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Mergers Without Markets: Do Mergers Among Publishers of Academic Journals Affect Prices?

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Abstract

Increases in the prices of academic journals over the past two decades have placed a significant strain on library budgets. Even though the industry is relatively unconcentrated and academics do not view journals or even journal articles as good substitutes for one another, recent research in the *American Economic Review* has suggested that the numerous mergers among journal publishers since 1990 have contributed significantly to these price increases, and has called for a new and idiosyncratic approach to product market definition in evaluating mergers in this industry. This paper discusses several analytical and methodological flaws in these findings and reports results based on different data. We conclude that the relationship between mergers and price changes in the academic journal industry is very poorly understood and that work to date does not provide a rationale for antitrust enforcement based on a definition of relevant product markets that is any different from that used in other industries.

MiCRA Working Paper Series, No. 2 (November 4, 2005)

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MiCRA WORKING PAPER, October, 2005

Academic journal price increases over the past two decades have placed a significant strain on library budgets. While there appear to be multiple causes of these price increases,[1] recent academic and policy attention has focused on a series of mergers among large publishers (see Table 1),[2] even though the academic journal publishing industry is relatively unconcentrated by traditional antitrust standards and the Department of Justice ("DOJ") has reviewed the mergers in Table 1 but not prevented any of them. Although library concern with publisher mergers has been long-standing, one reason for the increased focus on these mergers appears to be a recent empirical analysis of journal list prices over the period 1990 to 2001. That analysis, by Mark J. McCabe, purports to show that mergers between publishers of academic journals

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have contributed to a substantial increase in prices that libraries pay for journals,[3] and that these mergers have raised prices across broad "portfolios" of journals.

A potential corollary of empirical evidence that mergers are associated with price increases across portfolios of journals in broad academic fields, such as biomedicine, is that those portfolios comprise relevant antitrust markets in which to analyze mergers between publishers.[4] This conclusion should be somewhat surprising to antitrust economists because each of the articles in the journals that would comprise a broadly defined portfolio market is unique and few journals are especially close substitutes for one another. Using a traditional approach to market definition, neither many of the articles in such a portfolio nor many of the journals in which they are published would be included in the same antitrust product market. In effect, therefore, McCabe's results call into question the Department of Justice/Federal Trade Commission Merger Guideline's procedures for market definition and suggest that a new emphasis on budget, rather than substitution, effects is needed in certain industries, such as scientific journals, where libraries allegedly purchase portfolios of products subject to a budget constraint.

Section I of this paper discusses several analytical and methodological flaws in McCabe's analysis which raise serious questions about the validity of a relationship attributable to market power between journal price increases and mergers, and cast doubt on any recommendation that antitrust agencies use "portfolio markets" to analyze mergers in the publishing industry. Section II reports results from our own analyses of the relationship between publisher size and journal prices which are based on different data. Among other things, our data include observations through 2004 that allow us to examine whether the DOJ made the right decision when it declined to challenge Reed Elsevier's 2001 acquisition of Harcourt General, Inc. ("Harcourt") despite

opposition from informed customers, *i.e.* libraries. Our empirical results support the DOJ's decision and, concomitantly, provide reason to reject both concerns about recent mergers among journal publishers and proposals not to use the Merger Guidelines when defining markets in which "portfolio" or "budget" effects are alleged to be significant.[5]

These results also have at least one implication that goes beyond academic journals or other industries where portfolio effects might be alleged. There is an ongoing debate within the antitrust fraternity as to whether market definition is necessary when competitive effects have been observed directly. Some practitioners argue that when a merger or other change in market structure raises price significantly, some "relevant" antitrust market must exist and the usual exercise of defining a market is unnecessary. However, a merger can have an effect on price – for example, through a change in control and thus of management goals or philosophy – without having an effect on competition. Thus, the inference of a relevant market from evidence that prices have increased requires a high degree of confidence both that the price increase has indeed occurred *and* that it has occurred for reasons relating to market power. This is particularly true where there is a strong prior from structural evidence that a merger is unlikely to be anticompetitive, as in this industry, where "experience as a user often suggests that each *unique* title constitutes a distinct market for the purpose of antitrust analysis"[6], and thus, the *only* reason for believing that broad "portfolios" of journals could constitute relevant antitrust product markets would be a finding that at least some mergers have indeed resulted in price increases.

Merger policy without the safety net of market definition and, thus, a substantial probability of a false positive is problematic when, as in this industry, the cost of a false positive is likely to be high for two reasons. First, such findings could be used to prevent efficient mergers in the U.S. and Europe which might result in a significant increase in concentration in

some "portfolio market", but no increase in market power. Second, and more importantly, a false positive would divert attention away from other explanations for why journal prices increased rapidly over a period of years, some of which may reflect remediable market failures.[7] Correctly diagnosing those failures could lead to policy actions that are welfare increasing.

I. FLAWS IN McCABE'S ANALYSIS

In the portfolio pricing model, as applied by McCabe to journals, libraries are assumed to allocate or budget a fixed amount for journal purchases in each of several broadly related (but only vaguely specified) academic "fields" (*e.g.*, science, technology and medicine).[8] Within each field, libraries (or academic departments to which the task has been delegated) are assumed to first estimate each journal's cost per use (*i.e.*, the price divided by the number of journal uses) and rank journals with the lowest cost per use highest (or, perhaps more credibly, assumed to act as if they did). Next, starting with the highest ranked journal and moving down, a library purchases as many journals as it can, subject to its budget constraint. "Thus, titles compete with each other for budget dollars across an entire field [*i.e.*, portfolio], rather than across a narrow subfield, as intuition might otherwise suggest… ."[9]

How does the size of a publisher's portfolio affect its pricing? McCabe contends that "firms controlling larger portfolios of journals may have an incentive to charge higher prices, all else equal. The intuition for this result is similar to that in more traditional product markets. Greater portfolio size, perhaps due to a merger, enables a publisher to better internalize pricing externalities. So, in some instances, as a firm's size increases, the firm's *average* price does as well."[10] McCabe is careful to qualify his assessment of the relationship between portfolio size and price, stating that (1) larger portfolios *may* create an incentive to charge higher prices and (2)

prices increase with firm size only *in some instances.* Nevertheless, he clearly suggests that a merger which increases concentration in some unspecified portfolio market can be expected to lead to higher prices, even though merger-related price effects are due not to demand-side substitutability, but to budget (or income) constraints.

Under the portfolio model of library and publisher behavior, however, whether a merger can be expected to raise or lower prices depends on the demand elasticities of the affected journals. If indeed library budgets are fixed, then if demand for a journal is inelastic, a higher price will reduce expenditures on other journals. Thus, a merger that increases the "budget share" of a publisher reduces the profitability of a price increase, since the merged publisher internalizes a greater share of (negative) pricing externalities. Hence, a merger can reduce a publisher's incentive to raise the price for a high-ranked journal for which demand is inelastic.[11] This is opposite to the effect that mergers ordinarily have, since increasing the price of one product usually causes spending on competing products in the same antitrust market to increase. In the usual case, a merged firm would have more incentive to increase the price of a journal than did the journal's publisher before the merger because the libraries would be more likely to switch to another journal published by that firm.

Most economists would immediately object that budget effects cannot imply that mergers will reduce price, because the price elasticity of demand for a journal published by a profit-maximizing firm cannot have an absolute value less than one. However, the conventional wisdom among many industry observers is that the institutional demand for journals is very inelastic.[12] While we could offer a number of possible explanations for this paradox, we do not claim to have resolved it. We would argue, however, that any pricing theory based on comparative static results between two profit-maximizing equilibria cannot reliably predict the

price effects of mergers in such a market. Absent a theoretical explanation for the empirical anomaly that commercial publishers appear to hold academic journal prices well below the profit-maximizing level, there is no *a priori* basis for predicting that a merger will raise, rather than lower, prices.[13]

At the empirical level, McCabe's analysis is flawed by his failure to address certain evidence at odds with the conclusion that mergers have created monopoly power for for-profit publishers. In this regard, for example, he ignores his own empirical results which suggest that mergers between publishers with large portfolios affect price no more than mergers between publishers with far fewer (or even no) journals in the same portfolio. In addition, as we show in Section II, there is no systematic relationship between the magnitude of a merger-related change in a publisher's portfolio and the change in the relative prices of its journals. These empirical results suggest that any observed relationship between mergers and price effects is not attributable to an increase in market power.

In the same vein, McCabe excludes from his analysis non-profit and very small commercial firms (*i.e.*, those with biomedical portfolios consisting of fewer than ten journals) because their prices presumably are not affected by mergers. However, we found that the rates of price increase for non-profit and for-profit publishers between 1995 and 2004 were very similar, and our finding is consistent with anecdotal evidence from other sources. For example, according to an Oxford University Press report (2004),[14] the median price per page for Cambridge University Press journals increased faster from 2000 to 2004 than the median price per page for many commercial publishers.

Finally, McCabe's empirical analysis is also characterized by serious methodological flaws. He uses a "difference-in-differences" (DD) regression model to analyze whether there is

empirical evidence that merged publishers' journal prices increased more than the journal prices of publishers that did not merge. As he explains, "this approach involves specifying a separate fixed effect for each title (to 'difference' the data), a series of time dummies for each of the years in the sample, and a set of merger dummies (which measure the differences in the differenced data)."

In the DD model, the price of each individual journal is regressed against the year in which the price is observed and, in the case of journals published by a merged firm, dummy variables that indicate whether the year is before or after the merger occurred. In effect, the model compares the change in the average pre- and post-merger prices of journals published by merged firms with the change in the average pre- and post-merger prices of journals published by firms that did not merge over the observed period. A merger is found to affect price if the average change in the prices of journals published by merged firms between the two periods is significantly different than the average change in the prices of journals published by firms that did not merge.

This empirical approach raises several issues. First, it violates a standard assumption on which conventional tests for statistical significance rest. Specifically, the significance test as to whether mergers between publishers have affected price is based on the assumption that each journal is priced independently of every other journal. However, the portfolio model assumes just the opposite; namely, that when a publisher sets the price of one journal it takes account of the prices of other journals that it controls and that are part of the same portfolio. Thus, there is a disconnect between the assumptions underlying the theoretical and empirical models. If the journals in the sample are not all independently priced, then the DD model cannot reject the null hypothesis – that mergers do not affect prices – using conventional significance tests.

Second, as noted in one recent paper, most DD models are affected by serial correlation, a statistical problem that causes standard errors to be underestimated and, consequently, t-statistics to be overestimated.[15] To illustrate, one study used Current Population Survey data and a DD model to estimate the effects of purely hypothetical state laws on wages for women. The study showed that a conventional DD model rejected the null hypothesis (namely, that a hypothetical law has no effect on wages) at the 5% significance level for up to 45% of the fake laws. While McCabe's journal pricing model is likely affected by this serial correlation problem, he does not appear to correct for it before rejecting the null hypothesis (*i.e.*, the hypothesis that mergers do *not* affect journal prices). Thus, McCabe's study is flawed by two entirely separate econometric problems that undermine his claim to have found a *statistically significant* relationship between price increases for journals and mergers between publishers.

A third problem with McCabe's regression model is that it fails to take account of whether, even absent a merger, a merged publisher's journal prices could be expected to increase more in the period following a merger than the journal prices of publishers that did not merge. Specifically, our analysis of journal prices confirms, as might be expected, that the percentage increase in a publisher's prices tends to "regress toward the mean" over time. That is, there is a significant tendency for publishers who increase the prices of journals within a portfolio less than average in years t-1 and t-2 to increase their prices more than average in year t.[16] In view of this, we looked to see whether the merging firms in McCabe's analysis raised their journal prices more or less rapidly, on average, than non-merging firms in the pre-merger period.

Table 2 reports the annual average percentage increase in twelve different commercial publisher's biomedical journal prices for the three years 1996 – 1998.[17] Two of the 12 firms (Churchill Livingstone and Harcourt General) merged in 1997 and four (Wolters Kluwer with

Plenum, Thomson and Waverly) merged in 1998. The table reveals that, on average, the annual percentage price increases from 1996 to 1998 by publishers that merged in 1997 and 1998 were much smaller than the percentage price increases by other non-merging publishers during this period. For example, the average cumulative increase over the three-year period was 36.3 percent for the merging publishers and 54.7 percent for the non-merging publishers. Thus, given the tendency for commercial publishers' annual percentage price increases to regress toward the mean,[18] we would expect the merging publishers to have experienced larger percentage price increases in the years immediately after the mergers occurred than the non-merging publishers even if they had not merged. Given the small number of mergers in the study, the fact that merged firms' prices increased at a slower rate than other publishers' prices just prior to merger may be a random event. Alternatively, there may be some poorly understood underlying reason for why these firms merged. In either event, however, the result may be a spurious impression that prices rose because of the mergers.

II. EMPIRICAL ANALYSIS

This section presents results from two fundamentally different analyses of journal prices. We begin in Section II.A by following tradition and attempting to replicate McCabe's results. Since our data set runs through the year 2004,[19] we are able to analyze one transaction, Reed Elsevier's acquisition of Harcourt General ("Harcourt"), that McCabe could not. Even using the same approach as McCabe and the same focus on biomedical journals, our results support the DOJ's decision not to oppose that merger.

Next, since a publisher does not price each journal independently of all its other journals in the same portfolio, we analyze in Section II.B the effect of mergers on the *average* prices that

publishers charge for journals in each of 14 different portfolios.[20] That is, rather than treat each individual journal price as independently determined, we analyze *average* portfolio prices taking account of the size of the transaction. We find no systematic relationship between past mergers and prices: a merger was at least as likely to reduce a publisher's prices as it was to raise them.

It is important to note that we have analyzed the effect of mergers on the average prices of many different academic portfolios for reasons unrelated to any belief that each such portfolio comprises a relevant antitrust product market. Indeed, we suspect that each of these portfolios contains substantially more journals than would product markets defined using traditional antitrust analysis. Instead, our reason for analyzing prices across portfolios is twofold. First, a portfolio approach to analyzing the competitive effects of mergers is not useful as a policy tool unless it is broadly applicable to many different portfolios. If the empirical evidence suggests that prices are just as likely to fall in some portfolios as they are to rise in others, this adds additional support to the conclusion that a portfolio model analysis does not identify price effects related to monopoly power.

Second, we criticized McCabe's approach because it treats journal prices as independently determined for the purpose of analyzing statistical significance, even though the theoretical model assumes exactly the opposite; namely, that publishers do not price journals within a portfolio independently. A cross-portfolio empirical analysis provides at least a partial solution to this problem, since there is no apparent basis for assuming that budget constraints compel libraries to treat journals in one academic field as substitutes for those in a different field.

A. Results from McCabe's Methodology Applied to a Different Data Set

McCabe analyzed seven merger transactions that occurred between 1990 and 1998. However, his methodology cannot distinguish the effects of any two separate acquisitions by a single publisher in a given year (*e.g.*, it cannot separate the share of any merger-related change in the prices of Wolters Kluwer journals following its 1998 acquisition of Thomson from the share attributable to its 1998 acquisitions of Plenum and of Waverly). Therefore, he first estimates the *average* or *combined* price effects from each of four sets of transactions. These are shown below in the far-right column of Table 3,[21] which also shows (1) the number and estimated share of ISI-ranked biomedical journals each merger party controlled at the time of the transaction, and (2) the total number of biomedical journals controlled by the post-merger entity, and the estimated merger-related change in the Herfindahl-Hirschman Index ("HHI").[22]

Elsevier's acquisition of Pergamon created the largest biomedical portfolio (247 journals), increased Elsevier's pre-merger portfolio (190 journals) by 30% and increased the Hirschman Herfindahl index ("HHI") by 54 points. That acquisition is also associated with the largest estimated average price effect, 9.4%. However, the smallest transaction, Wolters Kluwer's 1990 acquisition of Lippencott, which increased Kluwer's portfolio by 20% (to a total of just 90 journals) and the HHI by a minuscule 6 points was estimated to increase the prices of the parties' journals by 8.1%, or almost as much as the much larger Elsevier/Pergamon transaction. The other two multi-party transactions, each of which involved substantially more journals than the Kluwer/Lippencott merger, had estimated average price effects that were only 25-30 percent as large. Thus, while McCabe's empirical analysis finds that mergers raise prices, it does not suggest any relationship between the size of a transaction and the magnitude of its effect on prices. In effect, it implies that some merger-related factor other than market power explains the observed price effect.

We attempted to duplicate McCabe's results by using the same specification but a somewhat different set of data. We first created a "biomedical"[23] portfolio of 638 journals for which prices were available for every year from 1995 to 2001, the last year for which McCabe had data. This biomedical data set allowed us to test for price effects associated with only two of the four combined transactions that McCabe analyzed: Wolters Kluwer's 1998 acquisitions of Plenum, Thomson, and Waverly, and Harcourt's 1997 and 1998 acquisitions of Churchill Livingstone and Mosby.

Table 4 compares our estimates of the average effects of Wolters Kluwer's three acquisitions and Harcourt's two acquisitions with McCabe's estimates of the average effects.[24] Using McCabe's specification (see Appendix A, Model A1), our estimate of the average effect from the first set of transactions is about 80 percent of McCabe's estimate, but our estimate of the effect from the second set of transactions is almost three times McCabe's estimate. Without access to McCabe's data set, we cannot explain these discrepancies. However, such dramatically different results should be resolved before making any policy recommendations based on the empirical evidence.

Since our data run through the year 2004, we can also use McCabe's methodology to estimate the price effects from Reed Elsevier's 2001 acquisition of Harcourt (see Appendix A, Model A2). Table 5 shows the estimated effect of that transaction and several others on the prices of biomedical journals controlled by each party to a transaction based on a data set containing all 591 such journals for which we have price data for the relevant period. That is, it shows price effects separately for each individual publisher's journals rather than the average effect for all the parties to a given transaction.

Of particular interest in Table 5 are the estimated coefficients associated with three mergers that McCabe does not examine: Taylor & Francis's 1998 acquisition of Routledge, Bertelsmann's 1998 acquisition of Springer-Verlag, and Reed Elsevier's 2001 acquisition of Harcourt. McCabe omits the first two mergers from his analysis because neither Routledge nor Bertelsmann published biomedical journals prior to the merger. Nevertheless, the DD model estimates that each merger had an effect on the prices of one party's biomedical journals that was statistically significant using standard (albeit, we would argue inappropriate) significance tests. Specifically, the first merger is estimated to have raised the prices of Taylor & Francis's biomedical journals by 12.0% relative to the prices for non-merging publishers, even though Routledge published no biomedical journals, while the acquisition by Bertelsmann (also not a publisher of biomedical journals) is estimated to have *reduced* the prices of Springer-Verlag's biomedical journals by 24.9%.[25] Note also that even when a merger occurred between two publishers of biomedical journals, the model estimates a large price increase for one party (*e.g.* Thomson) and a large price decrease for the other party (*e.g.* Wolters Kluwer).

Fortunately, the passage of time has allowed us to observe one more major natural experiment – the acquisition of Harcourt's journals by Reed Elsevier in 2001. Partly in response to concerns voiced by libraries, the Antitrust Division conducted an intensive investigation of that acquisition before allowing the transaction to proceed without conditions. Table 5 indicates that, based on a DD analysis, the libraries' concerns would appear to have been misplaced: the acquisition is associated with a substantial *decline* in the prices of both publishers' journals relative to the prices of non-merging publishers, even though it combined two of the largest biomedical portfolios. This negative price effect, like the estimated effects of Bertelsmann's acquisition of Springer-Verlag and Taylor & Francis' acquisition of Routledge, further supports

the inference that any merger-related price effects estimated using a DD model, even when (ostensibly) statistically significant, are unrelated to market power.

B. Results from a Multi-Portfolio Price Test

As explained above, if a publisher does not price each journal in each of its portfolios independently of every other journal in that portfolio, it is inappropriate to treat the price of each journal as an independent observation. Therefore, to analyze the effect of mergers on journal prices, we also used a model in which a publisher is assumed to price each of its portfolios independently, not each of the journals within a portfolio. For example, we assume that a publisher sets the *average* price of journals in its biomedical portfolio independently from the average prices of journals in its chemical, mathematics, social science and other portfolios. This assumption is reasonable if journals in one academic field are neither substitutes nor complements for those in a different field and competitive conditions vary across portfolios.

Using data from 22 independent publishers[26] in 14 broadly defined academic fields or portfolios[27] over 10 years (1995-2004), we constructed a dependent variable that was the log of the average price of a publisher's journals in a given portfolio. We then used two different models to analyze the relationship between that dependent variable and a number of independent variables.

The first of these two models estimated the effects of each individual merger on the average price that a merging publisher charged across portfolios (see Appendix A, Model A3). This approach differs from McCabe's in two respects. First, it looks at merger effects across all of a publisher's academic portfolios rather than just a biomedical portfolio. Second, the unit of observation is the average price a publisher charges for all the journals in a given portfolio. For

each publisher, we constructed two merger-related dummy variables. The first takes the value one in each year before a merger as well as the year in which the merger occurred, and the value zero in each year after a merger.[28] The second does just the opposite, taking the value zero in each pre-merger year and the value one in each post-merger year. The difference between the coefficients on the dummy variables for a given publisher therefore measures the effect of the transaction on that publisher's prices relative to the prices of other non-merging firms.[29]

The merger-related price effects are reported in Table 6.[30] Recall that Wolters Kluwer merged separately with three different firms (Plenum, Thomson, and Waverly) in 1998, while Harcourt merged with Churchill in 1998 and with Reed Elsevier in 2001. Column two shows the amount by which a merger is estimated to have affected each acquiring party's average portfolio price relative to the average for non-merging publishers, while column four shows the estimated relative price effect on the acquired publisher's portfolios. Thus, for example, following it acquisitions, the average price for a portfolio of Wolters Kluwer journals declined 10.2 percent relative to the average price of portfolios for non-merging publishers. However, the relative price for a Thomson portfolio increased on average by 15.6 percent, while the relative price for a Waverly portfolio increased 1.6 percent.

Turning to Reed Elsevier's 2001 acquisition of Harcourt, the estimated effect is reported separately for the average price of portfolios that Harcourt controlled before its merger with Churchill and the average price of portfolios that Churchill controlled before its merger with Harcourt. For example, consider journals that were in Churchill's portfolios before it was acquired by Harcourt in 1997. The average portfolio prices of those journals declined 8.4 percentage points relative to the average portfolio prices for non-merging publishers when comparing the period 1998-2001 to the period 2001-2004.

In total, Table 6 shows eleven separate merger effects from six separate transactions (Wolters Kluwer's three acquisitions,[31] Harcourt's acquisition of Churchill,[32] Taylor & Francis's acquisition of Routledge, and Reed Elsevier's acquisition of Harcourt). In five of the eleven cases, mergers are estimated to have reduced the average prices of a publishers' portfolios relative to the average prices of non-merging publishers' portfolios, while in six of the eleven cases, mergers are estimated to have raised publishers' relative prices. No effect is reported for Bertelsmann or Springer-Verlag because Bertelsmann did not publish academic journals before the acquisition.

In the second of the two models, which separately measures the average merger-related effect on prices of acquiring and acquired firms (see Appendix A, Model A4), the independent variables include (1) a dummy variable that represents post-merger years for acquired publishers; (2) a dummy variable that represents post-merger years for acquiring publishers; (3) the merger-related change in each publisher's share of a "market" portfolio; (4) the natural log of the sum of the average number of articles per journal in a publisher's portfolio in years t, t-1, and t-2; and (5) the natural log of the sum of the average "impact" of the journals in each publisher's portfolio in years t, t-1, and t-2.[33] The independent variables also included a set of year dummies and a set of dummies for every portfolio of every publisher.[34] The year dummies take account of the fact that price increases vary from year to year, while the publisher/portfolio dummies take account of the fact that journal prices can vary systematically across both portfolios and publishers. For example, nonprofit publishers, such as Oxford University Press, typically have lower prices within any given field than do for-profit publishers, and a given publisher typically has lower prices for journals in the field of art than in the fields of, say, chemistry or neuroscience.

Table 7, which reports the results from Model A4, does not support the hypothesis that mergers are consistently associated with journal price increases. When a merger results in a *de minimis* share change for a portfolio, the average price for acquired firms' portfolios in the years immediately following a transaction can be expected to increase relative to the portfolios of non-merging publishers by a statistically significant 8.6 percent, and the average price for acquiring firms' portfolios can be expected to increase by a statistically insignificant 2.0 percent. However, the coefficient on share change is a statistically significant *negative* 2.6 percent for each 10 percent *increase* in a publisher's share of the relevant portfolio; that is, the more a merger increases a publisher's share of journals in an academic field, the smaller the increase (and, at some point, the larger the decrease) in a publisher's average portfolio price. For example, if a merger increased an acquiring publisher's share of a portfolio by about 20 share points, the prices of that publisher's portfolio could be expected to decline by about 3.2 percent. This result is not consistent with merger-related price effects that are attributable to market power.

III. CONCLUSIONS

Although mergers among publishers are widely believed to have contributed to the rapid rise in journal prices that have been observed over an extended time period, we conclude that the only empirical foundation for this belief suffers from both theoretical and empirical flaws. On a theoretical level, even the "portfolio" model proposed for this market implies that when demand for individual journals is inelastic (as is generally believed to be the case, albeit for reasons not fully understood), mergers should reduce – not raise – the parties' profit-maximizing prices relative to non-merging publishers' prices over the immediate post-merger period. At the

empirical level, we show that prior work has not identified a statistically significant relationship between mergers and journal price increases. Specifically, standard tests for statistical significance are inappropriate when, as here, the observations in a sample are not independent. Nor is there any relationship between the magnitude of a merger-related price effect and the number of journals that a merger combines. Indeed, using the same model as prior work on a different data set, we found that mergers had a putative "statistically significant" effect on price even when the merging publishers did not have journals classified in the same portfolio. We also found that the Reed Elsevier-Harcourt merger, which involved combining more biomedical journals than any other, would be predicted by the DD model to have caused a decline in those publishers' journal prices. Finally, using a different model in which we estimate the effect of mergers on average journal prices in each of 14 different portfolios, we still find no evidence that past mergers have systematically raised prices.

While some mergers between publishers appear to have led to higher prices for some journals, it is abundantly clear that the reason for this increase is at best poorly understood. Absent evidence that a large increase in a publisher's share of a portfolio (*i.e.*, share in an academic field) is more likely to raise price than a small increase in share, there is no basis for attributing price increases to increases in market power, even when the price increases appear to be the direct result of an acquisition or change of control. We conclude that a portfolio theory of price determination does not provide a basis for antitrust enforcement agencies to define relevant product markets in the publishing industry any differently than they are defined in other industries.

Despite the conventional wisdom among librarians that mergers have contributed to price increases, our findings provide no support for using a novel approach to analyze mergers among

publishers of scholarly journals. Moreover, an antitrust policy based on this conventional wisdom could block changes in market structure that do not affect market power and, therefore, are likely to be efficient.

More importantly, using a non-traditional approach to mergers in the academic journal industry diverts attention from a number of unusual economic phenomena in search of a theory. These include:

- Demand for many individual journals published by commercial firms has been inelastic – even highly inelastic – over long time periods, even though these publishers are presumably profit-maximizing firms.
- Mergers are associated with large and statistically significant price effects that can be either positive or negative and which seem to be associated with changes in control, rather than with the creation of market power.

The large and sustained price increases that have occurred over a long period in journal publishing do not fit any standard static theory in industrial organization. Like inflation in health care costs and university tuitions, these price increases call for a dynamic, and perhaps even industry-specific, explanation rather than simply ascribing the effects to market power by default.

Table 1

Mergers Analyzed in this Paper

Publisher	Acquired By	Date of Acquisition
Churchill Livingstone	Harcourt General	9/30/1997
Mosby	Harcourt General	10/9/1998
Thomson	Wolters Kluwer	3/16/1998
Waverly	Wolters Kluwer	5/25/1998
Plenum	Wolters Kluwer	7/17/1998
Routledge	Taylor & Francis	11/4/1998
Springer Verlag	Bertelsmann	11/22/1998
Harcourt General	Reed Elsevier	7/12/2001

Table 2

Pre-Merger Average Annual Percentage Increase in Biomedical Journal Prices

By Publisher

Merging Publishers of Biomedical Journals	1996	1997	1998	Cumulative Increase (1996-1998)
Churchill Livingstone	11.0%	8.1%	12.9%	35.4%
Harcourt General	13.1	16.1	10.1	41.9
Plenum	10.2	9.3	9.8	32.6
Thomson	5.9	0.0	30.6	36.1
Waverly	20.8	11.2	6.1	42.2
Wolters Kluwer	20.1	10.0	(3.7)	26.4
Group Average	**14.0**	**11.0**	**9.2**	**36.3**
Non-merging Publishers of Biomedical Journals				
Springer-Verlag	20.9	6.8	(3.3)	24.8
Blackwell	18.8	14.9	19.3	63.5
Elsevier	30.2	16.4	10.6	67.0
Marcel Dekker	11.2	13.9	10.7	40.2
Taylor & Francis	12.4	13.6	13.2	44.7
Wiley	14.4	18.2	19.5	61.3
Group Average	**22.0**	**14.3**	**10.9**	**54.7**

Table 3

McCabe's Estimate of Merger Effects on Average Biomedical Journal Prices

(Mergers ranked by total number of journals)

		Merger Characteristics				
		Number and estimated percent[a] of ISI-ranked biomedical journals		Total post-merger journals and estimated ΔHHI		Estimated average price effect
Year	Merging Parties	Number	Percent	Total	Change in HHI	
1990	Wolters Kluwer	75	3.8			
	Lippencott	15	0.8	90	6	8.1%
1997/ 98	Harcourt	118	5.9			
	Churchill Livingstone	17	0.9	162	28	2.6%
	Mosby	27	1.4			
1998	Wolters Kluwer	112	5.6			
	Plenum	22	1.1			
	Thomson	41	2.1	212	72	2.0%
	Waverly	37	1.9			
1991	Elsevier	190	9.5			
	Pergamon	57	2.9	247	54	9.4%

a. Estimated shares based on a total of 2,000 ISI-ranked biomedical journals.

Source: McCabe (2002), pp. 260, 262, 263 and Table 2

Table 4

Model A1

Comparison of McCabe's Estimated Merger Effects with Our

Estimated Effects Using McCabe's Methodology

Transaction	Estimated Effect Using McCabe's Methodology and Our Data Set	Estimated Effect Reported by McCabe
Wolters Kluwer acquires Plenum, Thomson and Waverly	1.8%	2.0%
Harcourt acquires Mosby and Churchill Livingstone	7.7%	2.6%

Table 5

Model A2

"Merger-Related" Biomedical Journal Price Effects

(1995-2004)

Acquiring Firm	Effect on Acquiring Firm's Prices	Acquired Firm	Effect on Acquired Firm's Prices	Merger Date
Harcourt	5.7%	Churchill Livingstone	(2.6%)	9/30/1997
		Mosby[a]		10/9/1998
Wolters Kluwer	(20.4%)	Thomson	19.8%	3/16/1998
		Waverly	(0.8%)	5/25/1998
		Plenum	(1.8%)	7/17/1998
Taylor & Francis	12.0%	Routledge[b]	n.a.	11/4/1998
Bertelsmann[b]	n.a.	Springer-Verlag	(24.9%)	11/22/1998
Reed Elsevier	(12.0%)	Harcourt	(4.2%)	7/12/2001
		Churchill Livingstone	(11.2%)	7/12/2001

[a] Missing data

[b] Published no biomedical journals pre-merger

Table 6

Model A3

Estimated Effects of Mergers on Prices of Merging Publishers'

Portfolios Relative to Non-Merging Publishers' Portfolios

Acquiring Firm	Effect on Acquiring Firm's Prices	Acquired Firm	Effect on Acquired Firm's Prices	Merger Date
Harcourt	6.4%	Churchill	(2.9%)	9/30/1997
Wolters Kluwer	(10.2%)	Thomson	15.6%	3/16/1998
		Waverly	1.6%	5/25/1998
		Plenum	0.2%	7/17/1998
Taylor & Francis	15.7%	Routledge	36.8%	11/4/1998
Reed Elsevier	(8.1%)	Churchill	(8.4%)	7/12/2001
		Harcourt	(3.5%)	

Table 7

Model A3

Average Price Effect of Mergers Attributable to Portfolio Share Changes

Effect	Coefficient	p-value
Average price effect across acquired firm's portfolios (assuming *de minimis* share change)	8.6%	0.0001
Average price effect across acquiring firm's portfolios (assuming *de minimis* share change)	2.0%	0.1061
Price effect of 10 percentage point, merger-related increase in publisher's estimated share of academic field[a]	(2.6%)	0.0049

[a] The merger-related increase in an acquiring firm's share of an academic field equals the acquired firm's share of that academic field and *vice versa.*

Table 8

Results from Regression Model A1

Fit Statistics

Root MSE	0.133	R-Square	0.977
Dependent Mean	6.584	Adj R-Sq	0.973
Coeff Var	2.019		

Parameter Estimates

Variable	Estimate	StdErr	tValue	Probt
Intercept	6.384	0.051	126.307	0.000
year 1996	0.188	0.008	23.107	0.000
year 1997	0.307	0.008	37.746	0.000
year 1998	0.398	0.008	48.943	0.000
year 1999	0.507	0.008	62.243	0.000
year 2000	0.583	0.008	71.686	0.000
year 2001	0.629	0.008	77.299	0.000
pre merger Kluwer	-0.091	0.018	-5.172	0.000
post merger Kluwer	-0.074	0.018	-4.170	0.000
pre merger Harcourt	-0.065	0.022	-2.995	0.003
post merger Harcourt	0.012	0.022	0.572	0.567

Table 9

Results from Regression Model A2

Fit Statistics			
Root MSE	0.126	R-Square	0.979
Dependent Mean	6.750	Adj R-Sq	0.976
Coeff Var	1.864		

Parameter Estimates				
Variable	Estimate	StdErr	tValue	Probt
Intercept	6.499	0.042	155.861	0.000
year 1996	0.217	0.012	18.520	0.000
year 1997	0.334	0.012	28.575	0.000
year 1998	0.425	0.012	36.343	0.000
year 1999	0.545	0.012	47.110	0.000
year 2000	0.656	0.012	56.812	0.000
year 2001	0.702	0.012	60.806	0.000
year 2002	0.823	0.012	70.139	0.000
year 2003	0.933	0.012	79.467	0.000
year 2004	1.040	0.012	88.547	0.000
pre Kluwer merger - Kluwer	-0.110	0.029	-3.830	0.000
post Kluwer merger - Kluwer	-0.314	0.027	-11.636	0.000
pre Kluwer merger - Plenum	-0.136	0.032	-4.219	0.000
post Kluwer merger - Plenum	-0.154	0.030	-5.087	0.000

post Kluwer merger - Thomson	-0.196	0.042	-4.685	0.000
pre Kluwer merger - Thomson	0.002	0.039	0.058	0.953
pre Kluwer merger - Waverly	-0.054	0.038	-1.417	0.156
post Kluwer merger - Waverly	-0.062	0.036	-1.736	0.083
pre Harcourt merger - Harcourt	-0.083	0.023	-3.610	0.000
post Harcourt merger - Harcourt	-0.025	0.023	-1.117	0.264
pre Harcourt merger - Churchill	-0.137	0.040	-3.400	0.001
post Harcourt merger - Churchill	-0.163	0.040	-4.057	0.000
pre Taylor merger - Taylor	-0.073	0.033	-2.257	0.024
post Taylor merger - Taylor	0.046	0.032	1.453	0.146
pre Bertelsmann merger - Springer Verlag	-0.142	0.018	-7.801	0.000
post Bertelsmann merger - Springer Verlag	-0.391	0.018	-21.890	0.000
pre Elsevier merger - Elsevier	0.016	0.015	1.074	0.283
post Elsevier merger - Elsevier	-0.104	0.016	-6.633	0.000
post Elsevier merger - Harcourt	-0.067	0.023	-2.922	0.003
post Elsevier merger - Churchill	-0.275	0.040	-6.819	0.000

Table 10

Results from Regression Model A3

Fit Statistics				
Root MSE	0.096		R-Square	0.984
Dependent Mean	6.569		Adj R-Sq	0.982
Coeff Var	1.456			

Parameter Estimates				
Variable	Estimate	StdErr	tValue	Probt
Intercept	5.988	0.032	188.601	0.000
year 1996	0.136	0.013	10.449	0.000
year 1997	0.235	0.013	17.997	0.000
year 1998	0.334	0.013	25.659	0.000
year 1999	0.468	0.013	36.485	0.000
year 2000	0.529	0.013	41.231	0.000
year 2001	0.575	0.013	44.744	0.000
year 2002	0.677	0.013	52.514	0.000
year 2003	0.785	0.013	60.879	0.000
year 2004	0.895	0.013	69.378	0.000
pre Kluwer merger - Kluwer	-0.034	0.033	-1.051	0.294
post Kluwer merger - Kluwer	-0.137	0.031	-4.451	0.000
pre Kluwer merger - Plenum	-0.066	0.033	-2.010	0.045
post Kluwer merger - Plenum	-0.064	0.031	-2.074	0.038

post Kluwer merger - Thomson	-0.080	0.035	-2.260	0.024
pre Kluwer merger - Thomson	0.076	0.033	2.313	0.021
pre Kluwer merger - Waverly	0.056	0.047	1.200	0.230
post Kluwer merger - Waverly	0.072	0.044	1.658	0.098
pre Harcourt merger - Harcourt	0.031	0.033	0.936	0.349
post Harcourt merger - Harcourt	0.094	0.033	2.886	0.004
pre Harcourt merger - Churchill	-0.051	0.065	-0.779	0.436
post Harcourt merger - Churchill	-0.079	0.065	-1.224	0.221
pre Taylor merger - Taylor	0.023	0.031	0.755	0.450
post Taylor merger - Taylor	0.180	0.030	5.991	0.000
pre Taylor merger - Routledge	0.049	0.076	0.639	0.523
post Taylor merger - Routledge	0.437	0.075	5.836	0.000
pre Elsevier merger - Elsevier	0.082	0.031	2.659	0.008
post Elsevier merger - Elsevier	0.001	0.033	0.016	0.987
post Elsevier merger - Harcourt	0.060	0.033	1.820	0.069
post Elsevier merger - Churchill	-0.164	0.065	-2.524	0.012

Table 11

Results from Regression Model A4

Fit Statistics			
Root MSE	0.096	R-Square	0.983
Dependent Mean	6.492	Adj R-Sq	0.981
Coeff Var	1.475		

Parameter Estimates				
Variable	Estimate	StdErr	tValue	Probt
Intercept	5.245	0.131	40.084	0.000
year 1996	0.133	0.011	12.556	0.000
year 1997	0.232	0.011	21.454	0.000
year 1998	0.332	0.011	30.070	0.000
year 1999	0.460	0.012	38.787	0.000
year 2000	0.531	0.013	42.438	0.000
year 2001	0.573	0.013	44.520	0.000
year 2002	0.668	0.013	50.021	0.000
lnimpact_3yr	0.020	0.016	1.295	0.195
lnarticles_3yr	0.099	0.017	5.783	0.000
sharechange	-0.257	0.091	-2.821	0.005
target	0.086	0.020	4.307	0.000
acquiring	0.020	0.012	1.617	0.106

APPENDIX A. Description of Regression Models

A.I. MODELS USED TO REPLICATE McCABE'S RESULTS

Our first regression model attempts to replicate McCabe's results, using a balanced panel with 461 commercial biomedical journals for which we have prices published in US dollars for each year 1995-2001.[35] Because we do not have the list of journals that McCabe included in his "biomedical" portfolio, we define a biomedical journal to be any journal in one of the following four ISI "main group" categories: Health Sciences, Life Sciences, Neuroscience, and Pharmacology & Toxicology. Using the same construction as McCabe, our model is:

(A1) $\ln Price_{ijt} = \alpha + \beta_i + \gamma_1 * Time\ Dummy_t + \gamma_2 * Pre\text{-}merger\ Dummy_{jt} + \gamma_3 * Post\text{-}merger\ Dummy_{jt} + \mu_{ijt}$

where,

$\ln Price_{ijt}$ is the price of journal i for publisher j in year t.

α is the intercept.

β_i is the fixed effect for journal i.

$Time\ Dummy_t$ is the dummy variable representing year t. The coefficient on this variable measures the percentage average price change from 1995 to year t.

$Pre\text{-}merger\ Dummy_{jt}$ is a dummy variable for a publisher j that is involved in a merger that equals one prior to the merger (excluding 1995). Otherwise the variable equals zero.

$Post\text{-}merger\ Dummy_{jt}$ is a dummy variable for a publisher j that is involved in a merger that equals one in years following the merger. Otherwise the variable equals zero. The

incremental percentage change in the publisher's average price attributable to the merger is found by subtracting the coefficient on *Pre-merger Dummy*$_{jt}$ from the coefficient on *Post-merger Dummy*$_{jt}$. This model treats the combined firm as a distinct publisher, and thus does not separate the effect of the merger on the acquiring and acquired firms.

μ_{ijt} is the disturbance associated with journal i, publisher j, in year t.

Our second regression model (A2)[36] also copies McCabe's approach, but uses an expanded data set that includes three additional years, 2002-2004.[37] This data set also includes journals with prices listed in a foreign currency and converted to US dollars using an average nominal exchange rate. As before, we exclude any journal for which a price is missing in any of the years. The dataset covers 592 journals over 10 years for a total of 5920 observations. Equation (2) is thus the same as equation (1), except this model analyzes separately the effects of the merger on acquiring and acquired firms, by assigning pre and post-merger dummies separately to each individual publisher involved in a merger.

Modeling publisher mergers over this period is complicated by the fact that Churchill Livingstone was acquired by Harcourt, which was in turn acquired by Reed Elsevier. We take account of this complication by (a) treating Churchill Livingstone as a separate publisher after its acquisition by Harcourt, *i.e.,* we analyze the effect that Reed Elsevier's acquisition of Harcourt on journals that Harcourt acquired from Churchill Livingstone separately from the effect on other Harcourt journals; and (b) by giving both Churchill Livingstone and Harcourt three separate merger dummy variables. Like other publishers involved in a merger, each has a pre and post-merger dummy for the first merger in which it is involved. In addition, each has another post-merger dummy variable for the second merger in which it is involved. Thus, the first post-merger dummy variable equals one (for the merging firm) in years following the first

merger but prior to the second merger and zero otherwise; while the second post-merger dummy equals one (for the merging firm) in years following the second merger and zero otherwise. For example, as mentioned above, Churchill Livingstone was purchased by Harcourt in 1998, which in turn was purchased by Reed Elsevier in 2001. The incremental effect of the first merger on Churchill Livingstone's journals' prices is found by subtracting the coefficient on its pre-merger dummy from the coefficient on its first post-merger dummy. The incremental effect of the second merger is found by subtracting the coefficient on Churchill Livingstone's first post-merger dummy from the coefficient on its second post-merger dummy.

A.II. MODELS IN WHICH AVERAGE PORTFOLIO PRICE IS THE DEPENDENT VARIABLE

Our third regression model treats the arithmetic average price of journals in one of a publisher's product portfolios as the dependent variable.[38] Each of 14 academic fields defined by ISI is treated as a separate portfolio. The dataset, as in Model A2, covers 10 years, 1995-2004. We also expand the sample to 22 publishers by including 7 non-profit publishers. This results in a dataset containing 1760 observations on publisher/portfolio combinations. The estimated model was:

(A3) $\ln Price_{jkt} = \alpha + \beta_{jk} + \gamma_1 * Time\ Dummy_t + \gamma_2 * Pre\text{-}merger\ Dummy_{jt} + \gamma_3 * Post\text{-}merger\ Dummy_{jt} + \mu_{jkt}$

where,

$\ln Price_{jkt}$ is the arithmetic average price of publisher j's product portfolio k in year t.

β_{jk} is the fixed effect for publisher j's portfolio k as defined by ISI.

Other variables are defined as before.

Prices in the fourth regression model are constructed the same way as in the third model.[39] However, due to limitations on ISI impact and article data, we excluded data from years 2003 and 2004. The estimated model is:

(A4) $\ln Price_{jkt} = \alpha + \beta_{jk} + \gamma_1 * Time\ Dummy_t + \gamma_2 * \ln Impact\_3yr_{jkt} + \gamma_3 * \ln Articles\_3yr_{jkt} + \gamma_4 * Sharechange_{jkt} + \gamma_5 * Acquiring\ Firm\ Post\text{-}Merger\ Dummy + \gamma_6 * Acquired\ Firm\ Post\text{-}Merger\ Dummy + \mu_{jkt}$

where,

$\ln Price_{jkt}$ is the arithmetic average price of publisher j's product portfolio k in year t.

β_{jk} is the fixed effect for publisher j's portfolio k as defined by ISI.

$\ln Impact\_3yr_{jkt}$ is the natural log of the sum of the average ISI impact factors in years t, t-1, and t-2 for publisher j's product portfolio k. Because the impact factor is a measure of quality, the expected sign for the coefficient for this variable is positive.

$\ln Articles\_3yr_{jkt}$ is the natural log of the sum of the average ISI-reported number of articles per journal in years t, t-1, and t-2 for publisher j's product portfolio k. The expected sign for the coefficient for this variable is also positive.

$Sharechange_{jkt}$ measures the change in publisher j's share of "product" k attributable to a merger in a prior year.[40] The value is zero in every year prior to the year in which a publisher merged. If publisher A has a 20 percent share of product k and is acquired by publisher B who also has a 10 percent share of product k, then the value of the variable

sharechange for publisher B will equal 20 percent every year following the merger, and it will equal 10 percent every year following the merger for publisher A.

Acquiring Firm Post-Merger Dummy is a dummy variable that equals one if publisher j acquired another publisher of academic journals in one of the sample years prior to year t. This measures any merger-related effect on the average price across all journals of all acquiring firms that is independent of a change in market structure.

Acquired Firm Post-Merger Dummy is a dummy variable that equals one if publisher j had been acquired by another publisher in one of the years prior to year t. This measures any merger-related effect on the average price across all journals of all acquired firms that is independent of a change in market structure.

Other variables are defined as before.

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ENDNOTES

[1] See, for example, George Chressanthis and June Chressanthis (1994); Lisa Lieberman, Roger Noll and W. Edward Steinmuller (1992); Janusz A. Ordover and Robert D. Willig (1978); William J. Baumol and Yale M. Braunstein (1977); Fritz Machlup (1977); Theodore C. Bergstrom (2001); Joop Dirkmaat (2002); Robert E. Kohn (2002); and Theodore C. Bergstrom (2002).

[2] See, for example, Aviv Nevo, Daniel Rubinfeld, and Mark McCabe (forthcoming), and Albert Foer (Februay 11, 2005).

[3] See Mark J. McCabe (2002). Other empirical studies of journal prices have not attempted to isolate the effects of mergers.

[4] *Ibid*, p. 260. McCabe asks whether "mergers between commercial publishers affect prices? And if so, what are the implications for market definition, i.e., are there many small and unrelated journal niche markets, or do journals compete in a handful of broadly defined portfolio markets?"

[5] The economics literature contains few empirical examinations of the effects of mergers on prices, if only, one would hope, because most of the potentially anti-competitive mergers have been blocked by the antitrust agencies. Thus, most case studies of the effects of mergers have involved those where an antitrust agency has been overruled, either by another regulatory agency, as in the case of the TWA-Ozark and Northwest-Republic mergers (*e.g.*, Werden et al (1991) and Schuman et al (1992)). However, we are aware of few studies of the effects of mergers, such as Reed Elsevier's acquisition of Harcourt, that were approved by a federal antitrust agency over strong opposition by customers.

[6] McCabe (2005) p. 4.

[7] As detailed in Section II, we find substantial evidence that McCabe's empirical work has generated a false positive (*i.e.*, an incorrect conclusion that mergers among academic journal publishers have raised prices as a result of market power).

[8] Fixed library budgets imply that the short-run "market" elasticity of demand for the bundle of all journals in a portfolio is minus one: an x percent increase in the prices of *all* journals in that portfolio will produce an x percent decrease in total subscriptions.

[9] McCabe (2002) *op cit*, p. 261. McCabe also observes that "…individual titles within a given field are considered simultaneously. So, for example, biomedical libraries group titles from various subfields, *e.g.*, neurology, biochemistry, clinical medicine, *etc*., into a single 'portfolio' and broadly apply the cost per use criterion." However, he offers no methodology for identifying the fields or subfields that comprise a portfolio that is relevant to an antitrust analysis. Do economics journals comprise a relevant portfolio market for antitrust analysis, or should they be combined with journals from such fields as business, operations research, and public policy? Or are labor economics and industrial organization separate fields? McCabe does not report what libraries (or academic departments) consider separate fields to be for budget purposes. Nor does he empirically test to determine which definition of a field best fits the portfolio model (*e.g.*, produces the most significant regression coefficients).

[10] *Ibid*, p. 261.

[11] McCabe notes "…that in raising its average journal price, the large firm may find it profitable to lower the prices of some of its other titles." McCabe (2002) *op cit*, p. 261, note 11.

[12] See, for example, *ibid*, p. 262; Aaron Edlin and Daniel Rubinfeld (2004); and McCabe (2000), table 5.

[13] As an analogy, consider a merger between contiguous, but regulated, electric utilities. Since both firms presumably have unexercised market power, the focus of my concern would be on the effect, if any, of the merger on the ability of regulation to contain that market power.

[14]Sonya White and Claire Creaser (2004).

[15] Marianne Bertrand, Esther Duflo, and Sendhil Mullainathan (2004). This problem is entirely separate from the independent observation problem that was discussed above.

[16] To test this hypothesis, we first computed the average percentage price change in each of 7 years for every journal distributed by 19 different publishers in each of 14 different "portfolios." (See section II.B. *infra* for a discussion of these portfolios.) Next, for each publisher we calculated the deviation between the average price change for journals in one of its portfolios and the average price change for the entire 19-publisher portfolio in each year. (For example, let X_{it} = the average price change for all 19 publishers' journals in portfolio i for year t; and let x_{ait} = the average price change for publisher a's journals in portfolio i for year t. For each publisher, we computed $x_{ait} - X_{it}$.) The deviations in the average price changes for journals in a publisher's portfolios in year t served as the dependent variable in a regression in which the independent variables included, among others, deviations in the average price changes for that publisher in years t-1 and t-2. The estimated coefficients on the lagged deviations from the mean were negative and statistically significant at the 1% level of confidence, indicating that when a publisher raised the prices of its journals in a portfolio less than average in years t-1 and t-2 that publisher could be expected to raise its prices more than average in year t.

[17] In principle, a merger that occurred in, say, 1998 could affect prices in that year. However, the DD model requires an analyst to assume that the pre-merger environment ends in one period. Consistent with McCabe, we assume that the pre-merger period extends through the year in which a merger occurs.

[18] Over the period 1995 to 2004, the compound average price increase for the 6 publishers that merged in 1997 or 1998 was 9.4%, and ranged between 7.7% and 10.6%. For the six publishers that did not merge in those two years, the average price increase was 10.4% and ranged between 7.1% and 13%. Thus, over a relatively long time horizon, the two groups of firms had very similar compound average price increases.

[19] The price data for our study were collected by Reed Elsevier from publishers' catalogs. We do not have access to McCabe's data set.

[20] To test this proposition, we regressed the annual change in the log price of a journal against two independent variables: the average change in log prices of *all other* journals supplied by that journal's publisher and the average change in log prices of all journals other than the journals of that journal's publisher. We found a highly significant (the t-statistic was 69.4) coefficient of 0.98 on the average change in log prices of *all other* journals supplied by that

journal's publisher and a statistically insignificant coefficient of 0.01 on the average change in log prices of all journals other than the journals of that journal's publisher. These results show a very strong publisher-specific effect on individual journal pricing, indicating that a given publisher's journals are not priced independently.

[21] The *average* effect is for all of journals controlled by all of the parties to a transaction. Estimates of the merger-related price effect on the journals of each individual party to a transaction are discussed below.

[22] The Herfindahl-Hirschman Index ("HHI") is a measure of market concentration, and is equal to the sum of the squares of the market shares of the firms in a particular market. The DOJ/FTC Merger Guidelines regards a merger as problematic if it increases the HHI by more than 100 points to over 1800 in a relevant market. McCabe does not describe how he constructed his biomedical portfolio from libraries' biomedical holdings. We estimated the percent of ISI-ranked biomedical journals in each publisher's biomedical portfolio and the change in the HHI by constructing a biomedical portfolio comprised of four ISI "main groups" (life sciences; health sciences; neuroscience; and pharmacology & toxicology).

[23] See note 20 *supra*. These categories were selected in an effort to reproduce the category of journals that McCabe describes as the "Bio-Medical" field.

[24] See Appendix A for a description of the regression model.

[25] As discussed in section II, serial correlation can cause standard errors in DD models to be underestimated. This may explain why the DD model identifies price effects from mergers even when the merging publishers control few if any journals in the same academic fields or "portfolios."

[26] The 22 publishers included seven non-profit organizations, such as the American Chemical Society, Cambridge University Press and MIT Press.

[27] We treated each ISI "main category" as a portfolio. The 14 portfolios are: arts and humanities, biological sciences, chemistry and chemical engineering, earth sciences, environmental sciences, general, health science, life sciences, materials science and engineering, mathematics and computer sciences, neuroscience, pharmacology and toxicology, physics, social sciences.

[28] Following McCabe (see McCabe (2002), *op cit*, p. 263), the pre-merger dummy variable for a given publisher, with one exception, takes the value one in each year up to and including the year of the transaction (except for the first year in the sample, 1995). The post-merger dummy variable for a given publisher takes the value one in every year after that publisher merged. Since some publishers merged as early as 1998, the dummy variables in our analysis capture the long-run or "permanent" effect of those mergers. However, there are at least two reasons why mergers may not have a long-run effect on the merging firms' prices relative to those of non-merging firms. First, mergers may have little or no short-run effect on prices. Second, if merging firms initially raise their relative prices, non-merging firms may eventually also raise their prices in an effort to catch up.

[29] Since Harcourt merged with Churchill in 1998 and with Elsevier in 2001, in effect we have two separate pre-merger dummy variables for Harcourt. The first takes the value one in each year 1996-1998, and the second takes the value one in each year 1999 through 2001.

[30] This specification includes dummy variables for each year and for every field-publisher combination.

[31] These three transactions produce estimates of merger effects on the average portfolio prices of four publishers.

[32] This transaction produces estimates of merger effects on the average portfolio prices of two publishers.

[33] ISI uses the number of citations to articles in a journal to construct a measure of that journal's impact or quality. Since our data set includes information on number of articles and impact only through 2002, this most general specification does not include data from 2003 and 2004.

[34] See Appendix A.

[35] Table 4 *supra* contrasts the results using our data with McCabe's results. Table 8 contains the raw regression results.

[36] We do not present the estimated equation for Model A2 in Appendix A, as it follows the equation described for Model A1.

[37] Results from this model are presented *supra* in Tables 5 and 9.

[38] Results from this model are presented *supra* in Tables 6 and 10.

[39] Results from this model are presented *supra* in Tables 7 and 11.

[40] Note that publishers' shares of ISI-defined categories are calculated from only journals tracked by ISI, and only for journals for which we had a complete time series for the sample period.