TRANSPARENCY AT THE FEDERAL TRADE COMMISSION: THE HORIZONTAL MERGER REVIEW PROCESS 1996–2003

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I. INTRODUCTION

Government policy is more effective when the enforcement regime is transparent, because the economy benefits from the resulting reduction in transactions costs.[1] The Federal Trade Commission has promoted transparency through a number of formal and informal programs. Examples include detailed notices to aid public comment, press releases that clarify reasons for specific decisions, policy statements in speeches, and several research projects.[2] To further increase the information available to the public, the Commission recently initiated the Merger Transparency Project, a comprehensive review of the staff memoranda collected in all Hart-Scott-Rodino (HSR) horizontal merger matters for which

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[1] These transactions costs include, but are not limited to, reductions in uncertainty and risk, actual enforcement costs, and costs of over-deterrence.

[2] *See, e.g.,* Itron, Inc. and Schlumberger Electricity, Inc., FTC File No. 031 0201 (Aug. 10, 2004), *available at* http://www.ftc.gov/os/caselist/0310201/0310201.htm; Statement of Commissioner Thomas B. Leary: Synopsis, Inc./Avant! Corporation, FTC File No. 021-0049 (2002), *available at* http://www.ftc.gov/os/2002/07/avantlearystmnt.htm; Timothy J. Muris, Improving the Economic Foundations of Competition Policy, Remarks at George Mason University Law Review's Winter Antitrust Symposium (Jan. 15, 2003), *available at* http://www.ftc.gov/speeches/muris/improveconfoundatio.htm; David Scheffman et al., 20 Years of Merger Guidelines Enforcement at the FTC: An Economic Perspective (2002), *available at* http://www.ftc.gov/be/hilites/ftc20thanniversarypaper.pdf.

second requests were issued during fiscal years 1996–2003. Tabulations of this merger information were publicly released in February 2004.[3]

This article supplements the data release with econometric analysis to identify statistical regularities in the enforcement data.[4] The analysis examines several variables. As would be expected, market concentration, measured in a number of different ways, is associated with the outcome of a merger investigation. These relationships appear relatively stable over the eight-year period of the study; thus, enforcement does not seem to be influenced by the party controlling the White House. Other factors, such as the industry affected by the merger, entry conditions, and viable customer concerns, are also significantly related to the enforcement decision. In addition, merger enforcement may be affected by the theory of competitive concern, with the Herfindahl statistic (HHI) and its change relevant for coordinated interaction and a count of the number of significant rivals appropriate for unilateral effects. While data limitations preclude us from formally testing for the all the factors associated with enforcement decisions, a number of models are presented to aid the public in better understanding the merger enforcement regime.[5] Improving the understanding of what actually matters in a merger investigation should allow parties to interact more efficiently with the FTC.

The article starts with an introduction to the data and an overview of the models. Section III presents the means of the data before moving on to the estimation of the relevant models. As will be discussed, we model enforcement for a comprehensive sample of merger filings and two sub-samples—samples that focus on mergers subject to different styles of review implicitly driven by the number of competitive problems associated with the relevant transaction. The models, considered as a group, serve to enhance the transparency of the enforcement process. An analysis of the predictions appears in Section IV.

II. DESCRIPTION OF THE DATA AND MODELS

The Merger Transparency Project reviewed all the relevant staff memoranda prepared to aid the Commission's evaluation of horizontal mergers

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[3] Federal Trade Comm'n, Horizontal Merger Investigation Data: Fiscal Years 1996–2003 (2004), *available at* http://www.ftc.gov/os/2004/08/040831horizmergersdata96-03.pdf [hereinafter Merger Transparency Data].

[4] Data limitations preclude the study of the second request process, as most of the matters in which a second request is not issued are not officially briefed to the decision makers and, thus, no record of the analysis exists for study.

[5] In an unusual situation in which specific omitted factors were correlated with both the enforcement decision and important explanatory variables, the use of the affected model might generate biased predictions of future agency actions. Thus, an analyst must address this risk when applying the model.

filed under the HSR Act between October 1995 and September 2003. Information gathered in this review was used to create the publicly released tables and is used in this article to estimate various enforcement models. This section gives a brief background on the cases reviewed and describes the data collection process used in the Project. Then the presentation moves on to discuss the enforcement models specified for this study. The third subsection introduces the variables used in the analysis.

A. Data Collection

The data review process started with the universe of all 281 Hart-Scott-Rodino second requests issued by the Federal Trade Commission during fiscal years 1996 to 2003).[6] Any mergers that did not involve substantial horizontal issues or mergers that did not involve a full investigation (and therefore did not result in complete memoranda being produced) were deleted.[7] As a result, we were left with a total of 151 horizontal transactions to study.

These transactions presented a diverse set of mergers. Roughly half of the deals involved a single market in which the merger might adversely affect competition, while 35 transactions focused on five or more markets of concern.[8] Single-market investigations followed the detailed structure of the Merger Guidelines, with an analysis that started with market definition and then moved on to a competitive effects analysis that provided details on concentration, theories of concern, and ease of entry, as well as specific evidence that supported an inference of a competitive concern. (Efficiencies were discussed when considered relevant.) Merger memos that involved a small number of market analyses (e.g., two or three basic chemicals sold nationwide) also generally provided a detailed Guidelines-based evaluation for each relevant market.

When numerous markets were studied, a different structure was usually observed. For example, parts of the competitive analysis might have been

[6] The Department of Justice also reviews selected classes of mergers and, therefore, entire industries are excluded from the study. For an overview of DOJ enforcement, see Federal Trade Comm'n & U.S. Dep't of Justice, Merger Challenges Data: Fiscal Years 1999–2003 (2003), *available at* http://www.usdoj.gov/atr/public/201898.pdf.

[7] Seven investigations that were ongoing as of the end of fiscal year 2003 were also deleted, along with three other matters dropped for miscellaneous reasons. Merger Transparency Data, *supra* note 3, at Table 1.

[8] *Id.* at Table 2. The 784 markets identified in Table 2 of the Merger Data release contained the required HHI information in 780 markets (see Table 3.1) and the necessary significant rival data in 573 markets (see Table 4.1). We found both HHI and significant rival data in 570 markets. The bulk of this sample reduction from 780 to 570 is linked to the oil industry, as Table 3.3 lists HHI data for 276 oil-related markets, while Table 4.3 notes significant rival data in only 78 of those markets. Thus, of the 210 markets deleted for lack of data on significant rivals, 198 were related to the oil industry.

common across the many related markets (e.g., entry considerations assumed to be identical for 15 grocery store markets in specific towns), with the market-by-market analysis limited to the competitive structure. Thus, the enforcement outcome could be linked to the concentration-related variables, but the style of the analysis made it difficult to obtain market-by-market information for other variables.

The bureaucratic realities gave rise to one data set including the full 570 observations for which the concentration-related variables could be observed and a subset limited to the narrow sample of 128 observations in which more complete information could be systematically recovered from the case files.[9] The variables were coded from memoranda on these transactions. Two research assistants individually reviewed each memo and recorded the HHI statistics, the number of significant rivals, market shares, and the institutional detail (i.e., outcome of case, date, and the industry involved in the matter). For the 128-observation subset of the data, the research assistants also collected information on entry, hot documents, customer concerns, and product homogeneity. Differences in coding were resolved by a reviewing economist. The details of this evaluation process are provided in Appendix A.

Finally, we created two indicator variables to identify which of the Guidelines theories—coordinated interaction (collusion) or unilateral effects—was applied, using data on product homogeneity and market shares to exogenously classify the matters into either the collusion or unilateral effects categories.[10]

B. Modeling the Enforcement Decision

Once a second request is issued, many FTC stakeholders are interested in predicting the probability of an enforcement challenge. The publicly available tabulations of the merger enforcement data allow the calculation of rough estimates for these merger challenge probabilities by simply computing historical sample means associated with subsets of the data. However, these tabulations allow the predictions to focus on, at most, a couple of variables at a time. For example, one approach would base predictions on the HHI and the change in HHI information, but would have to exclude the data on the number of rivals. Similarly, another prediction could include information on rivals, but would have to exclude information on the HHI. Moreover, predictions could be made only for

[9] Each observation focuses on the antitrust analysis undertaken in one market. Specific mergers may involve competitive reviews in multiple markets.

[10] The exact details on the specification of the indicator variables are given at the end of Appendix A.

rather coarse categories of the HHI and the change in HHI; not specific values of these variables. These tabulations are useful, but must treat all mergers in each range of the HHI variables as having the same probability of enforcement.

This article uses econometric models to predict enforcement decisions.[11] An econometric model is valuable because it considers more than just a few independent variables at a time and allows for predictions at any feasible values of the relevant variables. It also allows formal hypothesis tests of the relationships between enforcement and the relevant explanatory variables. Because the basic outcome is binary—the FTC either brings an enforcement action or closes the investigation—we use a logit model, which is appropriate for binary outcomes.[12] Though the enforcement outcome is binary, the predictions obtained from the logit model range from zero to one. These predicted values are interpreted as the probability that an enforcement action will occur. (Naturally, it is unrealistic to expect the model to determine whether the Commission *will* seek enforcement or not; one can only estimate the *probability* of such an action.)

One reason the logit model is generally chosen over the standard linear regression model is that a linear model may give predicted enforcement probabilities greater than one or less than zero.[13] The downside of the logit approach is that it is a little more complicated to interpret the magnitude of the coefficients; the impact of a variable on the likelihood of enforcement cannot be inferred directly from the coefficient's value. We will elaborate on interpreting the predictions in Section IV.

The analytical structure, discussed below, postulates a number of models linked to the availability of data. It is important to understand that the data collection and estimation rules are generalizations designed to make the analytical process tractable. Any future investigation at the FTC can be subject to any type of review, depending on the constraints in place at the time of merger filing.[14] A stakeholder must carefully

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[11] The data is assumed to represent a sample of mergers that could have been filed during the time period. Firms could have considered other deals, but for a variety of reasons (e.g., lack of strategic fit) never filed the deals for FTC review.

[12] Probit models are also widely used. We chose the logit because its closed form solution simplified the implementation of our graphical analysis. *See* JOHN H. ALDRICH & FORREST D. NELSON, LINEAR PROBABILITY, LOGIT, AND PROBIT MODELS (1984) (providing an accessible introduction to logit and probit models).

[13] *See* Joel L. Horowitz & N.E. Savin, *Binary Response Models: Logits, Probits, and Semiparemtrics*, J. ECON. PERSP, Fall 2001, at 43 (discussing the problems associated with using the linear model when predicting a binary outcome).

[14] For example, a merger raising a single competitive concern might receive a very cursory review if the parties offer to settle immediately upon filing and provide the

choose which model best represents his situation to generate the best prediction of the enforcement probability.

The core model is focused on the full 570-observation sample and, thus, represents an overview of the FTC's enforcement process based on the widest data set available. A few generalizations of this model are considered, as variables are added to test specific hypotheses. Our core model links the enforcement decision to the structural variables (i.e., the HHI, the change in the HHI, the number of significant rivals) and the industry control variables (i.e., oil, grocery, and chemical industries).

The other models in this article build on the foundation provided by this core specification. The broad model is defined next, with the specification of the core model expanded to consider the variables available in the 128-observation sub-sample focusing mergers involving one to three markets. This model addresses the impact of additional considerations on the enforcement process. Estimation of this broad model appears impossible for mega-mergers that raise competitive concerns in a plethora of relevant markets because the raw data is not systematically available. Thus, it is impossible to test whether the broad model would offer meaningful results for those markets. The final model examines an analytical structure customized to the staff's theory of competitive effect (i.e., either collusion or unilateral effects). This model is most relevant for the smallest number of mergers because the data is limited to mergers that raise one or two competitive issues. Again, statistical testing of the broader applicability of the model is constrained by data limitations.

C. The Variables Used in the Models

Table 1 classifies the explanatory variables into four categories—Guidelines; Industry Indicators; Institutional; and Evidence—as well as mentioning variables that will prove useful in the final analysis. In addition to noting the sign of the predicted effect (discussed in detail below), the table states whether the variable was collected for the full 570-observation sample or the narrow 128-observation sample. Information on the ranges taken on by the variables is also given. The HHI and change in HHI (Change) variables are effectively continuous, the number of rivals (Rivals) and entry (Entry index) variables are discrete, and the rest of the variables are binary.

Commission with material to justify the special style of analysis. On the other hand, one or two of the markets associated with a mega-merger could receive an extensive case-specific analysis if the competitive issues required the investigational resources.

Table 1
Explanatory Variables Used to Explain the FTC Enforcement Decision

Variables	*Sign*	*Data*	*Nominal Range*
Guidelines Variables			
HHI—Post-merger Herfindahl statistic for market	+	570	342–10000
Change—Change in post-merger Herfindahl statistic	+	570	55–5000
Interaction—Product of HHI and Change	?	570	N/A
Rivals—Count of number of pre-merger Significant Rivals	–	570	2–16
Entry Index—Sum of timeliness, likelihood, and sufficiency	+	128	0–3
Industry Indicators			
Oil Industry—Indicator for oil industry market	+	570	0/1
Grocery Industry—Indicator for grocery market	+	570	0/1
Chemical Industry—Indicator for chemical market	+	570	0/1
Institutional Variables			
Muris—Indicator for merger evaluated after June 1, 2001	?	570	0/1
Filings—Five-month average of number of HSR filings	–	570	72/263
Filings/FTE—Filings divided by full-time equivalent staff	–	570	.31/1.06
Evidence Variables			
Hot Documents—Indicator for finding of hot documents	+	128	0/1
Customer Complaints—Indicator for validated complaints	+	128	0/1
Background Variables			
Homogeneous Goods—Indicator for homogeneous industry	N/A	128	0/1
Collusion—Indicator for collusion theory most relevant	N/A	128	0/1
Unilateral—Indicator for unilateral theory most relevant	N/A	128	0/1

The structural variables (classified under Guidelines) include the HHI and the change in the HHI, both of which are expected to be positively related to the likelihood of enforcement. In addition, an interaction variable, defined by the product of the HHI and change in HHI variables, is included in our model to allow for a broad range of nonlinear relationships among the structural variables. Although interaction terms are commonly used in econometric models for the purpose of broadening the flexibility of models, they do have some unusual effects.[15]

Finally, despite the fact that the Merger Guidelines do not explicitly suggest rivals as a measure of concentration, we include the variable because the Guidelines make substantial references to competition among rivals.[16] The reader may observe that the HHI-based and rivals variables are highly (but not perfectly) correlated and, thus, wonder about the benefit of including all three variables. As will be shown in the results section, each variable is individually significant in predicting enforcement. Under these circumstances, it is econometrically important to include all three, as excluding one (e.g., rivals) may cause the marginal effects of the other (e.g., the HHI and its change) to be incorrectly measured.[17] Rivals would have a negative effect on enforcement because a movement to fewer rivals increases competitive concerns in a market.

We apply a logarithmic transformation to the raw HHI, change in HHI, and number of significant rivals' data to slightly change the shape of the maximum-likelihood estimate of the logit function. The interaction variable enters as the product of the two logged Herfindahl-related variables. The resulting properties of the log-transformation are more

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[15] The interaction terms can enable the model to better predict results for more prevalent moderate values of the variables, but at extreme values (either very low or very high levels of the structural variables) the interaction term may cause a trivial distortion of the real relationship. To the extent the interaction term introduces error in these predictions, the effect is trivial as the impact is at the edge of the data (i.e., at rather large values of the HHI and the change in HHI). For example, the model might predict a 98.7% chance of enforcement at a very high level of the HHI and a *low* level of the change in HHI, while the model might predict a 97% chance of enforcement at a very high level of the HHI and a *high* level of the change in HHI. *See, e.g.,* DAMODAR N. GUJARATI, BASIC ECONOMETRICS 590–91 (4th ed. 2003); ERNST R. BERNDT, THE PRACTICE OF ECONOMETRICS: CLASSIC AND CONTEMPORARY (1991) (giving a more detailed explanation of interaction terms).

[16] U.S. Dep't of Justice & Federal Trade Comm'n, Horizontal Merger Guidelines § 2.2 (1992, revised 1997), *available at* http://www.ftc.gov/bc/docs/horizmer.htm. [hereinafter Merger Guidelines].

[17] This phenomenon is called an "omitted variables bias." *See* PETER KENNEDY, A GUIDE TO ECONOMETRICS 107–08 (5th ed. 2003) (providing a non-mathematical discussion of the omitted variables bias).

desirable than a model measuring the relevant variables in levels and also seemed to fit the data much better.[18]

As noted above, the three industry variables (i.e., for the chemical, oil, and grocery industries) are also expected to affect enforcement policy. Published tabulations are suggestive of more aggressive enforcement in the oil, grocery, and chemical industries, so the coefficients for these industry variables would be expected to exhibit positive signs.[19] Oil and grocery markets may face aggressive enforcement because competition in these markets is so crucial to the economy due to their overall size. While a full analysis of industry-specific antitrust procedures is beyond the scope of this study, the inclusion of the relevant indicator variables allows for the modeling of an industry-specific aggressive antitrust regime.

The four structural variables, along with the industry identifiers, form the core model, and this model can be used to identify the variables that impact the enforcement decision. Using this core model, we test two supplemental hypotheses for the potential impact of institutional considerations on the likelihood of enforcement action. First, we use a binary variable to examine the effect of the change of administration from Chairman Pitofsky to Chairman Muris in June 2001.[20] The variable could take on a negative sign, because prior research linked Republican political power with less interventionist activity in the market for corporate control during the 1980s.[21] On the other hand, Chairman Muris,

[18] In an ordinary regression model, the effect of the log transformation on the predicted outcome is straightforward: it is the marginal effect or the slope (i.e., the change in the predicted outcome from a change in the explanatory variable). In the logit model, the intuition is less straightforward. This is because (as will be discussed in more detail later) the marginal effect of a variable in the logit model depends on the values of it and the other variables. In fact, holding other variables constant, the marginal effect of a continuous explanatory variable will tend to follow a bell-shaped curve; that is, for small values of the explanatory variable, its marginal effect will tend to become larger in magnitude as the variable grows. The marginal effect will peak at a certain point, and then, as the explanatory variable continues to grow, the marginal effect will tend to shrink in magnitude. The log transformation will tend to squish the right side of the bell-like shape inward a little. The resulting change in shape is relatively minor, but it reduces the standard errors of our estimates considerably.

[19] See Merger Transparency Data, *supra* note 3, at Tables 3.2 to 3.4 and 4.2 to 4.4. The public release tabulated data for four industries (oil, grocery, chemical, and pharmaceutical). However, the pharmaceutical concentration data mirrored that of the full sample and, therefore, no dummy variable was included in the analysis. No other industry appeared to have a large number of observations in the data set.

[20] The indicator variable, Muris, was assigned to 0 for all cases decided prior to June 2001 and then switched to 1 for all cases decided after June 1, 2001.

[21] *See* Malcolm B. Coate, *The Shifting Sands of Merger Enforcement at the Federal Trade Commission*, 2 INT'L J. ECON. BUS. 393 (1995).

seconded by Commission Leary, observed that merger policy over recent administrations is bipartisan; hence, the variable could be statistically insignificant.[22]

A second hypothesis addresses the question of whether the enforcement standards change with the Agency's workload. HSR filings increased dramatically from 1996 through 2000 and budget restrictions prevented the FTC from significantly expanding its staff. After 2000, filings have fallen and, therefore, the workload variable has decreased. Two variables, the average number of merger filings over the five-month period predating the formal merger decision[23] (logarithmically transformed) and the average number of merger filings normalized by the budgeted number of full-time equivalent antitrust staff in the relevant year, are used to approximate the variation in workload. The expected sign of the workload variable is difficult to predict because a bureaucracy has a number of options to address an increase in workload, only some of which would affect a marginal enforcement decision. However, if pressed, one would expect a higher absolute or relative workload to reduce the likelihood of enforcement because the resources used to complete the record on the marginal case could be more effectively deployed in other investigations.[24]

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[22] Early in his administration, Chairman Muris reported "antitrust has become an area of bipartisan cooperation." Timothy J. Muris, Antitrust Enforcement at the Federal Trade Commission: In a Word—Continuity, Prepared Remarks Before the ABA Antitrust Section (Aug. 7, 2001), *available at* http://www.ftc.gov/speeches/muris/murisaba.htm. Commissioner Leary offered similar thoughts. *See* Thomas B. Leary, *The Essential Stability of Merger Policy in the United States*, 70 ANTITRUST L.J. 105 (2002).

[23] The average second request is open for roughly five months and, thus, the filings received in the five months before the final decision represent an estimate of the actual workload facing the Agency. Historical filing data were adjusted to reflect the current filing requirement associated with a merger valued at over $50 million. More accurate measurements of workload would be difficult to create. While it might be possible to recover the number of second request investigations "open" at the end of each month, such an analysis would catch a number of investigations that are "open" in name only as the staff does not bill material time to every open matter.

[24] Various institutional responses to a workload problem are possible. For example, the Agency might close solid, but relatively inconsequential, second request merger investigations to save resources in periods of peak demand for regulatory services. Here, a potential for bias exists because the sample would over-represent closed cases when workload is high. A workload control variable could account for this effect, and it would take on a negative sign. Alternatively, the Agency might issue second requests on only the strongest cases when workload is high. Again, bias may exist, if the sample would systematically under-represent closed matters. In this case, the workload variable would be positively related to the enforcement probability. Of course, it is also possible that the Agency might become more efficient; handling the new cases that arrive by redeploying resources from less essential tasks and reducing the effort on each matter (which reduces the staff hours spent on the analysis, but might not bias the decision process). Thus, it is possible that the actual enforcement regime will not be affected by workload. The impact of a workload variable on enforcement decisions is clearly an empirical issue.

Because concentration data is only the starting point for the standard FTC analysis, we sought to expand the inquiry to address other substantive factors. For example, the Merger Guidelines mandate an analysis of entry as part of the overall merger review process.[25] Likewise, the investigatory process at the FTC includes analyses that may identify hot documents or customer concerns.[26] As noted earlier, not all investigations include market-by-market consideration of these variables. Thus, it was impossible to recover meaningful data for these variables in the full 570-observation sample.[27] Without data, the core model could not be expanded to consider these variables. However, the information on these considerations was available in the files associated with the 128-observation sub-sample. This meant that it was possible to supplement the concentration-based study with a detailed evaluation of the effect of the entry and evidence variables.

Impediments to entry are generally considered a necessary condition for an enforcement action. However, the staff's analysis of ease of entry is not necessarily dispositive of the Commission's position on the entry issue. As the entry index defined for the study ranges from 0 to 3, it is reasonable to believe that the probability that the Commission concludes entry is impeded depends on the value of that index.[28] Thus, the entry index is expected to show a positive relationship with the probability of enforcement. The entry index entered into the model in logarithmic form to allow for a more non-linear effect.

Evidence compatible with the existence of likely competitive problems identified in a Guidelines-based analysis is also expected to increase the probability of enforcement. The review of the files identified two types of evidence, hot document and customer concerns, that were easily recoverable from the staff's written merger analysis. The presence of an affirmative finding for either variable would be expected to have a positive effect on the likelihood of enforcement, as these findings would strengthen the Commission's legal case against the merger.

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[25] Merger Guidelines, *supra* note 16, § 3.1

[26] *Id.* § 2.1 (focus on pricing and marketing practices and characteristics of buyers and sellers) and nn.21–22 (focus on bidding to customers and normal course of business documents). Reviews of this information may uncover hot documents and customer complaints.

[27] Initial consideration of the problem suggested staff would face a missing values problem if the full sample was surveyed for the entry, hot document, and customer concern information. While these issues are discussed in sufficient detail in some files, other files would just contain overview analyses not sufficiently linked to the market under review to be useful. Also, some investigations were truncated and, thus, the key data was not recorded.

[28] Appendix A discusses alternative proxies for ease of entry.

Finally, we examined whether the effect of the structural variables depends on which of the fundamental Guidelines theories—coordinated interaction (collusion) or unilateral effects—was applied. In unilateral effects theories, we posit the number of significant rivals drives the review process, while the Herfindahl-based variables have no effect on the outcome of the investigation. Conversely, in coordinated interaction theories, we hypothesize that the combined effect of the HHI index, the change in the HHI, and the interaction between these variables influences the competitive analysis, but the number of rivals does not. Such a model, if correct, would improve the ability to forecast enforcement by focusing the analysis on the relevant explanatory variables. The other control variables (entry, customer concerns, and hot documents) discussed above would be equally relevant to this model. Again, data limitations forced us to estimate this model with fewer observations, because the mergers with three markets under review did not clearly fit this generic style of analysis.[29]

III. OVERVIEW OF THE RESULTS

The analysis starts with a review of the means for the data and then moves on to present the results for the various statistical models. Table 2 lists the means for all the variables, while Table 3 contains parameter estimates for the core model. The various equations allow tests to determine if institutional considerations affect enforcement. Table 4 manages the transition from the full 570-observation sample to the focused 128-observation sample, while Table 5 addresses the robustness of the key results from the 128-observation analysis. Table 6 defines the parameters of the theory-specific model. All the results are discussed in detail below. The estimates in Table 4, along with the second column of Table 6 are of primary interest because these models appear best designed for forecasting enforcement activity. The models in Table 4 offer insights when data available to the analyst is limited, while Table 6 (column 2) offers a good choice when the analyst has a solid understanding of the theories of concern underlying the investigation.

A. INTRODUCTION TO THE DATA

Table 2 presents means for the variables, classified into two data sets and separated by outcome. The first data set is limited to the full 570-observation sample for which all the market structure data could be

[29] For more details on this theory, see Malcolm B. Coate, *Empirical Analysis of Merger Enforcement Under the 1992 Merger Guidelines*, 27 REV. INDUS. ORG. 279 (2005) (focusing on mergers in which only a single overlap is studied, thus addressing the competitive issues in more depth). It was possible to identify (not infer, as in this paper) the actual theories

Table 2
Means of the Variables by Outcome, FY1996–2003
(full sample of all mergers with data;
narrow sample of mergers with detailed data)

	Enforce Means	*Enforce Means*	*Close Means*	*Close Means*
Variable	*Full Sample*	*Narrow Sample*	*Full Sample*	*Narrow Sample*
HHI	5220	5833	3055	3271
Change	1774	1903	703	825
Interaction	—	—	—	—
Rivals	3.29	2.94	5.20	5.08
Hot Documents	—	.202	—	.051
Customer Complaints	—	.562	—	.026
Entry Index (0–3)	—	2.38	—	1.10
Homogeneous Goods	—	.236	—	.231
Oil Industry	.120	.011	.194	.077
Grocery Industry	.293	.067	.178	.077
Chemical Industry	.132	.190	.054	.077
Muris Cases	.166	.236	.178	.205
Log-Filings	5.06	4.97	4.99	4.91
Filings/FTE	.734	.677	.680	.653
Unilateral Cases	—	.775	—	.513
Collusion Cases	—	.225	—	.487
Observations	441	89	129	39

obtained. The second data set consists of the narrow 128-observation sub-sample, for which more detailed data could be systematically collected from the files.

In the full (570-observation) sample, the means of both the HHI and the change in the HHI variables are higher and the average number of pre-merger rivals is lower when the matter results in an enforcement action. The sample means suggest that enforcement is more prevalent in the grocery and chemical industries than in the rest of the sample, but less prevalent in the oil industry. This oil effect is an artifact of the data limitations because many oil industry cases had to be excluded from the 570-observation sample due to lack of data on the number of significant rivals.[30] In the smaller sample, the means of the standard

used to evaluate the mergers. Moreover, the study was able to identify historical events that could be used as evidence in the competitive analysis.

[30] The oil industry variable suggests that enforcement action is under-represented in the oil industry: oil mergers appear to make up a much larger portion of the closed

structural variables, along with hot documents, customer complaints, and the barrier to entry variables, are all different in the expected directions when the sample is split by the enforcement outcome. However, the sub-sample means are generally quite comparable to the full sample means, suggesting structural policy could be comparable. Of course, as enforcement probabilities almost certainly depend on the overall merits of the case, a detailed econometric model is needed to understand the relationships within the data.

B. Econometric Analysis of the Data

In this subsection, we discuss the estimates of our econometric models of the Federal Trade Commission's decision-making process. As two data sets were gathered, the statistical analysis will take place in two stages, first focusing on a core model for the full (i.e., 570-observation) data set and then on a broad-based model for the narrow (i.e., 128-observation) data set. In addition, one model will be estimated with the data excluded from the narrow sample. For each model, the statistical significance of the parameters is discussed. Note that our significance levels use clustered standard errors because some of the mergers involve multiple overlaps. The clustering procedure accounts for correlation among the observations from the same merger.[31]

Table 3 explores the core model, estimated with the full 570-observation sample. Results are presented for four different specifications. The core model (column 1) defines a standard model of concentration in which the HHI, the change in HHI, their interaction, and the number of significant rivals affect the enforcement decision. This equation also includes the industry controls. Statistical tests of the coefficients show that all the parameters are significant. Therefore, all four structural variables appear to impact the enforcement decision. The HHI and its change both significantly increase the probability of enforcement, while the Interaction term takes on a negative effect.[32] Rivals have a negative effect on enforcement, even after accounting for the impact of the HHI variables, suggesting few rivals also increase the probability of FTC action.

Moreover, the positive and significant coefficients of the industry indicator variables suggest that enforcement is more likely for mergers in

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investigations than the complaints. However, if the 198 oil investigations, excluded from the study due to the lack of data on significant rivals, are considered, this under-representation disappears.

[31] We use Stata's procedure for clustered standard errors. *See* http://www.stata.com/.

[32] For very large values of the HHI and its change, this negative interactions effect will tend to reduce the impact of the two HHI-based variables. The impact of this effect is illustrated in the top graph of Figure 1.

Table 3
Econometric Analysis of FTC Enforcement
for Full Sample, FY 1996–2003
(t-statistics in parentheses)

	Core Model (570 obs)	*Core Model with Muris (570 obs)*	*Core Model With Muris & Merger Wave I (570 obs)*	*Core Model With Muris & Merger Wave II (570 obs)*
Log-HHI	7.013* (3.09)	7.066* (3.13)	7.194* (3.11)	7.211* (3.14)
Log-Change	8.015* (2.94)	8.084* (2.95)	8.236* (2.97)	8.243* (2.97)
Log-Interaction	–.8696* (–2.70)	–.8783* (–2.72)	–.8958* (–2.72)	–.8971* (–2.74)
Log-Rivals	–1.760* (–2.04)	–1.782* (–2.00)	–1.804* (–2.12)	–1.798* (–2.10)
Oil Industry	3.090* (4.26)	3.131* (4.29)	3.068* (4.09)	3.057* (4.14)
Grocery Industry	2.139* (2.83)	2.126* (2.76)	1.879* (2.65)	1.942* (2.62)
Chemical Industry	2.345* (2.61)	2.345* (2.64)	2.324* (2.67)	2.305* (2.68)
Muris Cases	—	–.1045 (–.19)	.2592 (.35)	.2052 (.28)
Filings/FTE	—	—	1.462 (.87)	—
Log-Filings	—	—	—	.7272 (.74)
Constant	–60.62* (–3.16)	–60.99* (–3.20)	–63.07* (–3.23)	–65.82* (–3.27)
Log-likelihood	–204.3	–204.2	–202.6	–203.0

*(**) The coefficient is significantly different from 0 for 5 (10) percent two-tail test.

the three selected industries (oil, groceries, and chemicals) than for mergers in the other industries reviewed by the FTC.[33] For example, setting the number of rivals to four, and the HHI index and the change

[33] The result could be generated by a selection issue, as oil, grocery, and chemical cases destined to close might not warrant a second request in light of the Commission's expertise in these markets. Hence, enforcement at relatively low levels of concentration would be over-represented in the sample. We have seen no evidence to support this selection hypothesis.

in the HHI to 3360 and 810, respectively (their full sample means for four significant rivals), predicts an enforcement probability of 97 percent for an oil merger, 93 percent for a chemical merger, 92 percent for a grocery merger, but only 57 percent for mergers in other industries. It would appear that the FTC considers these industries particularly prone to less than competitive conduct and, therefore, enforces a more aggressive structural policy in these industries.

An unreported regression examines an expansion of the core model to include separate concentration-related variables for each industry classification: oil, grocery, chemical, and other.[34] A Wald test[35] rejects the hypotheses that the coefficients of the concentration variables are equal across industries.[36] The most notable difference involves the coefficient for the variable denoting the number of significant pre-merger rivals, which is statistically insignificant in the oil and grocery industries but significant for chemical and other industries. This suggests that enforcement is based primarily on the HHI and its change in the oil and grocery industries. Since collusion concerns are often considered particularly relevant to the oil and grocery industry, this focus on the HHI is understandable.[37] Thus, the industry-level concentration coefficients suggest that the pooled model in Table 3 reflects a general overview of the enforcement process but may not be the best representation for an analysis of the oil or grocery industries.

Columns 2 through 4 analyze how merger policy changes in response to differences in political leadership and Agency workload. An indicator variable for the Muris Chairmanship is introduced in column 2, and two variables intended to proxy for workload—the ratio of merger filings to full-time equivalents and the log of the number of merger filings—are introduced in columns 3 and 4. The coefficients of these three variables are statistically insignificant, and the inclusion of any of them does not

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[34] The core model already allows for different intercepts for the three industry classifications. The generalized model estimates separate effects for each of the four types of industries. This is identical to estimating a general effect and differences from that general effect for the three specific industries.

[35] The Wald test is a common test of significance in non-linear models. *See* GUJARATI, *supra* note 15, at 280 (offering a basic introduction to non-linear models and the Wald test).

[36] Chi-square statistic is 29.9, which is greater than the (95%) critical statistic of 21.0 for 12 restrictions.

[37] The commodity nature of gasoline and most other petroleum products, coupled with the relatively low shares in many markets, clearly points to a collusion concern. The grocery industry is a little more complicated, as some believe retailing is significantly differentiated. However, the posted price nature of the business, coupled with the relatively low shares, is also suggestive of potential problems with collusion.

substantially alter the impact of the other exogenous variables.[38] A further (unreported) test allowed all four market structure coefficients to change in June 2001, along with the fixed "Muris" indicator. Although the coefficients showed some differences, the relevant Wald test could not reject the hypothesis of equal coefficients in the enforcement model at the 5 percent critical level.[39] Thus, the results suggest that merger enforcement policy has remained relatively stable during the 1996 to 2003 time period, regardless of the Commission leadership or workload.

Table 4 examines how enforcement policy differs for the 442 markets generally associated with four or more overlaps and the 128 markets for which we have more specific data. The first two columns of the table repeat the core model from Table 3 (column 1) but estimate it separately for these two sub-samples. A Wald test suggests that the coefficients of the two models might possibly differ, as the equal coefficient hypothesis can be rejected at the 10 percent critical level but not at the 5 percent critical level.[40] The most obvious difference involves the coefficient measuring the impact of the number of significant rivals. This coefficient is statistically insignificant for the 442-observation sample but significant in the small-sample (128-observation model). An unreported regression on the 442-market sample (i.e., one allowing separate coefficients for each industry) suggests that, at the industry level, the number of rivals is also insignificant for matters having four or more overlaps.[41] This statistical conclusion is not surprising when one observes basically half the 442-observation sample is composed of oil and grocery mergers, which, as discussed above, are probably evaluated under a HHI-based collusion standard.

We can use the coefficients of the model (Table 4, column 2) to gain a sense of the effect of the number of rivals on predicted enforcement for the small sample. For example, setting the HHI index to 3685 and the change in HHI to 850 (the mean values for four pre-merger rivals) generates an enforcement probability of 58 percent for a four-to-three merger. Allowing the number of rivals to range between three and five

[38] To check for the robustness of the result, the Muris dummy variable was recalibrated to be 1 only for the investigations that started after June 2001. This new index generated the same basic results.

[39] Chi-square statistic is 9.90, which is less than the (95%) critical statistic of 11.07 for 5 restrictions.

[40] Chi-square statistic is 13.48, which is greater than the (90%) critical statistic of 13.36 for 8 restrictions, but not the (95%) critical statistic of 15.51.

[41] The number of significant rivals has no statistical effect across the sample (joint Chi-square test statistic for the hypothesis that all four industry-related rivals' coefficients are zero is 7.05, below the relevant (95%) critical statistic of 9.49 for 4 restrictions.) Thus, the hypothesis of no effect cannot be rejected.

Table 4
Econometric Analysis of FTC Enforcement
for Sub-Samples, FY 1996–2003
(t-statistics in parentheses)

	Core Model (442 obs)	*Core Model (128 obs)*	*Broad Model (128 obs)*	*Broad Model (125 obs)*
Log-HHI	7.890*	13.51*	17.91*	18.33*
	(2.72)	(2.98)	(2.31)	(2.18)
Log-Change	9.083*	15.91*	17.84*	16.79**
	(2.79)	(2.98)	(2.02)	(1.78)
Log-Interaction	–.9691*	–1.825*	–2.130*	–2.042**
	(–2.52)	(–2.95)	(–2.06)	(–1.85)
Log-Rivals	–.8228	–3.639*	–3.896*	–3.920*
	(–.74)	(–3.55)	(–3.18)	(–3.30)
Hot Documents			–.8420	2.782*
	—	—	(–.80)	(2.61)
Customer Complaints			4.453*	5.002*
	—	—	(3.33)	(3.25)
Entry Index			4.205*	6.077*
	—	—	(4.02)	(4.00)
Oil Industry	3.214*	.9581	3.833*	4.886*
	(4.30)	(.65)	(3.26)	(3.27)
Grocery Industry	2.380*	–.1943	.7846	4.190*
	(2.75)	(–.16)	(.49)	(3.91)
Chemical Industry	2.740*	2.013*	2.497*	2.122*
	(1.97)	(2.27)	(2.39)	(2.00)
Constant	–70.64*	–111.8*	–148.8*	–152.1*
	(–2.84)	(–2.89)	(–2.25)	(–2.13)
Log-Likelihood	–146.9	–47.00	–23.27	–15.69

*(**) The coefficient is significantly different from 0 for 5 (10) percent two-tail test.

(but holding the other concentration variables constant) predicts the probability of enforcement to be 80 percent for the three-to-two merger but only 38 percent for the five-to-four transaction. (Section IV discusses predictions in more detail.)

The third column of Table 4 adds the entry, hot document, and customer complaint variables to the core model to create a broad model that supplements structure with other evidence available to the FTC. It is estimated with the 128-observation sample. The structural variables retain their magnitude and significance. The entry variable has a signifi-

cant positive effect on enforcement, implying entry impediments made enforcement more likely.[42] The hot document variable does not have a significant effect on the probability of enforcement, a result apparently caused by an outlier in the data.[43] On the other hand, the customer complaint variable is strongly significant in the expected direction and has a large effect on the enforcement probability.[44] Again, focusing on the same four-to-three merger (with a HHI of 3685 and a change of 850), and assuming two of the three entry indicators show impediments, the model predicts a 46 percent chance of enforcement without customer complaints, and the effect jumps to 99 percent with verified complaints.

The last column of Table 4 addresses the outlier issue by deleting the three observations in which the failing firm defense was relevant from the sample and re-estimating the model on the smaller sample. The coefficient on the hot document variable becomes statistically significant, without a major impact on the other results. This coefficient suggests that the effect of hot documents on enforcement is substantial, though somewhat smaller in magnitude than the variable for the impact of customer complaints. For example, using the scenario discussed in the previous paragraph, a finding of hot documents raises the probability of enforcement from 46 to 93 percent (as opposed to 99 percent with customer complaints). The last two models in Table 4 suggest that more accurate predictions are possible when the relevant data on entry, customer concerns, and hot documents are available.[45] As solid information

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[42] Generalized specifications for the entry variable were also considered, although none proved clearly superior. One specification allowed the three entry considerations to take on unique values; however the restriction of equal coefficients could not be rejected. Another allowed the entry factors to interact and found a declining impact associated with adding another entry concern. We retain the log formulation of the index because it is simple.

[43] The data collection process did not delete matters in which a failing firm defense was considered viable by the staff. In one situation (the outlier), the Commission closed an investigation in the face of hot documents, probably because the target could easily be considered a failing firm. This unusual situation made it statistically difficult to identify a significant hot document effect.

[44] The customer complaint effect is robust to changes in the definition of the complaint variable and the specification of the data set. For example, if the customer complaint variable is coded as 1 if the staff finds either strong or moderate complaints, the significant effect is still observed. Likewise, excluding the 12 retail-related markets from the analysis has no material effect on the customer concern coefficient. Interestingly, the coefficient on the hot document variable is positive and marginally significant if the 12 retail-related cases are deleted from the sample.

[45] The inclusion of the new explanatory variables improves the ability of the model to predict historical outcomes. (By "predict outcomes," we mean that the predicted probability is greater than 50% for markets in which the outcome is "enforce" and less than 50% in markets where the outcome is "close.") The core model (column 2) is successful in predicting the outcome in 82% of the cases, while adding the entry and customer complaint

on hot documents will only be available to insiders, most users can apply either model (by setting the hot document variable to zero).[46]

Table 5 presents alternative analyses in which cases having strong customer complaints or easy entry are eliminated from the samples and new regressions run excluding those variables. These alternative analyses are undertaken because almost all (over 98 percent) of the cases having viable customer complaints result in enforcement, while none of cases exhibiting easy entry result in enforcement. That is, easy entry and customer complaints almost perfectly predict the enforcement outcome, without regard to any of the other variables. Thus, it could be appropriate to examine separately the markets for which the outcome is not easily predicted by specific information to see if the other factors affect enforcement in the same way. In the next section we will examine whether the results from these models are similar to the broad model (Table 4, column 3) presented in this article and, thus, be able to decide if that model is robust to the data used in its estimation. Failure to find relatively robust results would call the model into question and require the analyst to choose between the models in Tables 4 and 5 based on their personal understandings of the merger review process.[47]

The model in the first column of Table 5 deletes the 19 observations for which the review of the staff memoranda suggested that entry was easy.[48] Re-estimating the broad model with the reduced data set does not change the significance of the structural results, though it does change their magnitude slightly.[49] In the next two columns, all 51 observations in which the staff found serious customer complaints were deleted and the model is re-estimated, first without and then with an entry

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variables (column 3) improves the performance to 92%. (Prediction success for the fourth model is not computed, because it would not be fully comparable due to differences in the sample.)

[46] Merging parties with knowledge of "hot documents" in their HSR submissions probably want to use the model in Table 4, column 4.

[47] For example, one analyst might believe antitrust analysis proceeds sequentially through the key issues, with strong information on one issue (customer complaints or entry) sufficient to terminate the analysis and force action. Another analyst might believe antitrust analysis reviews all the facts simultaneously, and a decision is made based on the weight of the data. If the different models give rise to substantially different predictions, choice of model could be outcome determinative.

[48] Of the 29 Muris administration analyses, five found ease of entry. For the 99 pre-Muris matters, 14 identified ease of entry. These ratios are not significantly different (t-statistic .41).

[49] In an unreported regression, the entry index (now limited to the basic values of 1, 2, or 3) was not statistically significant (t-test 1.59) at the conventional (10%) critical level (t-score 1.67); thus, the entry variable was dropped from this regression. The oil dummy variable is also excluded because the deletion of the easy entry cases precludes the estimation of an oil industry effect.

Table 5
Econometric Analysis of FTC Enforcement for Small Samples, FY 1996–2003
(t-statistics in parentheses)

	Broad Model Without Easy Entry Cases (109 obs)	*Broad Model Without Case Complaints (No Entry) (77 obs)*	*Broad Model Without Case Complaints (77 obs)*	*Broad Model Without Case Complaints and Easy Entry (58 obs)*
Log-HHI	17.66*	10.96*	14.91*	15.50*
	(2.64)	(2.36)	(2.03)	(2.46)
Log-Change	18.93*	12.52*	15.07**	17.20*
	(2.41)	(2.29)	(1.76)	(2.15)
Log-Interaction	–2.234*	–1.486*	–1.838**	–2.054*
	(–2.46)	(–2.33)	(–1.83)	(–2.21)
Log-Rivals	–3.089*	–5.238*	–6.148*	–4.893*
	(–2.32)	(–3.01)	(–2.68)	(–2.33)
Hot Documents	–.4013	–.09914	–1.201	–1.070
	(–.43)	(–.11)	(–1.10)	(–1.21)
Customer Complaints	2.945*			
	(2.08)	—	—	—
Entry Index			3.977*	
	—	—	(4.31)	—
Oil Industry		2.089	4.215*	—
	—	(1.36)	(3.12)	
Grocery Industry	.3320	.8938	1.149	.6425
	(.20)	(.71)	(.81)	(.43)
Chemical Industry	2.381**	2.177*	2.591*	2.384**
	(1.84)	(2.29)	(2.66)	(1.84)
Constant	–144.1*	–85.66*	–118.6**	–122.4*
	(–2.50)	(–2.18)	(–1.91)	(–2.28)
Log-Likelihood	–24.85	–32.16	–20.24	–20.87

*(**) The coefficient is significantly different from 0 for 5 (10) percent two-tail test.

control variable. The most notable change in the results is that the coefficient of the rivals variable becomes larger.[50] However, to truly compare the models, predicted probabilities should be calculated (and are later in this article). In the last column, the data set was reduced to 58 observations by deleting all the observations with either ease of entry

[50] Additionally, removing cases with hot documents does not lead to substantive changes in the results.

findings or substantiated customer complaints. The structural variables remain statistically significant. This specification approximates the core model, with the exception that an insignificant hot document variable remains in the specification.[51] As the structural variables remain statistically significant in the reduced sample, their importance is not an artifact of the customer complaint and entry barrier data. The next section will compare predictions generated by these restricted sample models with comparable predictions associated with models that include entry and customer complaints.

Table 6 examines a model in which the theory of competitive concern (i.e., unilateral effects or coordinated interaction) determines the structural variables that affect the predicted enforcement outcome. Because the merger files might not contain enough detailed market-level analysis to focus the competitive evaluation on a specific theory of concern when the investigation involved too many issues or markets, the data are limited to the 101 observations in which Commission staff only had to study one or two markets for a particular case. In the first column of Table 6, the broad model with entry is re-estimated for the 101 observations.[52] All the significant results observed in the model with entry for 128 observations (Table 4, column 3) are obtained. This suggests that the fundamental parameters of the model are not affected by the sample reduction.

The customized regression model in the second column simplifies the analytical structure to include only the three Herfindahl-related variables (the HHI, its change, and the interaction term) when collusion is the theory of concern, and only the number of rivals when unilateral effects are studied.[53] The coefficients for the three collusion variables, as well as the unilateral effects rivals' variable, are statistically significant. Likewise, the customer complaint and entry variables retain their statistical significance.

This model can be compared to one that includes separate concentration variables for the collusion and unilateral cases (i.e., separate variables for the HHI, the change in HHI, the interaction, and the number of rivals are included in the estimated equation for all mergers, and the coefficients are estimated separately for the two theories). A Wald test on this (unreported) model concludes that the coefficients on the variables excluded in column 2 (i.e., the HHI, its change, and the interaction term for the unilateral cases and number of rivals for collusion cases)

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[51] This insignificant hot document result may be generated by the small sample.

[52] The oil industry variable is also deleted in these specifications because an insufficient number of oil mergers remain in the sample.

[53] The model also allows for a different intercept for unilateral effects cases.

Table 6
Econometric Analysis of FTC Enforcement for Custom Models, FY 1996–2003
(t-statistics in parentheses)

	Broad Model (101 obs)	*Custom Model[1] (101 obs)*	*Custom Model[1] With Muris (101 obs)*	*Broad Model (HHI only) (101 obs)*
Log-HHI Collusion	24.52* (2.72)	66.23* (2.13)	64.58* (2.02)	6.082* (3.03)
Log-Change Collusion	23.80* (2.30)	81.11* (2.04)	78.87** (1.90)	—
Interaction Collusion	–2.790* (–2.34)	–9.328* (–2.01)	–9.070** (–1.86)	—
Log-Rivals Unilateral	–3.982* (-2.34)	–7.709* (–2.64)	–7.718* (–2.73)	–4.231* (–2.24)
Hot Documents	–1.232 (–1.27)	–.08904 (–.07)	–.05254 (–.05)	–.9895 (–1.04)
Customer Complaints	5.207* (3.41)	3.430* (3.76)	3.449* (3.74)	5.263* (3.28)
Entry Index	6.647* (3.02)	3.952* (3.26)	3.949* (3.26)	6.653* (2.90)
Unilateral	—	582.2* (2.18)	567.9* (2.07)	—
Grocery Industry	–.2775 (–.10)	.4233 (.21)	.3969 (.21)	.009171 (.00)
Chemical Industry	3.011* (2.47)	2.938** (1.75)	2.933** (1.75)	2.805* (2.61)
Muris Cases	—	—	.1418 (.09)	—
Constant	–209.0* (–2.66)	–576.5* (–2.17)	–562.2* (–2.06)	–51.67* (–2.84)
Log-Likelihood	–14.86	–16.42	–16.41	–15.80

[1]All structural coefficients linked to specific collusion and unilateral theories.
*(**) The coefficient is significantly different from 0 for 5 (10) percent two-tail test.

are not significantly different from zero.[54] Thus, for matters with only one or two market overlaps, it appears that enforcement is affected only by the three concentration variables for collusion theories and only the

[54] The joint Chi-square statistic is 6.95, which is less than the (95%) critical value of 9.49 for 4 restrictions.

number of significant rivals for unilateral effects theories.[55] Column 3 of Table 6 repeats the custom specification for a model that includes the Muris indicator as a check on the initial result. The coefficient on that variable remains insignificant, suggesting that the earlier result of no political effect is robust.

It is also possible to test if the model in column 1 can be further simplified to the model in column 4 that posits the analysis would focus on the HHI index. The Wald test of the joint hypothesis that the coefficients for both the change in concentration and interaction variables are zero leads to the rejection of the two restrictions.[56] This implies that all three structural indices would likely impact collusion cases when focusing on matters with one or two overlaps. This test has no implications for unilateral effects cases.

This final set of regressions suggests that many merger investigations are closely customized to specific theories of competitive concerns. By focusing on either collusion or unilateral effects theories, enforcement staff can build a more solid case for enjoining the merger. This hypothesis should not be surprising, because a federal court will expect Commission staff to tell an anticompetitive story within a relevant market. The days of presumption-based antitrust are gone, as plaintiffs must supplement their structural case with facts supportive of real concerns or risk the court finding the presumption successfully rebutted.[57] Given that staff is focusing on a particular theory of concern to make a case, it seems reasonable to address that same theory of concern when predicting the enforcement outcome.

IV. ANALYSIS OF THE MODELS

The previous section's discussion of the signs and statistical significances of the coefficients identifies the direction of relationships (i.e., positive, negative, or not statistically different than zero) in the data. This section evaluates the models at particular values to determine the overall impact of the variables on enforcement probabilities. Three considerations are relevant: First, do the key explanatory variables matter

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[55] This result is foreshadowed by earlier analysis of the oil and grocery industries, which reported that the number of significant rivals did not affect the likelihood of enforcement. To the extent collusion theories are used to evaluate these standardized mergers, this result is no longer surprising.

[56] The joint Chi-square test statistic is 6.26, which is above the (95%) critical value of 5.99 for two restrictions. This implies that the restrictions should not be imposed.

[57] The interested reader need only review the *Baker Hughes* decision to see how poorly a pure structural case is likely to fare. *See* United States v. Baker Hughes Inc., 731 F. Supp. 3 (D.D.C.), *aff'd*, 908 F.2d 981 (D.C. Cir. 1990).

to the enforcement prediction? Second, do specific models offer robust predictions? And, third, do situations exist in which it is important to use a specific model? These questions are addressed below, through the analysis of various models, although only Table 10 will offer insights on more than one of the three questions.

As noted above, it is necessary to evaluate the models at particular points to determine the impact of the variables. This is because the coefficients in a logit model cannot be interpreted in the same manner as those from an ordinary linear regression, due to the non-linearity of the logit function. For example, in the linear probability model, if the dummy variable "hot documents" has a coefficient of 0.2, the likelihood of enforcement is 20 percentage points higher for a case with hot documents than a case without, *ceteris paribus*.[58] This is true regardless of the values of the other variables in the model. However, in the logit model, the marginal effect of each variable depends on the value of that variable and the value of all the other variables in the model. For example, the effect of a hot document on the likelihood of enforcement is different if the number of rivals is 3 than if it is 4. Moreover, the marginal impact of a variable depends on the level of the variable itself. For example, the difference in the likelihood of enforcement between mergers having 4 instead of 5 rivals is not the same as the difference in the likelihood of enforcement for otherwise identical mergers having 3 instead of 4 rivals.[59]

The shape of the relationship between the key variables and enforcement can be represented on a graph. Figure 1 illustrates how the HHI statistic affects the predictions of the broad model (Table 4, column 3), for selected values of the change in the HHI and number of rivals.[60] There are three graphs in the figure, one for each of three, four, and five rivals. Moving from one graph to another changes the number of rivals used for the prediction. The vertical axis on each graph represents the probability of enforcement, and the horizontal axis holds the values of the HHI. The graphs contain three lines, each representing a relation-

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[58] On occasion, the interpretation of the coefficients would be complicated by the fact that the linear model can predict probabilities outside the (0,1) interval.

[59] Although the difference between log of 2 rivals and log of 4 rivals is the same as the difference between log of 3 rivals and log of 6 rivals, i.e., $\log(4) - \log(2) = \log(6) - \log(3) \approx .69$, the difference in the likelihood of enforcement between mergers having 4 and 2 rivals will be not be the same as the difference between mergers having 6 and 3 rivals because of the nonlinear nature of the logit model.

[60] Three values (554, 850, and 1402) for the change in HHI (delta) are considered based on the sample means for the matters with 5, 4, and 3 significant rivals in the 128 observation sample. The entry index is held constant at 2, and all other variables are set to zero.

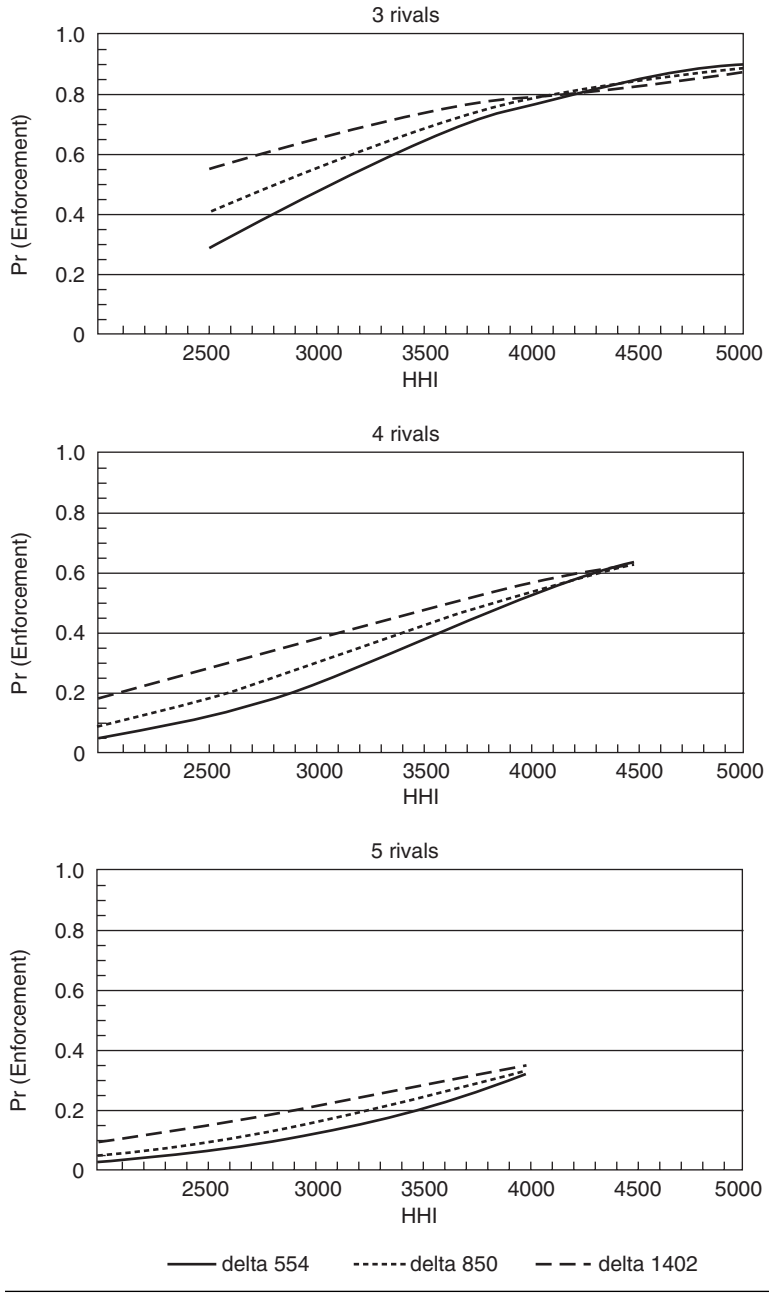
ship between the HHI and the enforcement probability. Moving between lines represents the effect of a different change in HHI on the enforcement prediction. The marginal effects can be visualized by noting the difference in predicted enforcement at different values of the various variables. Taken together, the graphs show that all three structural variables affect the likelihood of enforcement.

Note that in making the predictions, it is important to account for the fact that some combinations of the structure variables rarely or never occur in the data. Clearly the change in the HHI cannot be greater than the post-merger level (e.g., if the post-merger HHI is 5000, the change must be substantially less than 5000). We are careful not to make predictions at such impossible combinations. Similarly, there are certain combinations of the number of rivals, the HHI, and its change that rarely occur. For example, for a merger in markets with four rivals, the HHI index is typically no smaller than 2300 or larger than 5800, and its change is typically in the range of 250 to 1400. The model will only provide meaningful results if the relevant concentration parameters are relatively compatible with the historical data and, thus, we are careful not to make predictions for unlikely combinations of the rivals and the HHI variables.

Figure 1 shows that for markets with three pre-merger rivals, the predicted probability of an enforcement action is typically very high, especially for the large values of the HHI and its change where observations are likely to occur (e.g., HHI is regularly over 4000). Further, changes in the Herfindahl-related variables do not affect the likelihood of enforcement by very much for HHIs above 5000; all probabilities are close to one. HHIs below 4000 have a more noticeable marginal effect on enforcement, but there are not that many observations in this range. (If an additional figure were provided for two-to-one mergers, enforcement would appear almost certain.)

The second graphic illustrates the likelihood of enforcement for four-to-three mergers. In these four-to-three mergers, it is especially apparent how both the change and level of the HHI affect the probability of enforcement. As expected, the three lines (associated with different levels for the change in the HHI) have positive slopes, verifying the expected relationship between the HHI and the enforcement probability. The differences between the lines reflect the impact of the change in HHI variable on enforcement probabilities. For relatively low levels of the HHI, an increase in the change in HHI has a noticeable impact on the probability of enforcement. As the HHI rises, the impact of the change in the HHI diminishes until the effect appears to disappear for HHIs somewhat above 4000. Thus, the coefficients of the model suggest

Figure 1. Enforcement Predictions by Values of the Concentration Variables (model from Table 4, column 3 (128), rival count pre-merger)



that factors other than the change in the HHI must drive enforcement policy in this region, as the model predicts a 50–60 percent chance of enforcement in a highly concentrated (HHI over 4000) market regardless of the change in the HHI caused by the merger. Change in the HHI does have some effect in relatively unconcentrated markets (HHI around 2500), as the enforcement probability ranges from around 10 percent to about 25 percent as the change in the HHI rises.

The final plot predicts enforcement for five pre-merger rivals. These transactions are usually not subject to enforcement action, although the graph shows that values of the HHI over 3000 (associated with roughly one-third of the sample) trigger a small chance of enforcement. Relatively high changes in the HHI also make enforcement slightly more likely. Thus, in a five-to-four deal, both concentration variables have small effects on the probability of enforcement.

One can compare the three plots in the figure to see how the number of rivals matters. As can be seen, the likelihood of enforcement at specific values of the HHI and delta are noticeably lower when there are four pre-merger rivals than when there are three, and lower still when five rivals exist. Overall, Figure 1 clearly shows how the concentration variables materially affect the enforcement predictions.

The figures are powerful because they furnish a visual feeling of how the variables matter. But they are imprecise; to estimate enforcement probabilities or the marginal effects of variables with exactness requires calculating predicted values. In the tables below, we do so to further explore the effects of variables on enforcement probabilities.

In Table 7 we present enforcement probabilities for three core concentration-based models (the first, defined in Table 3, column 1, using 570-observations, and the other two defined in the first two columns of Table 4, using 442 and 128-observations, respectively). If the predictions differ materially, then the choice of model would have important implications for the prediction of an enforcement probability. Seven different values of the HHI are used, ranging from 2000 to 5000 with 500-point increments. Significant rival counts of 5, 4, and 3 are also used and for each rival count, the change in the HHI is pegged to the previously used sub-sample means of 554, 850, and 1402, respectively. The industry dummy variables are set to zero. In each cell of the table, three numbers are given: first for the model estimated with the full 570-observation sample; next the 442-observation sample; and third, the 128-observation sample.

Overall, the models generate similar prediction structures, although some differences can be observed. For three rivals, the 128-observation

Table 7
Enforcement Probability Predictions for Selected Models*

	Rivals		
Herfindahl	*5*	*4*	*3*
2000	22/24/11	43/44/40	NA
2500	28/32/16	50/52/47	NA
3000	34/39/22	55/58/52	77/77/86
3500	40/46/27	59/63/57	79/79/86
4000	45/52/33	63/67/60	81/81/87
4500	NA	66/70/64	82/83/87
5000	NA	NA	83/84/89

*Results for each cell are generated by using the models from Table 3, column 1, Table 4, column 1, and Table 4, column 2, in that order.

NA–Model is not supported in the data for that particular fact situation.

generates the highest predicted enforcement probability, with levels approaching 90 percent. In contrast, predicted enforcement probabilities from the other two models are in the high 70 percent and low 80 percent ranges. For four rivals (approximately the sample mean of the rivals variable), all the models offer almost identical predictions. Finally, for five rivals, enforcement is most likely for the 442-observation sample with a range from 24 to 52 percent (this result is the opposite of that found for the 128-observation model with three rivals). In sum, the predictions in Table 7 suggest that the choice of model will have only a marginal impact on the enforcement prediction for three or four rivals. In contrast, if five rivals are identified, the choice of model seems to matter. In general, if the merger at issue involves numerous markets of concern, it appears reasonable to use one of the large sample (either 570- or 442-observation) models for predicting enforcement outcomes because the historical cases underlying the parameter estimates are likely to be most similar to the case at hand.[61] The similarities in predicted values suggests that the choice matters little, although, as noted above, the 442-observation sample gives more weight to grocery and oil industries matters; hence, would seem more appropriate when standard collusion theories appear in a mega-merger.

Table 5 reported coefficients for broad models that exclude cases exhibiting easy entry and/or strong customer complaints. As discussed, we estimated these models to address the potential estimation problems

[61] For mergers involving few markets of concern, the analyst probably wants to use a more sophisticated model whenever the key data (entry impediments, customer concerns, and possibly hot documents) are available.

associated with easy entry and strong customer complaints. Table 8 compares the predictions of a model that includes a dummy variable set to zero to signify lack of complaints (Table 4, column 3) to the model that excludes markets having complaints (Table 5, column 3). This presentation serves as a check of the robustness of the original customer complaint model, as comparable predictions would suggest that the broad model is a reasonable representation of enforcement probabilities across the data set. The format of the table follows the description of Table 7, with probabilities computed for various values of the HHI and number of rivals (with the change in the HHI fixed at the mean for the relevant number of rivals).

There are two predictions in each cell of Table 8. For either low values of the HHI or few rivals coupled with very high values of the HHI, the predictions match very closely, suggesting that the exclusion of the cases with customer complaints changes very little. If the HHI is not low, some differences are observed. For example, the enforcement prediction using all the data (but setting complaints to 0) is 42 percent with four rivals and a 3500 HHI. Focusing on the smaller data set, which excludes all matters in which validated complaints were identified, generates a somewhat lower prediction of enforcement probability—35 percent. Even larger differences are observed for highly concentrated markets with five significant rivals. As these special case situations are rare, it appears the broad model generally offers robust results and should prove useful in predicting the outcomes of merger investigations.

Table 8
Enforcement Probability Predictions for Selected Models
(no complaints)*

	Rivals		
Herfindahl	*5*	*4*	*3*
2000	2/2	9/12	NA
2500	5/4	18/19	NA
3000	11/7	29/27	65/72
3500	20/12	42/35	73/77
4000	31/17	53/43	79/80
4500	NA	64/51	84/83
5000	NA	NA	87/85

*Results in each cell are generated by using the models from Table 4, column 3, and Table 5, column 3, in that order. (Hot documents and industry variables set to 0.)

NA–Model is not supported in the data for that particular fact situation.

The overall impact of customer complaints is illustrated in Table 9. Two sets of predicted probabilities are displayed in each cell. The first number predicts enforcement when there are no significant complaints, and the second number predicts enforcement when there are complaints. Both use the broad model in Table 5, column 1 (i.e., the model estimated with the sub-sample limited to markets having entry impediments). For all the predictions, the number of rivals is set to four, and hot document and industry effects are zeroed out. This model is chosen to abstract from entry conditions and allow a clean test of the impact of validated customer concerns, although similar results would be found if the broad model in Table 4, column 3, was used with the entry index set to two.[62]

Taken together, the data in Table 9 clearly show the importance of verified customer complaints. The enforcement probability with customer complaints always exceeds the probability without them, usually by a wide margin. For a relatively substantial level of the HHI (e.g., 3000s), the model predicts that a staff memorandum highlighting a customer concern will almost guarantee an enforcement action. As can be seen in the table, the existence of complaints increases the likelihood of enforcement from possible (around 20–50 percent) to very likely or even almost certain (80–90 percent) for matters having concentration around 3000. In contrast, if no complaints exist, enforcement probabilities reach 80 percent only when the HHI reaches 5000. These results suggest that correct enforcement predictions are heavily dependent on understanding the customer opposition to the merger.

Table 9
Impact of Customer Complaints on Merger Enforcement Probability Predictions*

Rivals 4-to-3	*200*	*400*	*800*	*1600*
2000	2/29	8/62	25/86	N/A
3000	19/82	32/90	50/95	N/A
4000	55/96	62/97	68/98	74/98
5000	82/99	81/99	80/99	79/99

*Results in each cell are generated by using the models in Table 5, column 1, with no customer complaints and with customer complaints, in that order. (Hot documents and industry variables set to 0.)

[62] Calculations suggest that the enforcement predictions for matters with no complaints would be lower and the predictions for matters with complaints would be higher. These results suggest an even stronger customer complaint effect would be observed.

Table 10 examines the impact of entry on the merger review process. The table records enforcement predictions for four models. The table varies the concentration statistics (with the HHI and its change set to their sample means corresponding to the respective number of rivals in the 128-observation sample) and the entry index; all the other variables are set to zero. The analysis (1) evaluates the importance of an entry finding, (2) checks for the robustness of the entry effect, and (3) offers insights into when the choice of a particular model should be made.

The broad model, with entry, is addressed first; using both the version estimated with the 128-observation sample (Table 4, column 3) and the version estimated without the verified customer complaint observations (Table 5, column 3). In the broad model with the 128-observation sam-

Table 10
Impact of Entry on Merger Enforcement Probability Predictions

		Entry	*Index*	
Model (observations)	*0*	*1*	*2*	*3*
Table 4, column 3 (128)				
2 rivals (7896 (2929))	28	88	98	99
3 rivals (4803 (1402))	6	52	86	95
4 rivals (3685 (850))	1	13	46	74
5 rivals (2874 (554))	*	2	9	26
Table 5, column 3 (77)				
2 rivals (7896 (2929))	39	91	98	99
3 rivals (4803 (1402))	7	52	85	95
4 rivals (3685 (850))	1	11	38	66
5 rivals (2874 (554))	*	1	7	18
Table 6, column 2 (101)				
(7896 (2929))	NA	NA	NA	NA
(4803 (1402))	42	92	98	99
(3685 (850))	10	63	89	96
(2874 (554))	*	4	16	38
Table 6, column 2 (101)				
2 rivals	59	96	99	99+
3 rivals	6	49	83	94
4 rivals	1	9	34	62
5 rivals	*	2	9	22

1–Results in each cell are generated by using the indicated model. (Complaints, hot documents and industry set to 0.)

NA–Model is not applicable in the particular fact situation

*Predicted enforcement probability is less than .5 percent

+Predicted enforcement probability is greater than 99.5 percent.

ple, the enforcement prediction increases materially with the entry variable, indicating entry impediments affect the review process. Not surprisingly, this evidence matters more for markets in which some post-merger competition can be expected. For example, given three rivals (or a post-merger HHI of 4803), increasing the entry index from 1 to 2 raises the probability of enforcement from 52 percent to 86 percent, while for four rivals (or a post-merger HHI of 3685), increasing the entry index from 1 to 2 raises the probability of enforcement from 13 percent to 46 percent.[63]

The second set of results repeats the analysis using the coefficients from the third column of Table 5. Again, entry appears to have an important effect on the predictions, with something of a trade-off between concentration and entry evidence obvious for moderately concentrated markets (investigations in most highly concentrated markets end in enforcement unless entry is easy, while investigations in most marginally concentrated markets close). Comparing the top set of cells of Table 10 (estimated with all the data) to the second set of cells of Table 10 (estimated only with matters without strong customer complaint findings) shows the predictions are remarkably similar. For example, if the HHI is set equal to 3685 (with four rivals), the enforcement probabilities will range from 1–74 percent as entry conditions move from 0 to 3 (for the top set of cells in Table 10) and 1–66 percent, again as entry considerations move from 0 to 3 (for the second set of cells in Table 10). An analyst could use either model to generate reasonable predictions for the enforcement decisions. This suggests that the predictions of the broad model appear robust with respect to entry.

The last two sets of cells in Table 10 use the customized model given in column 2 of Table 6 to generate predictions; first for the collusion matters and then for the unilateral effects cases. These predictions can be compared to those of the standard model to determine when it might be useful to attempt to apply the more complex analysis. The third set of cells shows that collusion cases with HHIs in the mid-3000s are likely to lead to enforcement when entry evidence is found. (Compare the 13 percent in the set of cells tabulated at the top of the table with 63 percent tabulated in the third set of cells; both for one entry finding and a HHI

[63] This marginal entry effect is eliminated by assumption in the model reported in Table 5, column 1, as it excludes the entry variable. Predicting enforcement with this model generates probabilities of 96% for 2 firms, 90% for 3 firms, 64% for 4 firms, and 22% for 5 firms, with all probabilities calculated at the same mean HHIs and changes used in Table 10. Repeating the calculation for the model reported in Table 5, column 4, generates 97, 89, 62, and 22% chances of enforcement for 2, 3, 4, or 5 rivals, respectively.

of 3685.) Thus, for HHIs in the mid-3000s and above, it appears useful to apply the theory-specific model of enforcement.

Unilateral models offer much less value, as the predictions are quite comparable. When three rivals exist, slightly different enforcement probabilities are observed when one compares the results of the broad model in the top set of cells to the unilateral effects model given in the bottom set of cells in Table 10. (The broad model's predictions range from 6–95 percent, while the custom unilateral model's predictions range from 6–94 percent.) A pure unilateral model would generate a higher prediction for two-to-one mergers (for example, the unilateral effects estimate of enforcement rises to 96 percent—from 88 percent at the top of the Table—with one entry characteristic), but generates slightly lower predictions when four rivals compete in a market (here compare the range of 1–74 percent for the broad model at the top of the Table with the range of 1–62 percent for the unilateral effects model).

The Table also suggests that unilateral effects cases with four rivals are less likely than collusion cases with comparable HHIs (3685, the mean for the matters with four rivals). In effect, a unilateral effects case is weaker than a collusion case at comparable levels of concentration.[64] These results imply the merger analyst should attempt to understand the competitive theory of concern before predicting the likely outcome of a marginal investigation. Such insights may require a careful study of the competitive process in the relevant market.

V. CONCLUSION

The statistical analysis generates a number of enforcement policy insights (although the possibility that the data review process did not allow for the recovery of all important variables argues for caution in interpreting the predictions). First, increases in the HHI and changes in HHI generally make enforcement more likely, as do reductions in the number of significant competitors. Second, the industry may matter, as the model predicts that enforcement is more likely in the oil, grocery, and chemical industries. Third, the models show no structural shifts during the eight-year period examined here; that is, neither political control of the Federal Trade Commission nor the merger wave is statistically related to the enforcement outcome.

[64] This observation may highlight an unwillingness to advance a marginal unilateral case without supportive evidence, given the relatively novel nature of the unilateral effects model. It also cuts against the popular perception that unilateral effects cases are more likely to be observed than collusion cases. The perception ignores the fact that most unilateral effects cases involve mergers best modeled as 3 to 2 or even 2 to 1. Few collusion cases are found with this high a level of concentration.

Enforcement predictions depend to some extent on the ability of the analyst to undertake a comprehensive analysis of the relevant competitive concern. For matters exhibiting four or more competitive overlaps (often, but not always, mergers in the oil and grocery industries) HHIs matter, but the number of rivals does not affect the evaluation process. For matters with three or fewer market overlaps, it is possible to show that other variables, such as customer concerns and entry conditions, significantly impact the merger analysis. These results do not seem very sensitive to the exact data used to estimate the model. Finally, it appears that different structural variables systematically drive the enforcement outcome in different types of competitive settings. The number of rivals matters in unilateral effects cases, while the HHI levels and changes matter in coordinated interaction cases.

To apply any model, it is necessary to compute reasonably accurate values for the independent variables. For the structural variables, the theory of concern and entry, this task should not be difficult, as these considerations underpin a standard merger investigation. For customer complaints, stakeholders may have more difficulty in using the broad model, as the extent and scope of the customer complaints are not always clear. However in creating the models, we faced the same problems, because not all the files recorded all the relevant information. Thus, after a review of market realities, the stakeholder may have to choose a model to match the data availability. Thus, in the real world, the "best" model will often depend on the information available to the analyst.

APPENDIX A
BACKGROUND ON THE DATA COLLECTION PROCESS

In any data collection process, a number of decisions have to be made to systematically tabulate the relevant information. This Appendix summarizes the key decisions made in this study. For all but the product homogeneity variable defined for this analysis, other insights on the data are contained in the Commission's Horizontal Merger Investigation Data document.[65]

Compiling the market concentration data was usually straightforward. The standard staff memorandum alleged a relevant market and presented a market share table. This allowed the collection of the post-merger HHI index, the change in the index caused by the merger, and the market shares of the merging parties.[66] For some of the transactions, the analysis presented alternative market definitions or multiple HHI statistics. In these cases, the memoranda were reviewed to determine which market or HHI the BC staff had considered most likely to be correct. For the few cases in which the memoranda did not address this issue, information on the first market or HHI mentioned was recorded.

The collection of the data on the number of significant competitors was more complicated. The process started with the review of market share tables and then identified the significant rivals from the relevant discussion of competition. The operative definition of a significant competitor was a firm whose independence could affect the ability of the merged firms to achieve an anticompetitive outcome. If the relevant anticompetitive theory was coordinated interaction (collusion), any firm required to participate in the collusive group would be a significant competitor. Alternatively, if the relevant theory was based on unilateral market power, a significant competitor would be a firm identified as a close rival to the merged firms in the post-merger competitive environ-

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[65] *See also* Merger Transparency Data, *supra* note 3.

[66] In a few cases, the HHI was computed from the available market share data.

ment.[67] The number of pre-merger significant rivals was identified for 570 of the 780 markets having usable HHI data.[68]

The institutional data included the enforcement outcome, an index linked to the date of the enforcement decision, and indicator variables for selected industries. For most mergers, coding the Commission's decision was straightforward because the investigation of the relevant markets led to either an enforcement action or a formal closing decision. On occasion, the parties abandoned their deal at the end of the investigation; these cases were coded as enforcement because the Commission had effectively made an enforcement decision at the end of the investigation.[69] The time index was based on the date of the FTC decision, which was almost always contemporaneous with the receipt of the final memoranda. This variable made it possible to compute a binary variable to distinguish the Chairmanships of Robert Pitofsky and Timothy Muris. The industry classifications (i.e., oil, grocery, and chemical) were obvious, given the products under review.

Information on four additional variables was collected for a subset of the data: hot documents, customer complaints, homogeneous goods, and an index related to entry.[70]

The hot documents indicator is a dummy variable that identifies the existence of a hot document. The variable was coded to equal one when the staff presentation noted a document, submitted by one of the merging parties, projecting that the merger would result in an adverse price or non-price effect on competition in the relevant market. The typical example involved an internal document predicting the merger

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[67] In some matters, both theories of concern were identified as possibly relevant. These memos tended to differentiate between competitors that mattered and fringe rivals; hence, the coding process was unaffected.

[68] A number of memos listed the concentration statistics, but failed to present market share tables. Without a list of the competitors, it was usually impossible to define the number of significant rivals.

[69] Three matters, in which the Commission accepted non-structural remedies unrelated to the horizontal concerns, were coded as closed investigations because the investigations of the horizontal competitive issues did not lead to enforcement actions linked to the structural problems. In each of these mergers, the transaction was consummated, while the remedy just affected an ancillary clause not tightly related to the merger under review. For example, in General Mills/RalCorp the Commission allowed General Mills to take ownership of the RalCorp brands, but had the sales agreement changed to enhance RalCorp's ability to supply private label cereal. Merger Transparency Data, *supra* note 3, at 3 n.8.

[70] This review is focused on 93 transactions which addressed 128 markets. *See* Merger Transparency Data, *supra* note 3, at 4–6, 7 (discussing the selection process, the hot document and customer concern variables, and a binary entry variable).

would lead to a direct price increase. Documents were also considered "hot" when the inference of a price (or non-price) effect from the merger was obvious from the document. For example, a document that detailed how one of the merging parties had driven the competitive process through its interactions with the other party would support the inference that this competition would be lost by the merger. Hot documents were found in the original Hart-Scott-Rodino filings, the second request submissions of top management, or the broader submissions from middle management. Documentary evidence of "close" rivalry between the parties, while informative to the merger analysis, was insufficient to trigger the hot document classification because the documents did not address the post-merger competitive environment.

The customer complaints indicator is a dummy variable coded to equal one when credible competitive concerns were raised by customers. The staff memoranda were analyzed to determine which cases exhibited theoretically valid customer complaints. In general, staff attempted to link the various customer complaints to the predictions of the relevant theory of concern. If the concerns were rejected as incompatible with a theory of competitive harm or if the evidence was quite mixed (indistinguishable customers presenting opposite opinions), the customer complaint variable was coded as zero to reflect the lack of solid customer opposition to the merger.[71] In other cases, the staff verified the significant concerns raised by customers. These matters were recorded as verified customer complaints. In general, the staff seemed to discover customer concerns through the investigation, but it is not uncommon for customers to contact the agency and express an opinion. The files do not systematically differentiate between these two types of situations.

The third variable focused on the industry under review to determine if the products in the relevant market were relatively homogeneous (and, thus, relatively vulnerable to coordinated interaction) or relatively heterogeneous (and, thus, relatively susceptive to unilateral concerns). The product in question had to be a very close substitute for the other products in the market to merit the relatively homogeneous classification. Significant geographic or product differences were sufficient to preclude coding as a homogeneous product.[72]

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[71] In a number of matters, staff did not discuss customer concerns. This collection of cases includes, but is not limited to, the pure retail matters in which customer complaints would not be expected. By construction, all of these cases are coded as not exhibiting "strong customer complaints."

[72] This variable was not used to tabulate the relevant enforcement data in the public release.

An entry index was defined to model barriers to entry. To create the variable, the memoranda were reviewed for evidence on the three characteristics of entry: timeliness, likelihood, and sufficiency.[73] Each characteristic was individually analyzed to determine if the staff memoranda made a credible finding of entry difficulties associated with the relevant consideration. The entry impediment index summed these three variables. The variable was set equal to zero if none of the entry characteristics (i.e., timeliness, likelihood, and sufficiency) revealed entry difficulties. The variable was defined to be 1, 2, or 3 if 1, 2, or 3 of the characteristics revealed entry difficulties, respectively. While the ease of entry inference would still be clear when the entry index took on the value of zero, a reasonable argument could be made that ease of entry became less likely as the number of entry considerations observed to be problematic increased from 1 to 2 to 3. For example, if the staff analysis only claimed timeliness precluded entry in response to less than competitive pricing, but that staff analysis had discounted a specific method of quick possible entry, it could be still be logical for others to conclude that entry would occur. However, the error in the timeliness analysis would have little impact on the bottom line when the entry analysis also included a strong argument suggesting that entry would not be likely in response to an anticompetitive price increase. Thus, the sum of the number of entry conditions suggesting entry impediments was assumed to represent a proxy for the overall strength of the available entry evidence.

Note that such a proxy is (by definition) somewhat arbitrary, and one could conceive of different forms. Almost all of these proxies impose certain restrictions on the effects of the entry impediments. For example, the sum of entry conditions assumes that the effect of each entry impediment is the same. One may, thus, consider including separate dummy variables for each entry impediment, but such an approach would assume that the effect of additional entry condition is the same regardless of whether none, one, or two entry impediments already exist. Another approach would be to include dummy variables for each possible combination of entry impediments. This would allow the effect of each additional impediment to vary depending on how many and what other entry impediments already exist. However, such an approach would require seven dummy variables, which is not feasible for our sample size.

Finally, data on market share, significant rivals, and product homogeneity were used to classify each merger analysis as either a coordinated

[73] The Merger Transparency Data released an entry index taking on the value 1 when at least one entry impediment was identified in the files, and 0 when all three considerations pointed to easy entry. Merger Transparency Data, *supra* note 3, at 8.

interaction or unilateral effects case. We used two rules to organize the information. The first rule recorded all relatively homogeneous goods markets as subject to coordinated interaction concerns, unless the existence of only two pre-merger rivals implied a unilateral dominant firm theory should be used. The second rule classified all heterogeneous goods markets (i.e., all markets that did not involve homogeneous goods) as subject to unilateral concerns, whenever the market share of the merging parties exceeded 35 percent. When the share of the merging parties fell below 35 percent, some form of coordinated interaction was presumed to represent the theory of concern.[74]

[74] The Merger Guidelines arguably do not allow for a presumption of a unilateral effects theory if the combined share is below 35 percent in a differentiated products market. Merger Guidelines *supra* note 16, § 2.211. The use of a coordinated effects model is a theoretical presumption for the statistical tests in this article.