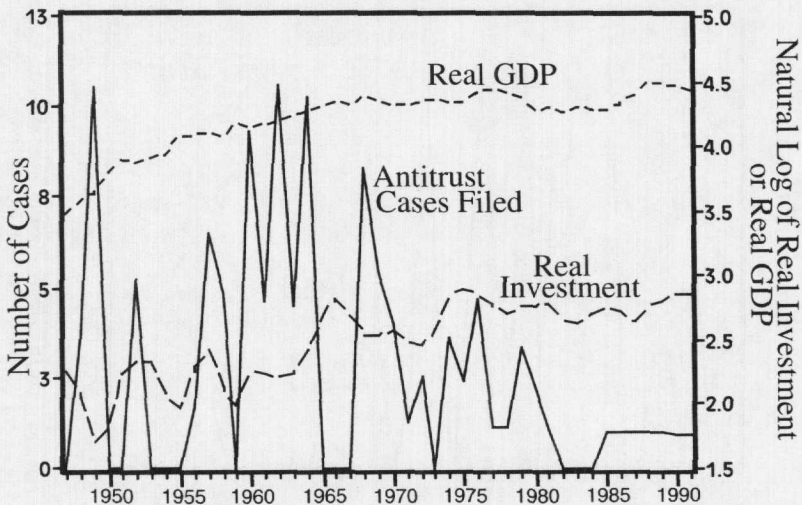


projected values throughout the 1960s and early 1970s. Experience in pharmaceuticals illustrates how antitrust can be linked with a regulatory initiative, which in turn was linked with a decline in new R&D investment. Figure 6 shows enforcement, physical investment, and GDP for the larger classification “chemicals and allied products,” which includes pharmaceuticals.

Petroleum Refining

Within months of assuming office in 1953, the Eisenhower administration filed a suit against five major oil companies, charging them with participation in a worldwide cartel. Sought-for relief included divestiture of joint ventures in production, refining, transportation, and marketing. The case reached its conclusion in stages as defendants signed consent decrees and the DOJ finally dropped charges against the two remaining defendants in 1968. In its early years, prosecution of the case was heavily influenced by international events, including nationalization of foreign oil assets in Iran, 1951–54, and the Suez Crisis, 1956–57, which threatened oil supplies to Europe during the height of the Cold War. Oil company joint efforts received antitrust immunity while the case was pending. The antitrust

FIGURE 6
ANTITRUST ENFORCEMENT, OUTPUT, AND INVESTMENT:
CHEMICALS AND ALLIED PRODUCTS INDUSTRY, 1947–91

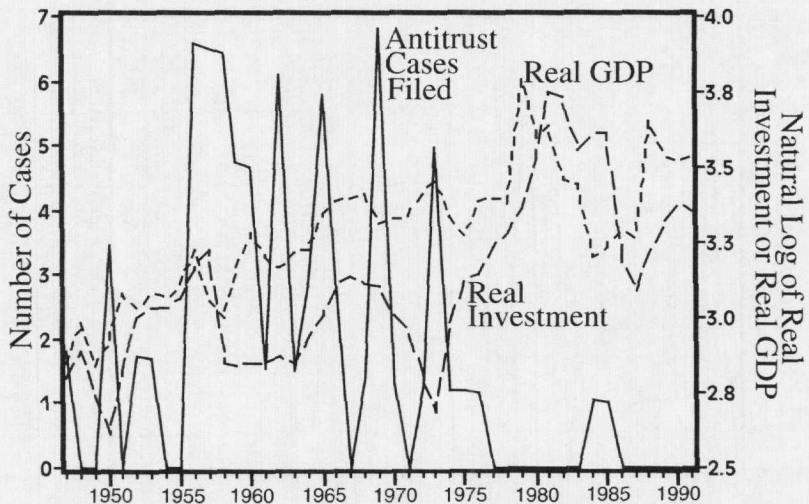


NOTE: See the notes to Figure 4 for a description of the relevant variables.

case also generated infighting between the DOJ and the Interior Department, and monopoly subcommittee hearings in the Senate. In another attack on petroleum refining, Eisenhower antitrust authorities sued to alter gasoline retail practices and filed suits against related sectors such as asphalt. They also pursued a vigorous anti-merger policy, denying each oil merger clearance request placed before it (Kovaleff 1980: 117). At the same time, crude oil producers (whose interests often diverge from refiners) sought to limit imports, adding to the uncertainties for refiners. “Voluntary” import restraints under the direction of the president were imposed in 1957, and these were replaced by mandatory quotas in 1959, when the president imposed restrictions on refined as well as crude oil. The obvious tension between national security issues, oil import restrictions, and antitrust was prominent in discussions at the time (Kaufman 1978: 74–75). It is possible that the antitrust actions and national security arguments served as cover for the import restrictions, much as the Sherman Act may have served as cover for the McKinley Tariff of 1890.

Regulatory actions reached another peak in the early 1970s (see Figure 7). The FTC’s monopolization case filed in July 1973 against the major oil companies was one of the last major antitrust events in

FIGURE 7
ANTITRUST ENFORCEMENT, OUTPUT, AND INVESTMENT:
PETROLEUM REFINING INDUSTRY, 1947–91



NOTE: See the notes to Figure 4 for a description of the relevant variables.

this industry. The case remained active until the early 1980s. Few cases were filed in the late 1970s. U.S. energy policy in the mid- and late-1970s was aimed at extracting rents from crude producers, real-locating those rents to east-coast refiners, and lowering the price of crude (refiners' chief input).

Antitrust, Uncertainty, and Investment

We can construct links between antitrust and investment at three levels: by focusing on a certain, stable switch in antitrust policy; by examining the effects of stepped up enforcement on uncertainty; and by viewing antitrust as a relatively easily measured signal for a broader spectrum of business regulation.

A Stable Switch in Policy

Consider an extreme antitrust policy, say, an exogenous, unexpected, and certain divestiture of large firms and a strict limit on future expansion. This sounds preposterous today, but was actually proposed by eminent economists. George Stigler (1952) in the "Case Against Big Business" proposed "dissolution of a few score of our giant companies . . . by the Antitrust Division acting through the courts." A year later, Stigler joined the Attorney General's Committee to Study the Antitrust Laws.

Though Stigler's experiment was never performed, some of the cross-section evidence suggests that such a policy would lower growth and investment, even if carried out with lightning speed and absolute certainty. At the industry level, an increase in concentration is on average accompanied by higher productivity growth and lower price increases. Leading firms also generated higher value-added per worker hours (Brozen 1982: chap. 3). Scherer's (1983) study finds that higher concentration is associated with greater R&D intensity, and this in turn leads to higher productivity growth. Similarly, Gupta (1983) finds that firm size is the dominant factor in explaining variations across firms in labor productivity. Finally, the literature on learning-by-doing suggests that cumulative experience in production raises efficiency (see, for example, Irwin and Klenow's [1994] study of memory chips). An aggressive policy of punishing winners in order to thwart possible monopolists may very well entail costs.

What would be the effect of an outright prohibition of merger? "Merger for monopoly" and merger for empire building have captivated economists. However, the systematic evidence favors the view that mergers solve dynamic problems in monitoring, incentives, and

the transfer of information. Telser (1984, 1987: chap. 8) offers a theory of innovation that results in differences in costs, and proposes merger as a way of removing the resulting inefficiency. He cites as supporting evidence the strong cross-section correlation between merger intensity, on the one hand, and rates of industry growth and measures of technical innovation on the other.

A clear, consistent, and well-understood shift to stricter antitrust policy has not been executed. What we do know about firm size, concentration, and merger suggests that such a shift would lower productivity and R&D. Forced divestiture, and a limit on market share or firm size, achieved through merger or otherwise, is also likely to affect competition—quite likely reducing it—though the actual effects have, for obvious reasons, not been studied.

Policy Uncertainty

The suggestion that uncertainty, and antitrust uncertainty in particular, may affect investment dates back at least to Wesley Claire Mitchell's discussion of attempts to break up U.S. Steel and other large corporations. According to Mitchell (1913: 85), "Throughout the year [1911] . . . enterprise on the part of large capitalists was materially checked by uncertainty regarding the legal position of business combinations. Hence all trades that depend upon the volume of new construction put under contract found 1911 a dull year." The comments of Roose (1954) and Friedman and Schwartz (1963) about the 1930s—cited earlier—run along the same lines.

More recently, the theory of investment under uncertainty has fleshed out Mitchell's conjecture. Irreversible investment in an industry or for the economy as a whole may decline if economic agents are uncertain about future payoffs. Temporary uncertainty may induce firms to wait even for positive net-present-value projects since they face the choice between (1) investing now and (2) waiting and perhaps investing later when the uncertainty is resolved. Since the decision to invest now cannot be undone later when the uncertainty is resolved, firms may wait even if they are not risk averse. Early contributions include Cukierman (1980) and Bernanke (1983). Pindyck (1991a) and Dixit and Pindyck (1994) survey the literature.

The theorists have been vague about the actual sources of uncertainty. Cukierman (1980: 463, 474) mentions only that "businessmen often talk about increased uncertainties" and refers to "ambiguous and sometimes contradictory statements by government officials." Bernanke (1983) mentions changes in monetary, fiscal, regulatory, or

other policy regimes, as well as international, commodity, technology, and sectoral shocks. Pindyck (1991a: 1141) briefly mentions “uncertainty over future tax and regulatory policy” and “political and economic stability.”

The comparatively small volume of applied work on the effects of uncertainty over time has focused on classic monetary factors or stock volatility. Evans (1984) finds that unexpected interest volatility lowered output. Ferderer (1993) finds a negative relationship between investment and the term premium in interest rates. However, given the Fed’s tendency to lower short-term rates in recessions, the last result may reflect Fed policy rather than investment behavior.

A longer line of studies finds a negative correlation between stock volatility, on the one hand, and consumer durable purchases, business investment, or aggregate output, on the other. However, these studies diverge in their interpretation of the volatility proxy. Romer (1990) explains the decline in consumer durable expenditures at the onset of the Great Depression by an increase in uncertainty, which was reflected in more volatile stock prices. She regards stock volatility as reflecting uncertainty of indeterminate origin. Pindyck (1991b) finds a similar negative relationship between recent investment behavior and stock volatility, but views stock volatility as reflecting volatility in product markets. In work on Germany, for the period 1880 to 1940, I find a similar relationship: stock volatility is correlated with declines in output (Bittlingmayer 1998). However, in view of the clear and dramatic effects of political developments on stock prices in the “natural experiment” of Weimar Germany, I view causation as running from political uncertainty jointly to output and stock prices.

In the work here, I use the number of antitrust cases filed against exchange-listed firms. It would be difficult to insist that an increase in antitrust filings represents a certain, predictable, and stable shift in policy. An increase in filings means stepped-up enforcement. The long-term implications depend on the courts and political consequences. Before the advent of merger pre-clearance in 1976, companies ran the risk that even completed acquisitions might be forcibly divested. At any point, it would mean that a possibly controversial merger, product introduction, or business practice might come under attack. Looking back, we can see that antitrust enforcement was episodic—flurries of enforcement were followed by retreats in enforcement. However, at the time of an initiative, businesses may rationally have interpreted an increase in enforcement as signaling a possibly permanent shift to a more aggressive regulatory regime. If the shift turns out to be temporary, it may take several years of restrained enforcement before those fears are laid to rest.

Federal Antitrust Enforcement and Other Policies

Finally, and perhaps most importantly, a federal antitrust initiative may imply other regulatory policies, congressional investigations or action at the state level. Federal antitrust often reflects an early testing of the waters, either for bigger cases or for other sorts of regulation. Bureaucrats and congressmen are interested in knowing which groups are likely to benefit, and which ones are likely to gain from action against a particular firm or industry. Various forms of turmoil—hearings, pressure from Congress, and regulatory action—signal a political threat to rents and may also give Congress and the executive branch an idea of the rents that can be extracted for protection. In other instances, a controversial antitrust action focuses public attention on an industry and lays the groundwork for other efforts. In still a third set of cases, antitrust represents a parting shot at an industry already under attack. Consequently, antitrust cases may foreshadow future regulation or reflect other initiatives already taken.

Several other analytical points deserve attention. First, in a “taxation by regulation” framework, the danger of greater “taxation” will result in less fixed investment and the substitution of more mobile factors. (Antitrust policy’s possible “taxes” include delayed investment and expansion, less competitive behavior, and the forced adoption of less efficient forms of organization.) Second, antitrust may be endogenous, but the algebraic sign of the endogeneity is unclear. On the one hand, the antitrust authorities may target industries with poor prospects because distressed industries are more likely to collude or propose questionable mergers. Alternatively, the government may target winners. Anecdotes can be marshaled for both points of view. In the final analysis, however, antitrust appears to be less endogenous than other business cycle variables—such as cash flow—used to explain investment. Third, antitrust policy raises the possibility of a “peso” problem. An increase in filings may signal an increased probability of a catastrophic regulatory environment—a widespread deconcentration initiative or the country going socialist—but the catastrophe fails to occur within the sample. If so, coefficient estimates will over-estimate the “pure” effects of actual levels of antitrust enforcement, but not their signaling effects.

Models of Investment

Formal models of investment emphasize three factors. First, the cost of capital takes center stage, reflecting economists’ view that demand curves slope down. The cost of capital is itself a function of

interest rates, the tax treatment of investment, and the relative price of capital goods. Second, the traditional models often emphasize the accelerator effect. A permanent increase in demand for the stock of capital has a disproportionate effect on the demand for net additions to that stock. Finally, depreciation of the stock of capital results in replacement demand.

In practice, the cost-of-capital factors seem to have little discernible effect on investment (Clark 1979, 1993). Chirinko's survey (1993: 1906) concludes: "The response of investment to price [i.e., cost-of-capital] variables tends to be small and unimportant relative to quantity variables." In the work that follows, I neglect cost-of-capital variables.

Let I_t be real gross investment in period t , K_t the real stock of capital, Y_t the level of real income, and ΔY_t the difference $Y_t - Y_{t-1}$. The canonical investment equation takes the form:

$$(1) I_t = \alpha + \beta K_{t-1} + \gamma \Delta Y_t + \varepsilon_t.$$

The coefficient β estimates the depreciation rate of the capital stock, and γ estimates the accelerator effect. In practice, the error term ε_t follows an autoregressive process, suggesting omitted variables. This specification appears as Clark's (1979) equation (4), which offered the most parsimonious explanation for past investment, 1954-73, and best predicted the 1970s investment slump using pre-1974 coefficient estimates.¹

In the work below, I alter this model by substituting lagged industry gross domestic product, Y_{t-1} , for the lagged capital stock, K_{t-1} , and by adding measures of the regulatory variable, antitrust case filings against exchange-listed firms. The use of lagged output in place of lagged capital stock has several rationales. First, Bureau of Economic Analysis estimates of K_t are averages of past I_t , with the averages based on assumed linear depreciation rates, largely fixed over time, for different types of capital goods. U.S. Bureau of Economic Analysis (1993, especially M-16 through M-17) contains a sobering and candid account of this procedure and its limitations. Aside from the obvious problems, episodes like the Vietnam War buildup are bound to distort this measure. Many industries made war-specific investments with high actual post-war depreciation rates that are not reflected in the

¹While parsimony alone argues against including the cost of capital, using it would also raise extraneous difficulties in the industry estimates below. First, while cost-of-capital measures by equipment type do exist (Clark 1993), industry measures do not. Second, even the cost-of-capital figures by equipment type are based on easily disputed assumptions about expectations of future tax and discount rates.

depreciation schedules. Unknown and potentially serious measurement problems aside, another difficulty arises because the measured capital stock is the weighted sum of past investment. A regression of investment on measured capital stock amounts to a regression on lagged dependent variables. This approach “explains” investment by looking at an arbitrarily weighted average of recent investment.

The use of gross product in place of the measured capital stock also has a positive defense. Recent empirical work emphasizes the importance of variables such as sales, cash-flow, and value-added in explaining investment behavior. Businesses may not make major investments until they see concrete evidence of an upturn in demand. In addition, businesses may rely on internal financing for cyclically sensitive portions of investment. In fact, time plots and cross-correlations show a close correspondence in many, though not all, industries between investment and industry output (GDP) lagged one year. The lag can be easily explained with a time-to-build assumption.

Regulatory stringency or regulatory risk constitutes the novel element in the analysis here. Since no single variable or even cluster of variables can measure the state of current and expected regulation with a high degree of precision, the “true model” must be stated in terms of a latent or unobserved variable Z^*_t . Adding that variable as well as substituting lagged GDP for lagged capital stock in (1) yields:

$$(2) I_t = \alpha + \beta Y_{t-1} + \gamma \Delta Y_t + \delta Z^*_t + \varepsilon_t.$$

Before I discuss the particular measure of regulation used here, recall the general econometric problem raised by mismeasured or latent variables: proxies used in place of Z^*_t will result in an estimate of δ biased toward zero.

An even more serious but largely unrecognized bias emerges if we attempt to correct for autocorrelated errors by taking first-differences. Indeed, with measurement error and under assumptions reasonable for the case at hand, first-differencing results in estimated coefficients that may be as low as 5 to 10 percent of their true value. Consequently, my strategy is to use alternative methods of assessing the reliability of coefficient estimates: partitions of the data set and bootstrapping.

To represent some important dimensions of regulatory risk, I use the number of antitrust cases filed against exchange-listed firms. Though the focus on listed firms narrows the scope of this variable, the resulting count variable still lumps together a variety of cases. Some cases involve multiple defendants; the charges differ (merger, single-firm monopolization, price fixing, criminal, civil); some are consent decrees; individual cases may or may not be the sideshow to

some other, more diffuse policy struggle; and the penalties for specific charges have varied over time, as has the probability of follow-up private suits. In some instances, major investigations are undertaken, but no case is filed. The monopolization case apparently planned but never filed against GM is a prime example. Arguably, investigations also generate uncertainty.

The lags and leads deserve discussion. A case filing represents one way that an investigation by the FTC or DOJ may end. It also marks the beginning of a legal proceeding, typically a protracted legal dispute. If the government's case looks promising, private plaintiffs or states may join the fray with piggyback suits. As a result, investigations under way and pending cases both imply uncertainty about the legal status of various business practices, or even the legal status of business success. Though news of investigations inevitably leaks, pinning down the actual beginning or even existence of all investigations, even those involving major firms, is a prodigious undertaking. Dates of ultimate resolution are also likely to be difficult to establish. The possibility of appeals and piggyback suits makes it unclear when a particular case has in fact ended.

The estimates below make a distinction between cases filed against firms in a given industry group and cases filed overall. A case filed against primary metals should have a larger dollar effect on primary metals investment than a case filed in telecommunications. Since the errors-in-variables problem is likely to be more severe at the industry level, the industry-coefficient is likely to suffer from a larger downward bias. Hence, a larger coefficient for own-industry cases than cases in general would offer support for the idea that case filings in a given industry—or the underlying policy equilibrium they represent—affect investment in that industry.

On the basis of this discussion, I modify equation (2) to explain, I_{it} , investment in industry i in year t . I also use lagged industry output, Y_{it-1} , as well as changes in industry output, ΔY_{it} , and add lagged and leading counts of cases filed against exchange-listed firms in the same industry i , Z_{it} , and against all firms, Z_t :

$$(3) \quad I_{it} = \alpha_i + \beta_i Y_{it-1} + \gamma_i \Delta Y_{it} + \sum_{j=-2}^2 \delta_{ij} Z_{it-j} + \sum_{j=-2}^2 \phi_j Z_{t-j} + \varepsilon_{it}.$$

The institutional facts argue for lagging and leading effects, roughly of two years in each direction.

Heteroscedasticity is not an issue here since I do not rely on estimated standard errors. However, I have adjusted the data for growth in the economy to allow a comparison of my results with those of

other studies and to simplify the bootstrapping (explained below). Specifically, I divide all variables by POP_t , U.S. population aged 16 or older, a measure of potential economic output, and denote the resulting per capita variables with an apostrophe, that is, $I'_{it} = I_{it} / POP_t$ and so on.

The available time series have only 41 annual observations because of the leads and lags. Not surprisingly, individual industry estimates show considerable variation, given that the model attempts to estimate 13 parameters, including the constant. Hence, the reported results here are based on models in which the cross-section slope coefficients are restricted to a common value for all industries in an industry group. I indicate that formally by suppressing the industry subscript for all coefficients except α_i :

$$(4) \quad I'_{it} = \alpha_i + \beta Y'_{it-1} + \gamma \Delta Y'_{it} + \sum_{j=-2}^2 \delta_j Z'_{t-j} + \sum_{j=-2}^2 \phi_j Z'_{t-j} + \varepsilon_{it}.$$

The system of equations in (4) was estimated using joint generalized least squares separately for three industry groups: nonmanufacturing, durable goods, and nondurable goods. (Pooled cross-section time series estimates with industry intercepts yielded similar results.) Separate estimates for three distinct sets of data offer one type check on the reliability of the estimates.

Bootstrapping offers an alternative strategy for assessing reliability. I used it only for antitrust enforcement, but not for Y'_{it-1} and $\Delta Y'_{it}$, since these variables have a strong track record in other investment studies. I do report their (unbiased) coefficients and their (quite likely biased) t-statistics.

I carried out the bootstrap calculations as follows. For each industry group (nonmanufacturing, durables, and nondurables) with industries 1, . . . , n, I drew random, contemporaneously linked observations from the n+1 series of industry and overall antitrust enforcement ($Z_{1t}, \dots, Z_{nt}, Z_t$). These draws took place with replacement and resulted in the creation of a new synthetic series of own-industry and overall enforcement. I then reestimated equation (4). I repeated this procedure 1,000 times for each estimated relationship. The statistic of interest was the frequency with which the resulting estimates based on synthetic series yielded coefficients less than (more negative than) those observed with the original set of enforcement series.

Table 1 presents the summary statistics. The first column presents the filings per \$100 billion of industry GDP. Note the high levels of filings in food, chemicals, and petroleum, and the low levels in non-manufacturing. The latter fact may partly reflect the existence of other regulatory regimes over these years in transportation, utilities,

finance, and communications. (The estimates below in fact exclude utilities since these are governed by a different regulatory framework and the data indicate that neither the few antitrust cases nor industry GDP explains investment by utilities.) The other columns show summary statistics for population-adjusted filings. The last column reveals relatively low autocorrelation coefficients, which justify a simple strategy of random sampling with replacement in the bootstrap. The low autocorrelations also offer additional justification for the view that these variables contain substantial measurement error since the regulatory regime is unlikely to shift radically from year to year.

Table 2 has the estimates. The coefficients on Y_{it-1} are interpretable as the long-run share of lagged industry product (GDP) going to industry investment. That share is roughly 6 percent for nonmanufacturing, 16 percent for durable goods, and 18 percent for nondurable goods. The coefficients on $\Delta Y_{i,t}$ are estimates of the fraction of short-run changes in industry output going to industry investment, roughly 4 to 6 percent.

One set of regression results uses only own-industry cases. The sum of the estimated $\delta_{j,s}$ (the coefficients on the Z_{it} variables) represents the cumulative statistical association between an extra case in an industry and the level of investment in that industry. Looking only at these own-industry effects, we see that each extra case is associated with a decline in investment of \$1.4 billion in nonmanufacturing, \$370 million in durable goods, and \$645 million in nondurable goods. Errors-in-variables by itself would bias these estimates toward zero. However, the level of antitrust in a given industry is correlated with the general level of antitrust and, possibly, the general regulatory climate the industry faces. Hence, these estimates omit two positively correlated influences and may in fact overestimate the "pure" own-industry negative effects. Those issues aside, the bootstrap calculations support the view that these estimated associations are statistically significant. Larger negative effects emerged for the simple estimates of own-industry effects in 108 out of 1,000 replications; for durable goods in 27 out 1,000; and for nondurable in 1 out of 1,000.

The other columns of Table 2 add total cases, Z_t , as an extra explanatory variable. The summed coefficients, ϕ_j , represent the estimated effect for each industry of an extra case overall. It turns out that the major effect of a case lies outside the industry it is filed against. An extra case overall is associated with a decline in investment in each of 21 industries of between \$34 million and \$110 million. The implied effect of a single case is thus the sum of (1) the effect in each of six nonmanufacturing industries (six times \$110 million), eight durable industries (eight times \$34 million), and seven

TABLE 1
ANNUAL ANTITRUST CASES INVOLVING AT LEAST ONE EXCHANGE-LISTED DEFENDANT,
BY MAJOR INDUSTRY GROUP, 1947-91

	Filings per \$100 Billion Industry GDP	Population-Adjusted Filings ^a			Autocorrelation Coefficient
		Mean	Standard Deviation	Maximum	
Nonmanufacturing					
Mining	0.15	0.14	0.47	2.26	-0.09
Transportation	0.35	0.52	0.85	3.45	-0.07
Utilities	0.13	0.10	0.38	1.63	0.35
Wholesale & Retail	0.27	1.45	2.06	8.68	0.05
Finance	0.22	1.20	2.02	10.43	0.71
Business Services	0.24	1.21	1.63	7.79	0.31
Communications	0.48	0.37	0.78	3.04	-0.24
Durable Manufacturing					
Primary Metals	2.17	1.59	2.29	9.13	0.28
Fabricated Metals	3.00	1.80	2.21	9.35	0.18
Electrical Machinery	3.28	2.20	3.46	18.70	0.60
Machinery	2.40	2.12	2.11	6.51	0.49
Vehicles	1.97	1.26	1.95	10.91	0.32
Other Trans. Equip.	1.08	0.50	1.10	5.71	-0.05
Stone, Clay, Glass	3.34	1.02	1.36	5.71	0.31
Other Durables	2.36	1.83	2.24	10.65	0.14

TABLE 1 (continued)

	Filings per \$100 Billion Industry GDP	Population-Adjusted Filings ^a			Autocorrelation Coefficient
		Mean	Standard Deviation	Maximum	
Nondurable Manufacturing					
Food	4.07	3.90	3.77	12.68	0.39
Textiles	0.94	0.30	0.81	4.40	0.08
Paper Products	2.70	0.95	1.62	6.92	0.21
Chemicals	4.22	2.66	3.16	10.65	0.15
Petroleum	7.26	1.77	2.27	6.80	0.43
Rubber	3.82	0.84	1.17	3.73	0.12
Other Nondurables	0.57	0.57	1.12	6.23	0.15
Mean	2.05	1.29	1.76	7.52	0.22

^aDivided by index of U.S. population aged 16 and over (1987 = 1).

TABLE 2
THE ESTIMATED EFFECT OF CASE FILINGS ON INVESTMENT

Estimated Effects of:	Nonmanufacturing Six Industries	Durable Manufacturing Eight Industries	Nondurable Manufacturing Seven Industries
$Y_{i,t-1}$ (Industry GDP) t-statistic	0.063 (48.9)	0.058 (31.9)	0.177 (20.2)
$\Delta Y_{i,t}$ (Change in Industry GDP) t-statistic	0.042 (4.4)	0.037 (3.8)	0.057 (1.9)
ΣZ_{it} (Cases in Own Industry) p-value	-1.445 [.108]	-0.683 [.286]	-0.645 [.001]
ΣZ_t (Cases in All Industries) p-value	-0.110 [.137]	-0.034 [.097]	-0.053 [.099]
Joint p-value			[.012]

NOTE: GLS system regressions of annual industry investment on lagged industry GDP ($Y'_{i,t-1}$), change in industry GDP ($\Delta Y'_{i,t}$), and industry and total antitrust case filings involving at least one exchange-listed firm, years t-2 through t + 2, ($Z'_{i,t-2}$ and $Z'_{i,t+2}$) = -2 to 2), 1949-90. Investment and GDP are expressed in terms of billions of 1987 dollars. All variables, including case filings, are divided by U.S. population aged 16 or older to reduce trend. Cross-section slope coefficients are set equal to one another, and the constant (not reported) is free for each industry. The ΣZ_{it} and ΣZ_t estimates represent summed effects over years -2 through +2. Parentheses indicate t-statistics, and brackets the percentage of bootstrap estimates that yielded larger negative effects than the estimates reported here. The joint p-value shows the percentage of bootstrap estimates in which both industry and total antitrust effects have larger negative effects than the original estimates.



nondurable manufacturing industries (seven times \$53 million), which totals \$1.3 billion; and (2) the additional effect in its own industry, which averages \$404 million. Statistically, each extra case is thus associated with a total decline in investment of about \$1.7 billion. Since these estimates capture the cross-industry effects, they come closer to providing an idea of the full possible consequences of a regulatory climate in which an extra case is filed against an exchange-listed firm. This climate includes accompanying regulatory initiatives, congressional hearings, or inflation or energy price shocks that provide occasion for an anti-monopoly campaign. These estimates do not reflect the consequences of an antitrust case filed in a political vacuum.

The bootstrap results for the second set of estimates generated higher p-values on the individual coefficients. Two of the three estimates based on cases in all industries yield p-values of less than 10 percent, and only nondurable manufacturing yields a p-value below that level on the own-industry coefficient. Since the own and industry random drawings remain linked in the bootstrap, the higher p-values may be due to the multicollinearity between individual industry case filings and overall filings. The circumstances call for the equivalent of a test in which both sums of coefficients are negative.

The last row of Table 2 shows that the likelihood of generating estimates jointly below the two original estimates was very low for all three sectors. Only 25 of 1,000 estimates yielded estimates of own and all-industry effects with larger negative values than the corresponding original estimates for nonmanufacturing. In durable and nondurable manufacturing, the frequencies were 6 and 12 out of 1,000. (Under the null hypothesis of no effect, the frequency would be 250 out of 1,000.) Estimated effects this large and negative for both own and all-industry case filings occurred relatively rarely with the bootstrapped data.

Conclusion

My aim has been to explain some of the variation in industry investment by appealing to political or regulatory uncertainty. A long tradition of lunch table economics holds that political and regulatory uncertainty affects the business climate, but empirical work on investment fluctuations has focused on other, more easily measured factors. The work here uses antitrust case filings as a measure of regulatory uncertainty. The resulting estimates imply that the low investment of the late 1950s and early 1960s was due at least in part to a resurgence of aggressive antitrust and related initiatives inter-

pretable as “anti-business.” Some of the unexpectedly low investment of the 1970s may have had a similar origin.

Contradiction or corroboration can be sought in other time periods, in detailed industry studies, and by looking to other countries. Examples from the United States include Teddy Roosevelt’s efforts to break up Standard Oil in 1907, Taft’s attack on U.S. Steel, the post-World War I monopoly initiative, the lax and then strict enforcement under Coolidge and Hoover, the suspension of antitrust followed by strict enforcement under FDR, and then suspension of major antitrust initiatives during World War II. Studies of the firm-level effects of actions against particular firms and industries represent another line of approach. The electrical equipment cases, the FTC’s campaign against vertical integration in cement, and the ready-to-eat cereals case offer potentially fertile ground. Studies of the effects of major private lawsuits, whether antitrust suits or not, would also be relevant. Similar studies of other countries face the problem that antitrust, particularly antitrust carried out with visible and contentious lawsuits, remains an American phenomenon. The challenge would be to find proxies for regulatory and political threats in other environments.

The approach here throws new light on some old issues concerning disparate areas of economics: investment and antitrust policy. The long tradition of appealing to “animal spirits” and “business confidence” as sources of fluctuations in investment may reflect the hard-to-measure nature of policy threats. At the same time, the results here offer confirmation of conjectures offered by Mitchell for the 1911 recession, and by Roose and by Friedman and Schwartz for the Great Depression.

Progress in understanding investment behavior may also depend on paying more attention to institutional issues and to economic and legal history, as well as care in interpreting statistical results. One important consideration is that uncertainty may be generated endogenously. An exogenous shock—such as an increase in energy prices—may generate a political reaction and difficult-to-measure regulatory risks and even more uncertainty.

For antitrust policy, the results support the view that major changes in policy provide a laboratory to study its effects. It turns out that whatever the ability of antitrust to lower prices and increase output in theory or in isolated circumstances, one actual effect of antitrust in practice may have been to curtail investment. In fact, the estimates here support the view that an extra case filed had its greatest effect on economy-wide investment. However, the fact that periods of enforcement coincided with other increases in conflict between government and business suggests that the estimated effects may reflect more

than the pure effects of antitrust in isolation. Antitrust enforcement may represent a relatively easily measured signal. In addition, the findings here may explain Sproul's (1993) "man-bites-dog" result that prices in markets subject to antitrust prosecution increase after a filing. Conceivably, prices rise because defendant industries fail to make efficiency-enhancing investments they otherwise would. If so, an additional effect of antitrust enforcement may have been to reduce efficiency and raise prices outside the industry in question.

Appendix: Data Sources

In this study, *investment* refers to the updated new plant and equipment series of the Bureau of Economic Analysis, described in Seskin and Sullivan (1985). All nominal series are deflated using the CPI set equal to unity in 1987. The investment and other BEA series are available on diskette. The figures for *Gross Domestic Product* are from the BEA series described by Parker (1993).

Data on *antitrust cases involving listed firms* come from Federal Trade Commission cases hand-compiled from *FTC Dockets of Complaints* published as part of *Trade Regulation Reports* by Commerce Clearing House. Reporting of FTC cases is very brief and includes mention only of the first-named defendant. Cases involving monopolization and merger typically involved only one defendant. However, since some cases involved horizontal conspiracy, this source yields an incomplete list of the defendants in FTC cases. Department of Justice cases through 1951 appear in Commerce Clearing House, *The Federal Antitrust Laws with Summary of Cases Instituted by the United States, 1890-1951* (1952). Later cases appear in Commerce Clearing House, *The Federal Antitrust Laws with Summary of Cases Instituted by the United States, 1952-1956 Supplement* (1957); Commerce Clearing House, *Trade Regulation Reporter, Transfer Binder, New U.S. Antitrust Cases Complaints, Indictments, Developments*, various dates. DOJ cases include longer descriptions which typically listed all defendants. If a named defendant was ever listed on the New York, American, or NASDAQ exchanges, that case was coded as involving at least one listed firm. Exchange listing was determined from a printout of all firms available on the University of Chicago's CRSP tapes. Each case was assigned to one of 21 industry groups.

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