

Some Empirical Evidence on the Effectiveness of Antimerger Relief in the United States*

Mikhail S. Kouliavtsev[†]

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Abstract

The paper seeks to fill the void in the empirical economics literature of U.S. antimerger policy. A new empirical measure of relief secured in a Section 7 case is proposed. The extent of obtained relief is modeled as a fraction of the competitive overlap subject to structural divestiture. The model of determination of the relative size and scope of divestiture is applied to a sample of recent Section 7 cases. The estimated model is reasonably successful at predicting the outcomes of several out-of-sample cases.

1 Introduction

Section 7 of the Clayton Act of 1914 made it illegal for two competitors to merge if such a merger would result in a significant restriction of competition. In 1950, the Celler-Kefauver amendment closed a significant loophole in the existing antimerger legislation by outlawing anticompetitive acquisitions of assets as well as acquisitions of stock. The law empowering the antitrust authorities to challenge anticompetitive

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[†]School of Business Administration, Philadelphia Univeristy, *Email*: KouliavtsevM@philau.edu, Ph: (215) 951-5329, Fax: (215) 951-2652.

mergers has been the same for over half a century now, although its interpretation has evolved over the years, as the government and the courts gained experience from handling various cases.

Identifying the “problem” cases out of numerous mergers taking place each year eventually became a standardized process, as the Department of Justice issued its first Horizontal Merger Guidelines in 1968. These guidelines specified thresholds of market concentration that, when exceeded, would likely trigger a more extensive investigation of a merger. As economic theory became more dominant in the analysis of antitrust cases, the Merger Guidelines were revised several times — in 1982, 1984, 1992, 1994, and 1997¹ — adding emphasis to such important factors as barriers to entry, efficiencies, and likelihood of collusion among competitors.

While the legal treatment of mergers improved steadily throughout the existence of antimerger enforcement, the remedies, or “fixes,” carried out under Section 7 were often ignored. Many researchers have pointed out that frequently the focus of merger investigations was on establishing the anticompetitive potential of the transaction. When such was found, the government can do no better than disallow the merger entirely. However, if there are substantial efficiencies foregone by prohibiting all (arguably) anticompetitive mergers, then such policy begs for improvement. Also, until the passage of the Hart-Scott-Rodino (HSR) Antitrust Improvements Act of 1976, the merger investigation typically did not commence until after the merger was consummated. Therefore, “disallowing” the transaction really meant “dissolving” the already-combined entities. This by itself can easily be seen to be problematic.

Resolving an anticompetitive situation arising out of a proposed merger became easier once the HSR Act gave the government the power to delay the merger while

¹The latest version of this document is available on the Department of Justice, Antitrust Division website at <http://www.usdoj.gov/atr/public>.

the investigation proceeds. Thus, dissolving potentially troublesome mergers after they have been consummated is usually no longer necessary. However, antimerger remedies only recently became the focal point of improvement of antimerger policy. Studies of merger challenges of the 1950s and 1960s (Elzinga 1969 and Pfunder, Plaine and Whittemore 1972) and 1970s (Rogowsky 1982) found that the relief obtained by the government is unsuccessful in a great majority of cases. The problems identified plagued both the instruments of relief used by the antitrust agencies (partial divestitures, reliance on marketing or conduct orders, bans on further acquisitions, etc.) and the enforcement of consent orders. In other words, remedies were often poorly designed in the first place and hence doomed for failure; additionally, sometimes even a well-structured solution would prove unsuccessful because its execution was not properly monitored.

In recent decades, antimerger remedies have increasingly consisted of asset divestitures. However, as is evident from numerous cases reviewed by Elzinga and Rogowsky, as recently as in 1980s relief obtained by the antitrust authorities in many cases was limited by the insistence of the agencies on relying on non-divestiture instruments, such as marketing orders, which simply prohibit certain types of conduct. Nevertheless, today divestiture of overlap assets is the preferred method of relief sought by the Federal Trade Commission (FTC) and the Department of Justice (DOJ).

2 Purpose of Study

It is worth pointing out that it is not the goal of this paper to evaluate the U.S. merger policy as a whole or to make policy recommendations regarding such aspects of it as legislation, interpretation of the law, dual-agency enforcement, or case selection process. It is true, for example, that if the government tends to challenge

some procompetitive mergers, then poor or no relief obtained in such cases may be better than carrying out a successful remedy, which repairs a nonexistent — though, perceived — injury to competition. For the purposes of the present study, we assume (perhaps, naively) that the process of screening anticompetitive mergers is efficient. In other words, we consider only relief sought in cases deemed problematic according to their anticompetitive potential, while ignoring any “Type I error” — challenging too many harmless cases.

Section 7 relief continues to be problematic today. While the antitrust agencies have committed to improving their approach and performance², there is evidence of inadequate remedies being used to address serious competitive issues related to recent merger activity. For example, Coate and Kleit (2001), who review 113 of recent FTC consent decrees, report that thirty-one of them were “compromise” or problematic settlements. They identify six cases in which divestiture was inadequate to address all of the likely competitive issues, and five cases with no structural remedy at all. Clearly, a study of the underlying process would contribute to a deeper understanding of the causes of such shortcomings and, ultimately, suggest a “diagnosis” that can be used to devise a “cure” for the ailing system.

The effectiveness of antimerger relief has not been adequately addressed in the empirical economics literature.³ Following the pioneering work by Elzinga (1969), Pfunder, Plaine and Whittemore (1972) and Rogowsky (1982, 1986), little has been done to assess the appropriateness of structural remedies. These papers reached a common conclusion that relief obtained by the antitrust authorities in the vast majority of Section 7 cases was unsuccessful.

²See Parker and Balto (2000) and Scheffman, Coate and Silvia (2002).

³It is also worth noting that all of the existing studies of Section 7 enforcement are done by current or former staff members of the FTC or the Justice Department. The present paper is, to the author’s knowledge, the first attempt to shed light on the mechanics of the antimerger review process using only publicly available sources.

Application of econometric techniques is also rather rare. The few studies that exist aim to address some particular aspect of the merger policy. For example, stock market event studies, popular in the 1980s and early 1990s, seek to explain the abnormal stock returns that accrue to firms planning to merge as the financial markets interpret the announcement of the acquisition as “efficiency-enhancing” or “market-power-creating.”⁴ Several papers attempt to quantify the impact of premerger notification (under the HSR) on the agencies’ decisions to challenge a particular merger.⁵ A large portion of the recent literature on merger policy deals with simulating the effects of acquisitions on prices in various markets.⁶

This paper’s main goal is threefold. First, it seeks to address the obvious void in the literature on the economics of merger policy by examining the effectiveness of remedies used in recent Section 7 cases. Second, it suggests and applies a new empirical approach to measuring the degree of success achieved in a particular merger challenge. Third, it demonstrates that a great deal of information potentially useful to the firms contemplating a merger can be gleaned from the data made public by the antitrust authorities.

The present study focuses on cases reviewed by the Justice Department, mainly because the Antitrust Division staff are typically more forthcoming about disclosing the details of their economic analysis than the Bureau of Economics at the FTC. However, a priori, there is no reason to expect that choosing only DOJ cases introduces any sample selection bias: while mergers in some industries are frequently reviewed

⁴See, for example, Eckbo (1992), McGuckin, Warren-Boulton, and Waldstein (1992), Eckbo and Weir (1985), Schumann (1983), and Stillman (1993).

⁵See Johnson and Parkman (1991) and Lopatka and Mongoven (1995).

⁶An exhaustive list of relevant papers is obviously too long to be reproduced here, but see, for instance, Werden and Froeb (1994, 1996), Werden (1996), Crooke et al. (1999), Froeb and Tschantz (2001), Jayaratne and Shapiro (2000), and Epstein and Rubinfeld (2001) for recent examples of advances in merger simulations.

by the same agency⁷, generally who handles the case is decided on a case-by-case basis. Rogowsky (1982) discusses the benefits and costs of dual-agency antimerger enforcement and finds that there are very subtle differences in the outcomes achieved by the two agencies.

The remainder of the paper is organized as follows: Section 3 briefly discusses the theoretical foundation; Section 4 presents the empirical approach; Section 5 discusses the sources and construction of the data; estimation techniques and results are presented in Sections 6 and 7; Section 8 presents and discusses the results of out-of-sample prediction, and Section 9 concludes.

3 Theoretical Background

A summary of antimerger activity at the Justice Department is presented in Table 1. As is evident from the table, the vast majority of Section 7 cases are settled rather than litigated. Consequently, the remedies implemented in such cases are results of negotiations.

The process of determination of appropriate structural relief can be viewed as a bargaining game between two players: the Firm proposing to merge with a competitor and the Agency (government's antitrust authority). The proposed merger is assumed to result in some potential for harm to competition in the *overlap* markets. The bargaining game is a negotiation over the division of assets involved in this overlap: any divestiture of assets obtained by the Agency resolves some of the anticompetitive issues (a complete divestiture — i.e., elimination of overlap — would resolve such issues completely), while the portion of assets retained by the Firm contributes to

⁷For instance, airline mergers are typically handled by the DOJ, while mergers of healthcare providers and acquisitions of firms producing equipment for the Department of Defense and the military lie in the domain of the FTC.

competitive injury.

Table 1: Summary of Antimerger Activity at the Antitrust Division of the DOJ

FY	Number of Challenges	Number of Complaints	Outcome		
			Settled (% of Complaints)	Restructured or Abandoned	Litigated
1990	13	11	5 (45.5)	2	6
1991 ^a	13	4	3 (75)	9	0
1992	7	4	4 (100)	3	0
1993	10	5	4 (80)	5	0
1994	22	10	7 (70)	14	1
1995	18	9	6 (66.7)	10	2
1996 ^b	30	10	9 (90)	20	0
1997	31	14	13 (92.9)	17	1
1998	51	15	10 (66.7)	41	0
1999	47	21	20 (95.2)	26	1
2000	48	21	18 (85.7)	2	1

^a One case was dismissed after the court denied a preliminary injunction.

^b One transaction challenged by the DOJ was subsequently approved by a regulatory agency.

Source: FTC Annual Reports to Congress pursuant to the HSR Act, FY 1990–2000.

The standard bargaining theory results⁸ suggest that the player with a relatively

lower cost of delay gets the larger share of the pie. In the following section, we propose a new approach to empirically test whether such predictions are consistent with the observed patterns of divestitures. Specifically, the following question is posed and answered: what (merger-specific and other) factors affect the outcome of the bargaining situation in each particular case?

4 Empirical Approach

The players' degrees of patience are not empirically observable. However, the magnitudes of these discount rates are not important, because the payoff to Agency depends

⁸See the classic paper by Rubinstein (1982).

only on its cost of delay *relative* to that of the Firm, not on the absolute magnitudes of these costs. A useful analogy is suggested by Muthoo (1999): in a boxing match, the stronger of the two athletes wins while their absolute strengths are irrelevant.

The outcome of the negotiation is determined by the *bargaining strength* parameter τ defined by

$$\tau = \frac{r_A}{r_F}$$

where r_A and r_F are the Agency's and the Firm's discount rates, respectively. This bargaining strength parameter is modeled here empirically as an unknown function $f(\mathbf{V}_A, \mathbf{V}_F)$ of the vectors \mathbf{V}_A and \mathbf{V}_F of exogenous factors affecting each player's degree of patience. As discussed below, each vector is player-specific in the sense that \mathbf{V}_i 's components are determinants only of player i 's cost of delay for $i = A, F$. However, it is possible to interpret the impact of any individual variable as the net effect on the outcome.

The cost of prolonged negotiation to the Agency is determined by several factors. For example, Agency's cost of delay with respect to any particular case is expected to be greater whenever it has a relatively heavy workload. In other words, one would expect the Agency to accept more quick settlements — which tend to be weaker — when it must deal with many pending matters at the same time.

Merger-specific efficiencies are also expected to increase the Agency's cost of delay, making it more impatient. The more the society stands to benefit from a particular merger, the greater is the cost of delaying it because of antitrust review. This assumes, of course, that the Agency seeks to maximize consumer welfare and thus finds it costly to delay a welfare-enhancing merger. Such an assumption is consistent with modeling the antitrust agencies as benevolent government authorities, which is the approach used here, but is inconsistent with the results from public choice literature.⁹

⁹The public choice theory of antitrust enforcement, which gained popularity in the 1970s, views

The antitrust agencies are not immune to political pressure from the legislative and/or the executive branches. To the extent that there are partisan ideological differences in the approach to merger policy among influential political figures, the Agency is likely to be affected by the current regime's attitude to antitrust actions. Coate, Kleit and Bustamante (1995) suggested that a heavily Democratic congress could expect the antitrust agencies to challenge and litigate more cases, while a more Republican congress would prefer settlements. On the other hand, the Republican-dominated congress may insist on litigation so as to avoid allowing the antitrust agency to assume the role of an unofficial regulator, whereas Democrats would opt for some type of settlement. The overall effect on either case selection or outcomes is uncertain; consequently, the impact on the Agency's degree of patience in dealing with *only* settled cases is also ambiguous. One possibility is that demanding successful litigation in the majority of cases diverts the Agency's and Congress' attention away from the few remaining settlements, where the Agency is highly impatient.

The severity of anticompetitive concerns associated with the proposed merger is likely to affect the degree of patience of the Agency. An acquisition that would tend to cause substantial competitive harm if not properly remedied will increase the return to prolonged bargaining for the Agency; hence its cost of delay will be lower.

Finally, a merger that receives a lot of exposure in the media puts additional pressure on the Agency to bring the case to resolution quickly. Several factors may contribute to how well any particular acquisition is covered by the media. For instance, a merger that promises huge consumer savings through the realization of the agencies' staffs (attorneys) as individual utility maximizers. Rather than pursue the intended objectives of preserving competition and enforcing the antitrust laws, the lawyers often see public service as a stepping stone towards more lucrative careers in private practice. Therefore, they tend to seek to maximize the visible "output" of their agency by, for instance, bringing as many easily winnable cases as possible. See, for example, Rogowsky (1986, 1987); MacKay, Miller and Yandle (1987) is a good collection of papers on public choice.

some merger-related synergies is likely to be publicized to a great extent. On the other hand, a merger that is likely to lead to consumer harm due to substantial market power achieved by the Firm is likely to generate a public outcry and hence be covered thoroughly as well. Also, mergers in markets for consumer goods typically receive more media exposure.

On the Firm's side of negotiations, the "hostage" effect is present in a settlement whenever the entire proposed acquisition is held up by the Agency's review of potential anticompetitive problems in one or more of the relevant markets. The larger the uncontested portion of the merger relative to the portion under review, the greater is the "hostage" effect, and hence the greater is the cost to the Firm of prolonged negotiations.

The anticompetitive potential of the merger also influences the cost to the Firm of delaying the settlement. Firm may be more patient in its dealings with the Agency if it is confident that it is going to benefit quite a bit from a great deal of market power obtained through the acquisition. If so, it pays to wait because a smaller divestiture is likely to not diminish Firm's additional market power by very much.

An important aspect of negotiations with the Agency arises out of dynamic considerations of repeated contacts between the Firm and the antitrust authorities. While in this model, the players are assumed to bargain over the specifics of an individual case, in reality it is likely that firms who have frequent interactions with the government tend to consider the "reputation" effect of resisting the authorities. If so, then larger firms, who deal with the government often, may not be the toughest hagglers, but be willing to compromise quickly.

On the other hand, it is possible that Firm size is positively related to its ability to bargain and delay accepting an offer. If the "reputation" effect is not important to the Firm, then one would expect larger firms to act more patiently in dealings with

the authorities because of their ability to finance such lengthy negotiations. This “war chest” effect characteristic of large firms was first investigated by McCall (1984) in his study of the applicability of a rule of reason to predatory pricing.

Finally, a higher anticipated cost of completing any divestiture is likely to increase the degree of patience of the Firm. Theoretically, the more costly it is to comply with a consent decree requiring a divestiture of a given size, the more willing the Firm will be to wait in the hopes of striking a better deal, *ceteris paribus*. It has been suggested by previous research¹⁰ that retail properties are much more difficult to sell than other assets (plants, manufacturing equipment, etc.) because of the need to ensure that economies of distribution are not lost when outlets are sold to different buyers. If this stipulation is valid, then certain firms, such as owners of grocery chains, will have lower costs of delay than other firms.

To summarize, the vectors of factors determining the cost of delay to each player can be written as follows:

$$\mathbf{V}_{\mathbf{A}} = \{\text{Merger-specific efficiencies, current workload of the agency, political pressure, merger's public exposure, anticompetitive potential of the merger}\}$$

$$\mathbf{V}_{\mathbf{F}} = \{\text{“Hostage” factor, anticompetitive potential of the merger, “reputation” effect, anticipated cost of complying with a divestiture order}\}$$

Note that with the exception of the anticompetitive potential of the merger, the components of vectors $\mathbf{V}_{\mathbf{A}}$ and $\mathbf{V}_{\mathbf{F}}$ appear in one vector or the other, but not both. This modeling assumption greatly simplifies the interpretation of estimated coefficients on the variables proxying the impact of each factor on the outcome of negotiations.

¹⁰See, for example, Coate and Kleit (2001).

5 Construction of the Data

The sample is drawn from the universe of 99 Section 7 cases settled by the Antitrust Division of the DOJ between 1990 and 2000, as reported in the Annual Reports to Congress pursuant to the HSR Act.¹¹ After eliminating the cases involving joint ventures, and those for which reliable data could not be located, there are 73 usable observations. An observation in this instance is a settlement between the parties on the one hand and the DOJ on the other, which is fewer than the number of transactions reviewed.¹² For each case, the relevant information was taken from the texts of the Formal Complaint, the Proposed Final Judgment, and the Competitive Impact Statement filed by the staff of the Antitrust Division.¹³ Where additional information was required, other sources, such as industry periodicals and company financial statements were consulted. It is worthwhile to note that all information used is publicly available to any researcher for replication.¹⁴

Before discussing the construction of individual variables, it is useful to define the competitive overlap empirically, especially since this concept is quite central to the analysis presented here. Coate (1992, 1995) suggests using sales of the acquired firm in the relevant market as a measure for the size of the overlap. However, occasionally the target's sales are significantly larger than those of the acquiring company in a particular market, so consistently using acquired firm's sales would overstate the overlap for these mergers. Therefore, the overlap is taken to be equal to the sales of

¹¹Note that the reports do not necessarily list only (or all of) the cases initiated under the HSR premerger notification system. Identification of these cases would potentially compromise the confidentiality used to collect the proprietary information from the parties.

¹²Several cases dealt with asset swaps or multiple transactions (sometimes involving three or more firms.)

¹³The list of cases is available from the author upon request as Appendix A.

¹⁴A potential drawback in relying on the public record produced by the DOJ is due to the fact that the documents, such as the Competitive Impact Statement, are produced *after* the settlement is reached. Therefore, the Antitrust Division staff have an incentive to present the factual information in a manner that is convincing that the consent decree resolves all of the competitive issues.

the firm with a smaller presence in the relevant market.

The dependent variable, D , equals the fraction of the competitive overlap subject to divestiture. It is calculated as the ratio of sales generated by the assets to be divested to sales from total overlap assets. Note that, by definition, $0 \leq D \leq 1$. In a number of cases, the settlement called for a divestiture of assets, revenues from which exceeded those initially determined to be subject to review (i.e., in overlap). In the context of the present model, such divestitures would imply $D > 1$. However, since this is obviously inconsistent with the bargaining framework employed here — it means that the Agency is able to obtain a portion of the cake larger than the amount bargained over — the dependent variable is set to equal one for these cases. As a result, D is “censored” in the following sense: an observed value of $D = 1$ implies $D^* \geq 1$, where D^* is the “unobserved” true measure of the divestiture’s impact, and is interpreted as full structural relief obtained.¹⁵

The variable VALUE is assigned the value of the proposed transaction, in millions of dollars. Where a foreign acquirer is involved, and the value of the merger is reported in a different currency, the official exchange rate for the date of the proposed merger is used. Additionally, in one case involving a stock swap, the price of a share on the date of the merger announcement is used to estimate the corresponding asset purchase price. The values are deflated using the GDP deflator to 1996.

The total annual revenues of the acquiring firm are recorded in SALES, also deflated to 1996. This variable measures the relative size of the acquirers, potentially capturing the “reputation” effect described above.

In addition, examination of the Department of Justice complaints and competitive impact statements yielded information on the following variables:

¹⁵The use of quotation marks in this sentence indicates that the resulting econometric model resembles a censored regression model, which would be appropriate if D^* were truly unobservable.

CONSUMER = dummy; equals 1 if the merger involves a consumer product;

USA = dummy; equals 1 if the acquiring firm is a US entity;

RETAIL = dummy; equals 1 if the potential divestiture would involve selling retail units (e.g., grocery stores or movie theaters);

HHI = Herfindahl Index (after merger, assuming no divestiture) for each relevant market affected by merger;

BARRIER = dummy; equals 1 if the Complaint or the Competitive Impact Statement contained significant evidence of difficult, unlikely, untimely, or insufficient entry;

COLLUDE = dummy; equals 1 if the Complaint or the Competitive Impact Statement alluded to a high probability of coordinated action among firms (collusion.)

While collusion is typically only discussed in those cases where both the likelihood of coordination is high and the corresponding loss in competition would be substantial, barriers to entry are claimed to be present and significant in every case. Intuitively, this is not surprising, since, according to the theory of contestable markets, without difficult entry, firms in even highly concentrated markets should behave competitively as the threat of *potential* entry forces prices down. Nevertheless, only where time-consuming or unlikely entry is supported by concrete evidence, the variable BARRIER is assigned a value of 1; whenever no support is provided, the barriers are assumed to be insignificant. Out of 73 cases, in 56 instances entry barriers are demonstrated to be substantial.

The documents also provided information on the dates of the merger, the complaint, and the entry of the Final Judgment; total sales of the acquired entity and

sales of the acquired entity involved in competitive overlap. The ratio of the acquired firm's sales in overlap to its total sales defines the fraction of the merger subject to antitrust review.¹⁶

The variable HOSTAGE is equal to one minus the portion of the acquisition under review; therefore, it measures the fraction of the deal held up by the investigation. This variable is similar to the measure SETTLE VALUE used by Coate, Kleit and Bustamante (1995) and Coate and Kleit (2001) to investigate the parties' incentives to fight the FTC, fold (abandon the merger) or settle.

The following additional explanatory variables were either constructed from the information above or obtained from other sources:

EFFICNCY = proxy for merger-related efficiencies that would potentially accrue to the acquiring firm; equals VALUE times the fraction of the deal under review.

The rationale for using this particular measure is as follows: a large overlap is likely to translate into substantial synergies realized by the acquirer as some of the acquired assets that duplicate the firm's own operations are shutdown, scrapped, or sold off. More precisely, the importance of merger-related efficiencies depends on the size of the overlap relative to other mergers as well as on the absolute size of the transaction; therefore, $VALUE \times (1 - HOSTAGE)$ captures both aspects of this relationship.¹⁷ Note that given the construction of EFFICNCY, Agency, assumed to seek

¹⁶In several cases the information on target's sales in a particular geographic market was unavailable. Then, the "fraction under review" is approximated by the ratio of the number of target's facilities (plants) in affected markets to the total number of its facilities.

¹⁷Other proxies for merger-specific efficiencies found in the literature include the number of pages in the FTC Bureau of Economics memoranda devoted to the explanation of proposed cost-savings (Coate, Kleit and Bustamante 1995) and the number of FTC docket entries per case (Rogowsky 1986). Both measures are somewhat less direct and require access to the agency's restricted internal documents. Furthermore, the former measure may to some extent reflect the degree of disagreement between the parties about the scope of potential synergies rather than the substance of the savings themselves.

to maximize consumer welfare, is “penalized” for substantial divestitures, which tend to eliminate a large portion of overlap. In other words, merger-specific efficiencies directly affect Agency’s payoff.

WORK = measure of the workload at the DOJ at the time of each case; equals the total number of transactions reported to the Antitrust Division in the month when complaint is filed;

CONGRESS = share of Democrats in the House of Representatives;

SENATE = share of Democrats in the Senate;

POLITICS = (unweighted) average of CONGRESS and SENATE.

The preceding three variables proxy the extent of political pressure on the antitrust authorities stemming from the partisan differences in the approach to antimerger policy.

WSJ = number of articles published in *The Wall Street Journal* dealing with the merger;

COURT% = the estimated probability that the merger will be enjoined, if litigated.

The probability of government’s victory in court is simulated using the estimates from the econometric model described and estimated in Coate (1995) and used in Coate and Kleit (2001).¹⁸

STRUCTURE = BARRIER × HHI / 10000.

¹⁸Details of this simulation are available from the author as Appendix B upon request.

This is an additional measure of the likely anticompetitive effect of the merger.¹⁹

TIME = number of months since the first case in the sample.

Given that the sample cases span a period of about eleven years, this variable is included to account for any time-dependent changes in the design of divestiture remedies.

Descriptive statistics of the variables discussed above are shown in Table 2.

6 Econometric Model

Since the dependent variable D is censored at both tails, zero and one, use of Ordinary Least Squares (OLS) would lead to inconsistent estimates. In other words, we seek to explain the variation in the unobserved dependent variable D^* by using its censored counterpart D . The relationship between D^* and D can be summarized as follows:

$$D = \begin{cases} 0 & \text{if } D^* \leq 0 \\ D^* & \text{if } D^* \in (0, 1) \\ 1 & \text{if } D^* \geq 1 \end{cases} \quad (1)$$

The frequency of each instance of D is shown in Table 3. The relevant regression equations are estimated using the tobit model. The expected effects of explanatory variables on the relative size of divestiture can be derived from the discussion of the factors likely to affect the players' costs of delay.

¹⁹Where the case involved more than one (geographic and/or product) market, the maximum value of HHI was used for these computations. An unweighted average as well as a weighted average of the various markets' Herfindahls were also attempted, with the weights equal to the shares of each particular market in the total overlap (measured by combined acquirer and target sales.) Neither of the averages proved to result in significant COURT% or STRUCTURE variables.

Table 2: Descriptive Statistics

Variable	Mean	Std. Dev.	Min.	Max.
D	0.6251	0.3661	0	1
VALUE ^a	6.2786	2.3359	2.0148	10.9651
EFFICNCY ^{a, b}	4.5868	1.9285	0	9.9075
CONSUMER	0.3425	0.4778	0	1
WORK ^c	3.229	1.0545	0.97	4.94
CONGRESS	0.5056	0.0532	0.4690	0.6138
SENATE	0.4869	0.0464	0.45	0.57
POLITICS	0.4962	0.0473	0.4618	0.5869
WSJ	5.9863	9.2429	0	47
HOSTAGE	0.6658	0.3142	0	1
SALES ^a	7.3833	2.074	2.7661	11.4076
USA	0.8904	0.3145	0	1
RETAIL	0.0959	0.2965	0	1
COURT%	0.782	0.354	0.00002	1
STRUCTURE	0.4194	0.3056	0	1
TIME	94.8342	38.3986	0	143.4

$N = 73$.

^a Natural logs of actual values.

^b By construction, $EFFICNCY = \ln(\text{VALUE} \times (1 - \text{HOSTAGE}))$ resulted in several negative values, which were replaced by zeros.

^c WORK is reported as hundreds of transactions per month.

Table 3: Frequency of the Observed Dependent Variable

Value	Frequency	Percent
$D = 0$	7	9.6
$0 < D < 1$	37	50.7
$D = 1$	29	39.7
Total	73	100.0

For example, a consumer welfare-enhancing merger (i.e., one with a relatively high realization of EFFICNCY) puts pressure on the Agency to minimize the delay and resolve the case quickly; therefore, its coefficient is expected to be negative. The coefficient signs on the political variables (CONGRESS, SENATE, and POLITICS) are

undetermined a priori. Similarly, the effect of acquiring firm’s relative size, measured here by SALES, is ambiguous based on the theoretical arguments. Additionally, USA is included to investigate whether foreign acquirers systematically achieve different outcomes from their domestic counterparts due to difference in their bargaining costs; a priori, no expectations are formed for this coefficient. The expected signs of the coefficients on all variables are summarized in Table 4.

Table 4: Variables’ Expected Signs

Variable	Expected Sign
EFFICNCY	–
CONSUMER	–
WORK	–
CONGRESS	?
SENATE	?
POLITICS	?
WSJ	–
HOSTAGE	+
SALES	?
USA	?
RETAIL	–
COURT%	+
COURT% ²	–
STRUCTURE	+
TIME	?

7 Results

Several underlying models can be posited and estimated depending on what one considers to be the major driving force behind the bargaining process. Results of estimation are presented in Table 5 below. Model 1, for example, is a “Chicago-plus-

Efficiencies” model similar to a model suggested and estimated in Coate (2000).²⁰ According to the Chicago school of thought, conduct and performance of the industry are directly determined by its structure — i.e., market concentration, ease of entry and collusive behavior. Therefore, a merger presenting a great deal of competitive concern is deemed undesirable and must be remedied adequately. The scope of the divestiture is assumed to be determined primarily by the anticompetitive potential of the merger, but merger-specific efficiencies are included to offset the harmful effect on competition. Formally, the degree of patience of the Agency is affected most of all by how competitively harmful a particular merger is likely to be. The model performs poorly as only the constant coefficient is statistically significant.

Next, we estimate a model, in which political forces play a central role in determining the outcome of negotiations. One might think of this model (Model 2) as arising out of the public choice theories of antitrust, according to which the Agency tends to maximize its bureaucratic output, while being influenced from the outside by political pressures. While this model appears to perform slightly better than Model 1, all of the explanatory power rests with WSJ. The results suggest that while a high-profile case’s degree of public exposure in the media affects the outcome of the settlements, outside influences, such as Congress’ supervision of the antitrust agencies, are not important. Note that the coefficient on WSJ is of the wrong sign — it is expected to be negative, a priori — but interpretation of individual coefficients is hardly appropriate in this context, as the modeling assumptions clearly do not stand up to empirical testing.

Model 3 posits a particular relationship between the Firm and the Agency, in

²⁰In that study, the likelihood of an FTC challenge is investigated given the characteristics of a proposed acquisition. Although an entirely different issue is being addressed here, one would expect that the probability of a challenge and extent of structural relief obtained in any case are affected by similar factors.

which the Firm-specific and merger-specific characteristics are central to the bargaining process, while Agency's approach is the same to all cases. This assumption may be plausible if in a typical case, Agency allows Firm to make whatever concessions the latter deems worthwhile in order to get the approval for its acquisition. In such a case, the Firm-side factors are important, while the variation in Agency's characteristics across different mergers matters relatively little. The results indicate that the portion of the deal not subject to antitrust review but held up by the investigation (measured by HOSTAGE) explains all of the variation in the dependent variable. In other words, the only factor affecting Firm's cost of delay substantially arises from the inability to consummate the entire merger. Note the (statistical) insignificance of COURT% and COURT%², pointing to the fact that firms proposing mergers motivated by the pursuit of greater market power are just as patient in their dealings with the government as are firms pursuing other objectives through acquisition.²¹

Model 4 is a "Consumer Welfare" model. It is estimated here to investigate whether the goal of protecting or maximizing consumer welfare (as opposed to, for example, total welfare) forces the Agency to be more patient in remedying the mergers, which are likely to bring the most consumer harm if not fixed. None of the included variables' coefficients are significant, so this modeling scenario does not appear plausible.

The relatively poor performance of the four "restricted" models discussed so far suggests that a combination of factors is at play. Therefore, a full or "Econometric" model is estimated (Model 5), allowing for various Agency- and Firm-side character-

²¹There is some anecdotal support for this type of model. The rules of premerger notification grant a good deal of strategic power to the Firm, who can essentially choose when to "start the clock" on the review process. The antitrust agencies have no control over when the filing is submitted to them, but are limited to a 30-day waiting period, in which to make a decision whether to pursue a challenge. In other words, the Agency's approach is likely to be the same to the review of most proposed mergers, at least initially.

istics to contribute to explaining the underlying process.

The last column of Table 5 presents the estimates from this model; the marginal effects of explanatory variables²² are also given for each model.²³

Nine out of thirteen coefficients are statistically significant at conventional levels.²⁴ The variable of interest, HOSTAGE, is significant and positive, as predicted by theory. Note that the coefficient falls in magnitude when additional regressors are included, as is evident from a comparison of results from Model 5 with those from Model 3. The EFFICNCY measure is also highly significant as is WSJ, although WSJ still has the wrong sign. It may be that a great deal of media exposure increases the pressure on the agency to “get it right” thus making it more patient. If this is a correct conjecture, then WSJ will have a positive effect on the outcome.

The coefficient on CONGRESS is significant and negative, suggesting that a larger share of democrats is associated with less successful antimerger policy. The somewhat puzzling result is the unexpected sign on the WORK proxy: it is positive, although just barely statistically significant. It is possible that the effect of high workload at the DOJ is misspecified in this model. For example, if during merger waves, the government is forced to challenge a smaller proportion of mergers, it may be limited to bringing only the strongest cases, which are easier to resolve with a strong settlement.

²²Whenever a variable’s coefficient is not significantly different from zero, the marginal effect is omitted.

²³A series of diagnostic tests was performed to assess the robustness of the estimated results, including moment-based tests for the presence of multiplicative heteroskedasticity and for the validity of the normality assumption on the error term. Details are available upon request from the author as Appendix C.

²⁴Coate (2000) attempts several models in his study of FTC decisions and also concludes that such “econometric” models are best in terms of their explanatory power.

Table 5 Estimation Results (Tobit)

Dependent Variable: D

(absolute value t -stats in parentheses)

Variable	Model 1 Marginal Effect	Model 2 Marginal Effect	Model 3 Marginal Effect	Model 4 Marginal Effect	Model 5 Marginal Effect
Constant	0.7487** (2.203)	1.4804 (0.947)	-0.05593 (0.152)	0.4131 (1.091)	3.184** (2.164)
EFFICNCY	-0.0047 (0.104)			-0.0223 (0.484)	-0.1527*** (3.392)
CONGRESS		-2.2029 (0.874)			-4.2927* (1.903)
CONSUMER		-0.1015 (0.606)		0.173 (0.951)	-0.025 (-0.169)
WORK		0.198 (1.566)		0.1607 (1.218)	0.1808* (1.657)
WSJ		0.075*** (3.248)	0.0398		0.0903*** (3.334)
HOSTAGE			0.903*** (3.542)	0.5231	0.4193* (1.951)
USA					-0.1712 (0.86)
SALES		-0.0112	0.0589		0.0241

continued on next page

$N = 73$

* Significant at the .1 level; ** significant at the .05 level; *** significant at the .01 level.

continued from previous page

Variable	Model 1	Marginal Effect	Model 2	Marginal Effect	Model 3	Marginal Effect	Model 4	Marginal Effect	Model 5	Marginal Effect
RETAIL			(0.256)		(1.521)		0.287		(0.651)	
COURT%	-1.6433 (1.393)				0.1043 (0.376)		(0.919)		-0.07267 (0.274)	
COURT% ²	1.4269 (1.313)				-1.7206 (1.607)		-1.6859 (1.425)		-2.6025** (2.498)	-1.4948
TIME	0.0029 (1.338)		-0.0048 (1.201)		1.5598 (1.598)		1.6262 (1.495)		2.5081*** (2.698)	1.4406
Log Likelihood	-67.3333		-55.5138		-0.0003 (0.152)		-0.0003 (0.07)		-0.0068** (1.969)	-0.0039
					-58.641		-65.6461		-42.8758	

N = 73

* Significant at the .1 level; ** significant at the .05 level; *** significant at the .01 level.

Also, focusing on only settled cases may inadvertently introduce a degree of selection bias into the analysis: it is possible that relief obtained in *all* merger cases (including those litigated) suffers considerably, but settled cases fare better on average. On the other hand, given the overwhelming prevalence of settlements among all Section 7 cases, this scenario is not likely.

The insignificance of the coefficients on SALES and on the dummy variables CONSUMER, USA, and RETAIL suggests that bigger firms, domestic producers, makers of consumer products, and retail chains do not on average receive any special treatment. Finally, the anticompetitive potential measure, COURT% and its squared form, COURT%², are both significant and have opposite signs.

The effects on the unobserved dependent variable of a one standard deviation change in each x can be computed using the information from the descriptive statistics.²⁵ Table 6 summarizes these results. The conditional mean of D , as reported by Limdep, is 0.3645 and is computed as

$$E[D|\mathbf{x}_i] = 0 \cdot \text{Prob}[D = 0] + 1 \cdot \text{Prob}[D = 1] \\ + E[D|0 < D < 1] \cdot \text{Prob}[0 < D < 1]$$

²⁵The need for the marginal effects arises from the difficulty in interpreting the raw tobit coefficients. Because of the censoring in the dependent variable, the obtained β 's do not have valid intuitive meaning. The corresponding marginal effects are computed as partial derivatives of the expected value (conditional mean) of the observed dependent variable with respect to the independent variables, and equal the estimated coefficients scaled by the probability of nonlimit observations in the sample. That is,

$$\partial E[D|\mathbf{x}_i]/\partial \mathbf{x} = \boldsymbol{\beta} \times \text{Prob}[0 < D < 1]$$

The derivatives are evaluated at the means of the explanatory variables. Since the marginal effects are essentially the tobit coefficients scaled down by a probability, they are smaller in magnitude than the raw coefficients.

Table 6: Marginal Impacts (MI) on \tilde{D} of Significant Variables

Variable	Mean	Std. Dev. (σ_x)	MI on \tilde{D} of σ_x
EFFICNCY	4.5868	1.9285	-0.16913
WORK	3.229	1.0545	0.109563
CONGRESS	0.5056	0.0532	-0.13118
WSJ	5.9863	9.2429	0.479707
HOSTAGE	0.6658	0.3142	0.075659
COURT%	0.782	0.354	-0.52916
COURT% ²	0.7351	0.3793 ^a	0.54642 ^a
TIME	94.8342	38.3986	-0.14975

^a The standard deviation and marginal impact for COURT%² are computed and reported for consistency purposes only. The change in COURT%² induced by a one-standard-deviation change in COURT% is, of course, the more relevant measure.

Therefore, for example, an increase in the workload of the DOJ of about 105 transactions per month (corresponding to a one- σ_x increase) from the mean of 323 reported mergers is associated with an increase in the size of divestiture of 0.1096 (from 0.3645 to 0.4741.) Similarly, an increase in the percentage of the deal held hostage to the review from 66 percent to 98 percent, increases the fraction of overlap subject to divestiture by roughly 0.076, from 0.3645 to 0.4402.

Somewhat less straightforward is the interpretation of the effect of a change in COURT% since the variable enters the index function both linearly and quadratically, and the coefficients have opposite signs. A decrease in the probability of a governmental victory in court from .782 to .428 (a one-sigma drop) has an overall effect of reducing the divested fraction of overlap by 0.0879. Thus, on average, a merger with about a 35 percent lower probability of being enjoined is subject to only a 9 percent smaller divestiture.²⁶

In summary, EFFICNCY²⁷, WORK, CONGRESS, and WSJ have quantitatively

²⁶Details of this computation are available from the author upon request as Appendix D.

²⁷A one standard deviation rise in EFFICNCY corresponds to an increase in merger-specific efficiencies from roughly \$98.2 million to \$675.4 million. However, given the construction of this measure, these results should be interpreted with caution.

meaningful effects on the size of the resulting divestiture, although a one- σ_x change in WSJ required for the above computation (about 9.2 articles) is rather large relative to the mean of less than 6. The effects of HOSTAGE and the probability of a court blocking the merger, on the other hand, are not substantial.

8 Out-of-Sample Prediction

Information on seven additional cases, all settled by the Antitrust Division in 2001, was gathered.²⁸ Below, one case is discussed in detail so as to give the reader an idea of what a typical observation looks like. The results of prediction of all seven out-of-sample cases are presented in Table 7 following this discussion. As is evident from the reported results, five of the seven cases are predicted reasonably well by the model. The two remaining mergers yielding rather inaccurate predictions are analyzed below.

The *Premdor/Int'l Paper/Masonite* case dealt with the merger of a Canadian maker of interior molded doors — Premdor, Inc. (Premdor) — and a maker of molded doorskins (an input into the production of molded doors) — Masonite Corporation (Masonite). Masonite was the only firm in the molded doorskin business that was not vertically integrated into the manufacture of molded doors; Premdor, on the other hand, was one of Masonite's key competitors as well as a substantial customer.²⁹ Approximately 23 percent of Premdor's total sales in 2000 were revenues

²⁸There were eight consent decrees during the 2001 fiscal year. However, the Thomson-Harcourt merger involving Thomson's acquisition from Reed Elsevier of Harcourt textbook publishing assets, was excluded due to lack of reliable data. The case alleged potential competitive problems in markets for thirty-eight college course textbooks as well as the market for computer-based testing services. Given the data requirements for computations of the overlap and divestiture measures, the potential for imprecise results is obvious in this case. The full list of cases used in this out-of-sample prediction test is available from the author upon request as Appendix E.

²⁹This case is an example of an occasional horizontal merger challenged by the government on largely non-horizontal grounds in addition to the usual loss-of-competition concerns.

from sales of interior molded doors, and Premdor also held a 48.5 percent interest in a Chilean producer of molded doorskins, Fibramold. Masonite's total sales in 2000 were \$465 million with about half of this amount accounted for by revenues from molded doorskins.

The proposed merger between Premdor and Masonite, valued at \$527 million, was announced on September 30, 2000.³⁰ The relevant antitrust markets were determined as follows: for interior molded doorskins, the United States was deemed the appropriate geographic market, while for molded doors the geographic market was argued to be comprised of small regional areas, each with a radius of about 300 miles and centered at the point of manufacture.

The vertical integration of the firms-parties to the merger presented additional complicating aspects. The upstream and downstream product markets are closely connected because the interior molded doorskins are a key input in the production of interior molded doors and account for about 70 percent of the production cost. The proposed merger would enhance substantially Premdor's otherwise small presence in the molded doorskins market and not (directly) affect the structure of the molded doors market. However, elimination of an independent producer of molded doorskins (Masonite) may lead to increased incentives for Premdor to foreclose other non-vertically integrated firms from the molded doorskins market; it would also make coordinated action with the only other significant competitor (a firm, not party to the merger) easier and more likely. In other words, the downstream molded doors market, while not affected directly, contributed several significant elements to the analysis of the potential anticompetitive problems, such as likely coordinated action.

Given the resulting HHI measure for the upstream and downstream markets of

³⁰See Katz (2002) for a more detailed discussion of this case.

4200 and 3600, respectively³¹, evidence of past collusive attempts in the industry, and significant sunk costs required to initiate entry, the estimated probability of the court enjoining the merger is .99973.

The settlement negotiation resulted in a consent decree requiring the divestiture of one of the two production facilities, owned by Masonite. Since no information was available on the production distribution across the two plants, located in Laurel, MS and Towanda, PA, they were assumed to have equal capacity, and consequently $D = 0.5$. The model predicted a divestiture of about 0.52, which is very close to the observed outcome of one-half.

Table 7: Out-of-Sample Prediction

Case	Divestiture (D)	
	Predicted	Observed
3D Systems/DTM	0.24329	0
AB Volvo/Renault/Mack Trucks	0.66193	1
Georgia-Pacific/Fort James	0.75177	1
Premdor/Int'l Paper/Masonite	0.51941	0.5
News Corp/Fox/Chris-Chraft	0.42851	1
Signature Flight Support/ Ranger	0.90289	1
WorldCom/Intermedia	0.28107	0.93118

The predicted outcomes discussed here should be interpreted with caution. Given the approximations needed to construct some of the relevant measures, the results should not be expected to be precise. Also, the validity of using estimates from a prior period to predict later out-of-sample observations will be compromised if the approach to the settlement process is markedly different in 2001 from to that of the previous years.³²

³¹Again, the downstream market (interior molded doors) was not affected structurally, so pre- and post-merger HHIs are the same.

³²While there is no specific reason to suspect that this is the case, two aspects are worthy of

If one considers predictions of less than 0.5 reasonably good approximations of observed outcomes in the interval $[0, 0.5)$, and predictions of 0.5 or greater reasonable estimates of outcomes in $[0.5, 1]$, then only two cases are poorly predicted. Furthermore, if one breaks the $[0, 1]$ interval into quartiles, and requires a “good” prediction to be in the same quartile as the actual observed outcome, then three cases are incorrectly predicted.

The case involving a merger of Worldcom with Intermedia Communications was settled by a consent decree requiring a nearly complete divestiture of all assets acquired by Worldcom as part of the merger. The overlap subject to review by the DOJ constituted the entire merger, thus resulting in no significant hostage effect. Therefore, according to the model developed here, the acquiring firm should possess substantial bargaining power as most of the deal is being challenged. The model predicts a relatively small divestiture of about 28 percent of the overlap, while the Justice Department achieved a nearly 93 percent divestiture.

The problem may lie in the regulatory framework, under which the merger was proposed. Both Worldcom and Intermedia are providers of various telecommunications services, including Internet backbone connectivity. In order to take control of Intermedia’s Internet Backbone Provider (IBP) operations, Worldcom filed an application for the transfer of various licenses issued by the Federal Communications Commission (FCC) to Intermedia. Unless and until the FCC granted the transfer, the merger could not be consummated, which essentially amounts to review of the

note. First, the methods of merger review and analysis are constantly evolving; therefore, if this evolution process is not “smooth” but rather is characterized by bursts of innovation, predicting future cases can lead to poor results. Second, in 2001, the Justice Department and the FTC raised the threshold requirements for reporting a merger under the HSR, which immediately resulted in fewer transactions filed and fewer low-profile mergers reviewed. “Low-profile” here refers to size-of-transaction and size-of-person tests, which are reflected in the value of the deal and sales of the firms involved. Any such merger may still be well covered in the media and be of considerable interest to various groups.

merger by a regulatory agency in addition to the challenge by the DOJ on antitrust grounds. This additional source of delay is not accounted for by the model.

The other settlement that appeared problematic for the model is in the case of a merger of two operators of television stations. News Corporation proposed to acquire 10 stations owned by Chris-Craft, including KTVX-TV, a Salt Lake City ABC affiliate. News had its own station, KSTU-TV in the same market, which it operated through its subsidiary, FOX. The hostage effect associated with the delay due to antitrust review was a substantial 0.9 since only one of the 10 stations was located in the overlap. One would expect the acquiring firm to be facing significant costs from delaying the consummation of the merger and thus be willing to settle quickly. In other words, a relatively high predicted value of D is expected. However, the model yields a prediction of less than 0.43.

Upon closer examination, the structural characteristics of the relevant market barely warrant issuing a challenge. Although the premerger HHI of about 2000 and change of 785 points associated with the merger are both above the Justice Department Guidelines' thresholds, this case can be argued to carry only a marginal potential for competitive harm.³³ The combined firm would hold a 40 percent market share, which even in the presence of entry barriers — argued to be substantial in this case — seems less than threatening. Two additional TV stations would continue to compete with the combined firm for the spot advertising revenue. The estimated probability of defeat in court is about .63 (the sample mean is .78.) Therefore, it is not surprising that the model produces a relatively modest prediction for a case that is unlikely to raise significant competitive concerns.

The mixed results of these out-of-sample prediction exercises suggest that the estimated model should only be used as a rough benchmark in attempting to forecast

³³The average post-merger HHI for the sample cases is 4569.

what a divestiture ought to look like in any particular settlement. Given that an individual case may differ substantially from the “mean” Section 7 challenge, those differences should be considered as well.

9 Concluding Remarks

In this paper, we hope to address the obvious void in the empirical literature of the economics of merger policy. While many aspects of the policy continue to be the subject of research, structural remedies are often ignored. This paper demonstrates that application of econometric techniques can help isolate the effects of various exogenous influences on the underlying process. We hope that this study is a first, albeit small, step in the right direction.

A variety of extensions to the presented framework are possible. We limit ourselves to one suggestion here: application of the predictive ability of this divestiture model to non-settled cases. What *would* a settlement look like *if* the parties reached an agreement instead of insisting on litigation? Potentially, such study could reveal whether, on balance, the merging firms would have been better off agreeing to the predicted divestiture rather than incurring significant litigation costs and facing the possibility of defeat in court.

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A List of Sample Cases

1. *US v. North American Salt* CV 90-C-2631
2. *US v. American Safety Razor Company and Ardell Industries, Inc.* CV 90-0188
3. *US v. Baker Hughes, Inc., Hughes Tool Company, Norton Company, and Eastman Christensen Company* CV 90-0825
4. *US v. The Gillette Company, Wilkinson Sword, Inc., Stora Kopparbergs Bergslags AB, and Eemland Management Services BV* CV 90-0053
5. *US v. Brown & Root, Inc., Halliburton Company, and Offshore Pipelines, Inc.* CV 90-1986
6. *US v. First Hawaiian, Inc. and First Interstate of Hawaii, Inc.* CV 90-00904
7. *US v. General Binding Corporation and Velobind, Inc.* CV 91-1822
8. *US v. Fleet/Norstar Financial Group, Inc.* CV 91-0221-P
9. *US v. Tidewater, Inc. and Zapata Gulf Marine Corporation* CV 92-0106
10. *US v. Borland International, Inc. and Ashton-Tate Corporation* CV C-91-3666-MHP
11. *US v. Society Corporation and Ameritrust Corporation* CV 1:92CV0525
12. *US v. USAir Group, Inc.* CV 93-0530
13. *US v. Cookson Group plc, Electrovert Ltd., and Electrovert USA Corp.* CV 92-2206

14. *US v. Texas Commerce Bancshares, Inc. and Texas Commerce Bank-Midland, N.A.* CV 3-93CV0294-G
15. *US v. Texas Commerce Bancshares, Inc. and Texas Commerce Bank-Beaumont, N.A.* CV 3-93CV0368-D
16. *US and the State of Florida v. Morton Plant Health System, Inc. and Trustees of Mease Hospital, Inc.* CV 94-748-CIV-T-23E
17. *US and the States of Florida and Maryland v. Browning-Ferris Industries, Inc.* CV 1:94CV02588
18. *US v. Sabreliner Corporation* CV 95CV00421
19. *US v. Interstate Bakeries Corporation and Continental Baking Company* CV 95C4194
20. *US and the State of Florida v. Reuter Recycling of Florida, Inc., and Waste Management, Inc. of Florida* CV 1:95CV01982
21. *US v. Computer Associates International, Inc. and Legent Corporation* CV 1:95CV01398
22. *US and the State of Texas v. Kimberly-Clark Corporation and Scott Paper Company* CV 3:95CV3055-P
23. *US v. Pacific Scientific Company* CV 1:96CV00165
24. *US v. Georgia-Pacific Corporation* CV 96-164
25. *US v. Jacor Communications, Inc. and Citicasters, Inc.* CV C-1-96-757
26. *US v. American Skiing Company and S-K-I Limited* CV 1:96CV01308

27. *US and the State of New York v. American Radio Systems Corporation, The Lincoln Group L.P., and Great Lakes Wireless Talking Machine LLC* CV 1:96CV02459
28. *US and the States of California, Connecticut, Illinois, Massachusetts, New York, Washington, and Wisconsin v. The Thomson Corporation and West Publishing Company* CV 1:96CV01415
29. *US v. US West, Inc. and Continental Cablevision, Inc.* CV 96-2529
30. *US and the State of Connecticut v. Oldcastle Northeast, Inc., CRH plc, Tilcon, Inc., and BTR plc* CV 396-CV-01749
31. *US v. Westinghouse Electric Corporation and Infinity Broadcasting Corporation* CV 1:96CV02363
32. *US, the State of Texas, and Commonwealth of Pennsylvania v. USA Waste Services, Inc. and Sanifill, Inc.* CV 1:96:CZ02031
33. *US v. Chancellor Media Corporation and SFX Broadcasting, Inc.* CV 97-6497
34. *US and the State of Colorado v. Vail Resorts, Inc., Ralston Resorts, Inc., and Ralston Foods, Inc.* CV 97-B-10
35. *US v. American Radio Systems Corporation and EZ Communications, Inc.* CV 1:97CV00405
36. *US v. EZ Communications, Inc. and Evergreen Media Corporation* CV 1:97CV00406
37. *US v. Signature Flight Support Corporation* CV 97-0248
38. *US v. Hicks, Muse, Tate & Furst, Inc., Capstar Broadcasting Partners, and SFX Broadcasting, Inc.* CV 98CV2422

39. *US v. CBS Corporation and American Radio Systems Corporation* CV 98CV00819
40. *US and the States of New York and Illinois v. Sony Corporation of America, LTM Holdings, Inc. d/b/a Loews Theatres Cineplex Odeon Corporation, and J.E. Seagram* CV 98-CIV-2716
41. *US v. Halliburton Company and Dresser Industries* CV 98-CV-2340
42. *US v. Aluminum Company of America and Alumax, Inc.* CV 1:98-CV-1497
43. *US and the States of Ohio, Arizona, California, Colorado, Florida, Commonwealth of Kentucky, States of Maryland, Michigan, New York, Commonwealth of Pennsylvania, States of Texas, Washington, and Wisconsin v. USA Waste Services, Inc., Dome Merger Subsidiary, and Waste Management, Inc.* CV 1:98CV1616
44. *US v. SBC Communications, Inc. and Ameritech Corporation* CV 1:99CV00715
45. *US v. General Electric Company and Innoserv Technologies, Inc.* CV 1:98CV01744RCL
46. *US v. AT&T Corporation and Tele-Communications, Inc.*
CV 1:98CV03170
47. *US v. Capstar Broadcasting Corporation and Triathlon Broadcasting Company*
CV 1:99CV001043
48. *US v. Bell Atlantic Corporation and GTE Corporation* CV 1:99CV0119
49. *US and the States of New York, Florida, and Commonwealth of Pennsylvania v. Waste Management, Inc., Ocho Acquisition Corporation, and Eastern Environmental Services, Inc.* CV 98-7168

50. *US v. Chancellor Media Corporation, Whiteco Industries, Inc., and Metro Management Associates* CV 1:98CV02815
51. *US v. Suiza Foods Corporation, d/b/a Flav-o-Rich Dairy, Land O'Sun Dairy, Louis Trauth Dairy, and Broughton Foods Company, d/b/a Southern Belle Dairy* CV 99-CV-130
52. *US v. Central Parking Corporation and Allbright Holdings, Inc.* CV 99CV00652
53. *US v. Chancellor Media Corporation and Kunz Company*
CV 1:98CV02763
54. *US v. Cargill, Inc. and Continental Grain Company* CV 1:99CV01875
55. *US and State of Texas v. Aetna, Inc. and The Prudential Insurance Company of America* CV 3-99CV1398
56. *US v. Signature Flight Support Corporation, AMR Combs, Inc., and AMR Corporation* CV 1:99CV0537
57. *US v. Imetal, DBK Materials, Inc., English China Clays, PLC, and English China Clays, Inc.* CV 1:99CV01018
58. *US and the States of Illinois and Missouri v. Allied Waste Industries, Inc. and Browning-Ferris Industries, Inc.* CV 1:99CV00894
59. *US v. Allied Waste Industries, Inc. and Browning-Ferris Industries, Inc.* CV 1:99CV01962
60. *US v. Computer Associates International, Inc. and Platinum Technology International, Inc.* CV 1:99CV01318

61. *US v. Florida Rock Industries, Inc., Harper Bros., Inc., Commercial Testing, Inc., and Daniel R. Harper* CV 99-516-CIV-J-20A
62. *US v. AT&T Corporation and MediaOne Group, Inc.* CV 1:00CV01176
63. *US v. CBS Corporation, Infinity Broadcasting Corporation, and Outdoor Systems, Inc.* CV 1:99CV03212
64. *US v. AlliedSignal, Inc. and Honeywell, Inc.* CV 1:99CV02959
65. *US v. Allied Waste Industries, Inc. and Superior Services, Inc.* CV 1:00CV01067
66. *US v. Alcoa, Inc. and Reynolds Metals Company* CV 1:00CV00954
67. *US v. Clear Channel Communications, Inc. and AMFM, Inc.* CV 1:00CV02063
68. *US v. The Earthgrains Company, Specialty Foods Corporation, and Metz Holding, Inc.* CV 00CV1687
69. *US v. Dairy Farmers of America, Inc., Societe De Diffusion Internationale Agro-Alimentaire, and Sodial North America Corporation* CV CN00-CV-1663
70. *US v. JDS Uniphase Corporation and E-TEK Dynamics, Inc.* CV CV00-2227
71. *US v. Ingersoll-Dresser Pump Company, Ingersoll-Rand Company, and Flowserve Corporation* CV 1:00CV01818
72. *US v. L'Oreal USA, Inc., L'Oreal S.A., and Carson, Inc.*
CV 1:00CV01848
73. *US v. SBC Communications, Inc. and BellSouth Corporation*
CV 1:00CV02073
74. *US v. Republic Services, Inc. and Allied Waste Industries, Inc.* CV 1:00CV02311

75. *US v. Allied Waste Industries, Inc. and Republic Services, Inc.* CV 1:00CV1469

B Simulation of COURT%

Using the data on FTC's Section 7 cases from the 1980s and early 1990s, Coate (1995) estimates the following model:

$$\text{COURT}\% = F(-6.2 + 1.97\text{COLLUDE} + 4.26\text{BARRIER} + 0.000816\text{HHI})$$

where $F()$ is the cumulative normal distribution, the variables are defined as above, and all coefficients are statistically significant. Admittedly a very crude estimate, the probability of the government prevailing in court gives one an idea of the perceived anticompetitive potential of the merger. The reliability of this measure is further reduced by the fact that the underlying model is generated by the data from the FTC but is being applied to the data from the Justice Department for a later period.

The above notwithstanding, COURT% is essentially a computable index of the merger's relative potential harm. For example, a merger leading to a post-acquisition HHI of 5000, with significant entry barriers and no hard evidence of collusive behavior, has a .9838 probability of being enjoined; one with HHI = 2000, difficult entry and unlikely coordination among firms — a .379 probability. Formally, we assume that the same underlying case selection process generated the two samples, and that the courts maintained their approach to prosecuting anticompetitive mergers throughout the period spanned by both data sets.

C Diagnostic Tests

In the full (“Econometric”) model, error variance may not be constant since several of the included variables – for example, WORK and CONGRESS – have the same values for a range of observations. Also, it is possible that mergers involving large firms (i.e., with large realizations of SALES) result in outcomes with systematically larger errors. Therefore, a test for the presence of multiplicative heteroskedasticity is in order.

Pagan and Vella (1989) suggest a series of moment-based tests, among them a simple test for the restriction of homoskedasticity. Since the test can be carried out without estimating the unrestricted model, its use is intuitively appealing. The Lagrange Multiplier (LM) statistic for the null of constant variances is 14.467 and is distributed, under the null hypothesis, as a chi-square with 12 degrees of freedom. The critical value at the .05 level is 21.03, and at the .1 level it is 18.55, so the null of homoskedastic variance cannot be rejected.

Another moment-based test can be carried out to determine whether the residuals in the tobit model are normally distributed. The test, also originally suggested by Pagan and Vella (1989) is adopted for censoring in both tails. The residuals from tobit estimation are differences between predicted and actual values of D , where prediction is given by

$$\begin{aligned} \hat{D}_i = & 0 \cdot \Phi \left[\frac{0 - \beta' \mathbf{x}_i}{\sigma} \right] + 1 \cdot \left(1 - \Phi \left[\frac{1 - \beta' \mathbf{x}_i}{\sigma} \right] \right) \\ & + \beta' \mathbf{x}_i \cdot \left(\Phi \left[\frac{1 - \beta' \mathbf{x}_i}{\sigma} \right] - \Phi \left[\frac{0 - \beta' \mathbf{x}_i}{\sigma} \right] \right) \\ & + \sigma \cdot \left(\phi \left[\frac{0 - \beta' \mathbf{x}_i}{\sigma} \right] - \phi \left[\frac{1 - \beta' \mathbf{x}_i}{\sigma} \right] \right) \end{aligned} \quad (2)$$

In (2), $\Phi()$ is the standard normal distribution and $\phi()$ is the corresponding density.

The test statistic is based on the distribution of the residuals’ third and fourth

moments. For the normal distribution without censoring, these are

$$\begin{aligned} E[\epsilon^3] &= 0 \\ E[\epsilon^4] &= 3\sigma^4 \end{aligned} \tag{3}$$

However, if $D = 0$ or 1 , then we can derive the moments of the truncated distribution from the following recursion provided by Pagan and Vella (1989) and modified appropriately for the case of censoring in both tails:

$$\begin{aligned} \text{Let } E_i &= E[\epsilon^i | D = 0 \text{ or } D = 1] \\ \text{Then } E_i &= (i - 1)\sigma^2 E_{i-2} - \sigma\lambda(-\boldsymbol{\beta}'\mathbf{x})^{i-1}, \quad i = 2, \dots, \\ \text{where } \lambda &= \frac{\phi\left(\frac{0-\boldsymbol{\beta}'\mathbf{x}}{\sigma}\right) - \phi\left(\frac{1-\boldsymbol{\beta}'\mathbf{x}}{\sigma}\right)}{\Phi\left(\frac{1-\boldsymbol{\beta}'\mathbf{x}}{\sigma}\right) - \Phi\left(\frac{0-\boldsymbol{\beta}'\mathbf{x}}{\sigma}\right)} \end{aligned}$$

The observed value of the LM statistic is 118.29, which is highly significant at any reasonable level of confidence — the critical value of a chi-square with two degrees of freedom is only 5.99 at .05 level. Thus, the null of normality is firmly rejected.

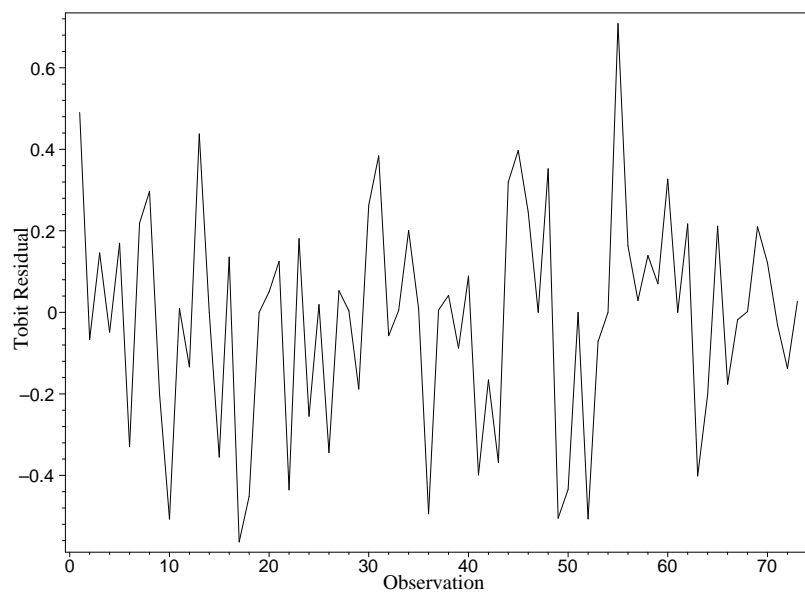
While this test indicates that the assumption of normality may not be appropriate, the recent econometric literature has little to say about what to do next. Intuitively, one could assume a different distribution (for instance, lognormal, exponential or Weibull) and test the obtained residuals again. However, no particular choice of distribution is justified a priori; moreover, assuming a distribution other than normal may in fact make matters worse (Greene 2000, p. 916).

An alternative solution is to use a least absolute deviations estimator (LAD), which has been shown to be robust to changes in distribution. But the cost may be substantial in terms of precision, as the LAD estimator is not efficient. In other words, in applications where prediction is of interest, as it is here, this loss in efficiency is not desirable. Moreover, Greene (1999) shows that the marginal effects

computation used above continues to be valid even if the disturbances are not normally distributed. That is, the marginal effect of each explanatory variable equals the estimated coefficient times the probability of nonlimit observations, and this result holds generally for any continuous distribution.

One can also examine the plot of the residuals from the tobit model to see whether any obvious pattern, such as an upward or a downward trend is present. These residuals are plotted in Figure 1; since no discernible pattern is evident, the normality assumption is retained.

Figure 1: Plot of Tobit Residuals



D Marginal Impact Computation for COURT%

To calculate the change in the dependent variable induced by a one-standard-deviation change in COURT%, write the relevant part of the index function as

$$E[D|\mathbf{x}_i] = \psi_1 \bar{X} + \psi_2 \bar{X}^2$$

where \bar{X} is the mean of the variable of interest (in this case, COURT%), and $\psi_i = \hat{\beta}_i \times \text{Prob}(0 < D < 1)$ is the marginal impact. What is the effect on the LHS of a one- σ_x change in X ?

$$\begin{aligned} E[D|\mathbf{x}_i, \sigma_x] &= \psi_1(\bar{X} + \sigma_x) + \psi_2(\bar{X} + \sigma_x)^2 \\ &= \underbrace{\psi_1 \bar{X} + \psi_2 \bar{X}^2}_{E[D|\mathbf{x}_i]} + \psi_1 \sigma_x + \psi_2(2\sigma_x \bar{X} + \sigma_x^2) \end{aligned}$$

Therefore,

$$E[\Delta D|\mathbf{x}_i, \sigma_x] = \psi_1 \sigma_x + \psi_2(2\sigma_x \bar{X} + \sigma_x^2),$$

where $\psi_1 = -1.4948$, $\psi_2 = 1.4406$, $\bar{X} = 0.782$, and $\sigma_x = -0.354$.

E Out-of-Sample Prediction Cases

1. *US v. 3D Systems Corporation and DTM Corporation* CV 1:01CV01237
2. *US v. Premdor, Inc., Premdor U.S. Holdings, Inc., International Paper Company, and Masonite Corporation* CV 1:01CV01696
3. *US v. Aktiebolaget Volvo, Volvo Trucks North America, Inc., Renault S.A., Renault V.I. S.A., and Mack Trucks, Inc.* CV 1:00CV03006
4. *US v. Georgia-Pacific Corporation and Fort James Corporation* CV 1:00CV02824
5. *US v. The News Corporation Ltd., Fox Television Holdings, Inc., and Christcraft Industries, Inc.* CV 1:01CV00771
6. *US v. Signature Flight Support Corporation, Ranger Aerospace Corporation, and Aircraft Service International Group, Inc.* CV 1:01CV01365
7. *US v. WorldCom, Inc. and Intermedia Communications, Inc.* CV 1:00CV02789