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Merger Retrospective Studies: A Review

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WHETHER THE ANTITRUST agencies during the Bush administration were setting appropriate thresholds for merger review has become a subject of intense debate.[1] An outcome of this debate has been a widespread call to evaluate merger policy using studies that retrospectively analyze the actual competitive effects of consummated mergers.[2] Information about the actual competitive effects of mergers and other transactions that have been permitted by the agencies can help in evaluating whether the agencies are setting appropriate thresholds for challenging mergers. As Dennis Carlton has pointed out, this is particularly true if the actual competitive effects can be compared to the agencies' pre-merger predictions of those effects.[3]

A merger retrospective study necessarily can analyze only those mergers that have actually occurred. For the most part, this means that mergers included in a retrospective study are those that were cleared by the agencies.[4] That the sample of cleared mergers is not a random sample of all mergers is obvious. Less obvious is that the sample of mergers studied by researchers is likely not a random sample of all cleared mergers. With a few exceptions, researchers conducting retrospective merger studies have tended to focus on controversial "marginal" cases. While it is human nature to want to resolve a controversy, researchers have also done a valuable service. To improve agency decision making, an understanding of what transpired in a marginal case is often much more useful than an understanding of what transpired in a non-marginal case. Nevertheless, it is important to recognize that the results from merger retrospective studies generally describe the competitive effects of the marginal merger, not the "average cleared merger," let alone the "average proposed merger."

Besides being limited to consummated mergers, retrospective merger studies have also been limited in their industry scope by data availability. Analyzing the effects of a merger typically requires detailed data on prices, costs, and other economic conditions both before and after the merger. For most mergers, such data are not readily publicly available. Most studies have been done in industries for which there are public data sources, either because of regulation (e.g., airlines) or for marketing reasons (e.g., consumer products).

Most retrospective merger studies have focused on price. However, it is important to note that price is not the only competitive variable that can be affected by a merger. A merger's competitive effects may well extend to product improvements, new product introductions, advertising and promotion, repositioning of existing products, etc. All else equal, the total competitive effect can be determined by analyzing quantity (or share) changes.[5] Several of the studies we discuss below analyze share in addition to price.

Some retrospective merger studies have evaluated the effects of mergers on the costs of the merging parties. Because efficiencies claimed by the parties are often a subject of contention during merger reviews, the studies that have analyzed whether mergers have actually delivered efficiencies are particularly valuable.

In this article, we review various merger retrospective studies that have appeared since 1990 (although some of these studies address mergers that took place in the 1980s). While we focus primarily on studies that have appeared in the technical economics literature, we also describe some less formal studies.[6]

The existing merger retrospective studies that we discuss below address mergers that span a period of over twenty years. During that time, the technical tools and approaches the agencies use to analyze mergers have evolved substantially, and the enforcement philosophy of the agencies may have shifted over time with different presidential administrations. There are far too few retrospective merger studies to make any assessments as to whether agency enforcement in any one period was too restrictive or too lax.

To summarize our discussion below, the majority of studies that analyze price effects have found post-merger price increases. A significant minority of studies have found no price effects. This is perhaps the expected result when retrospective merger studies focus on marginal mergers, and often controversial mergers at that. The studies that have analyzed cost changes have found that the mergers studied achieved substantial cost-savings.

Difference-in-Differences Methodology

Given that a common theme among merger retrospective studies in the economics literature is the use of the difference-in-differences (DID) approach for estimating the effect of a merger, we provide an introduction to that methodology at

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the outset.[7] Done properly, a DID analysis is a useful tool for establishing the competitive effects of a merger. The starting point for understanding DID is the familiar "before-after" comparison, whereby prices before an event such as a merger are compared to prices after the event. For example, the prices of the merging companies' products before and after the merger might be compared. However, this simple before-after comparison for the potentially affected products or geographic areas does not control for changes in other economic factors that occurred between the before and after periods. While in some cases it might be possible to control for changes in observable economic factors by including such factors in a regression model, there may be other economic factors that are unobservable and thus not readily controlled for in this way.

DID provides a way to control for changes in economic factors other than the merger. It does so by identifying a "control" product or geographic area for which price is affected by the other economic factors, but not by the merger itself. Thus, the change in price in the control area or product before and after the merger provides a measure of the effect of the other economic factors. This price change for the control can then be subtracted from the price change in the affected area or product and one can assess the impact of a merger by analyzing relative price changes before and after a merger.

For example, suppose that a merger between two companies affects customers for the product in St. Louis but not Omaha, while the prices for the product in St. Louis and Omaha would otherwise move together (i.e., are highly correlated) due to common supply and demand conditions. Thus, Omaha can serve as a good control for St. Louis. Further assume that, in the period after the merger, the price in both St. Louis and Omaha increased by 10 percent due to common increases in cost and demand, but the price in St. Louis increased by an additional 5 percent due to the merger. A simple before-after comparison in St. Louis would yield a price change of 15 percent, which would substantially overstate the 5 percent effect of the merger. Only by subtracting the 10 percent price change observed in Omaha (the control area) from the 15 percent price change observed in St. Louis would we obtain the correct estimate of 5 percent for the effect of the merger.

For the DID approach to be useful, three conditions must hold. First, the control area or product must be unaffected by the merger. Otherwise, it is not truly a control. Second, the economic factors other than the merger must have a similar impact in both the control and affected areas or products. Otherwise, the control area or product will not be able to provide any information about the other economic factors in the affected area. Third, to the extent there are any factors that affect price but are unique to the affected or control areas or products, they cannot be correlated with the incidence of the merger. For an example of this last condition, suppose economic factors specific to St. Louis would have caused the St. Louis price to decrease by 5 percent, while Omaha's prices remained constant. Further suppose that the merging parties decide to merge because they believe a merger would allow them to offset this price decrease and thereby maintain their prices. Then, the DID approach would mistakenly conclude that the merger had no effect (both the control and affected products would show no price change post-merger).

The DID approach as described above can be augmented by controlling in a regression framework for the economic factors specific to, respectively, the affected and control areas or products. This provides a further ability to isolate the effect of the merger.

Economists have used the DID approach in a wide variety of contexts, such as program evaluation.[8] In antitrust, certain familiar types of analyses are actually examples of the DID methodology. For example, regression analyses of the price effects of entry, such as those used in the *Whole Foods*[9] and *Staples*[10] cases, employ cities without entry as a control for cities with entry. This is just a form of DID. We describe in detail below how merger retrospective studies have used the DID methodology to analyze the effects of mergers.

The Oil and Gas Industry

The oil and gas industry has provided the basis for several merger retrospective studies. Two recent studies of specific transactions were conducted by Taylor and Hosken[11] and Simpson and Taylor.[12] In addition, the U.S. General Accounting Office (GAO) conducted a study[13] that assessed the price effect from eight different mergers simultaneously, including the two mergers analyzed by Taylor and Hosken and Simpson and Taylor.

Taylor and Hosken addressed the price effect of the 1997 joint venture agreement between USX-Marathon Group and Ashland Inc., which combined the downstream refining and marketing operations of the two companies. The joint venture, Marathon Ashland Petroleum (MAP), combined four Marathon refineries with three Ashland refineries. In addition, Marathon contributed 51 wholesale terminals and 3,980 retail outlets and Ashland contributed 33 terminals and 1,420 retail outlets.[14]

Taylor and Hosken analyze the competitive effects of this transaction using a DID approach to control for regional changes in costs or demand that affect wholesale or retail gasoline prices, including those factors which are unobserved or difficult to measure. Specifically, they note that Marathon and Ashland competed with each other throughout the Midwest. Five of the joint venture's refineries are located in the Midwest, and Marathon and Ashland were among the top four wholesale suppliers in Kentucky.[15] The authors analyze retail and wholesale prices in four cities affected by the transaction, two in Kentucky and two in Virginia.

Using Chicago as a control city, Taylor and Hosken find no evidence that retail prices for reformulated gasoline (RFG) in Louisville, Kentucky increased following the MAP joint venture. However, they find that rack (wholesale) prices for RFG in Louisville increased relative to Chicago in the two years following the joint venture. The increase in rack prices

was not passed on to the retail level, thus squeezing retail margins. Similarly, there is no evidence that retail RFG prices in Covington, Kentucky increased in the year following the transaction. However, the authors find weak evidence that retail prices increased in the second year following the joint venture. As in Louisville, Taylor and Hosken find that RFG rack prices increased relative to Chicago following the joint venture.[16] In an attempt to test the validity of the control city, Taylor and Hosken try alternative control cities. They find that in some cases their results are sensitive to the choice of the control city. In Kentucky, the authors find that their results are generally robust to alternative choices for the control city, but that results for the two Virginia cities are much more sensitive to the control.

Interestingly, while the authors find a significant increase in Louisville's wholesale RFG prices following the joint venture, Taylor and Hosken attribute this increase to the fact that the post-transaction period coincided with St. Louis's entry into the RFG program. The authors argue that this event doubled the RFG demand in the southern Midwest in mid-1999 and that this demand increase, rather than the joint venture, was the cause of the gasoline prices increase in Louisville.[17]

In a paper that employs a very similar methodology to that of Taylor and Hosken, Simpson and Taylor assess the effect of MAP's 1999 acquisition of Ultramar Diamond Shamrock's (UDS) terminaling assets in Michigan on retail prices in Michigan. The transaction increased MAP's share of refined petroleum products terminal storage in Michigan from about 16 percent to about 25 percent and increased the share of retail outlets with a MAP brand from about 16 percent to about 24 percent.[18] Simpson and Taylor analyze retail prices for conventional gasoline in six Michigan cities[19] between January 1997 and December 2002 and find no evidence that the transaction led to higher prices.

Simpson and Taylor employ a DID methodology and choose South Bend and Elkhart/Goshen in Indiana to serve as control cities for the six Michigan markets. All cities consume conventional gasoline, and the authors argue that South Bend and Elkhart/Goshen have similar demand and supply conditions to those in the six cities affected by the acquisition. Simpson and Taylor also include in their statistical model indicator variables constructed to account for a number of supply shocks that may have affected prices in the relevant cities. These supply shocks may have impacted the differential between the cities affected by the merger and the control cities in Indiana. The results of their statistical model indicate that the acquisition did not lead to increased retail prices for conventional gasoline.[20]

Hastings[21] exploits an interesting aspect of the data to examine the impact of ARCO's 1997 long-term leasing and re-branding of approximately 260 Thrifty retail outlets in Southern California. Hastings begins by highlighting two potentially competing explanations for increased retail gasoline prices. Some prior research has found evidence of higher retail gasoline prices in areas with increased vertical integration. However, Hastings points out that vertical integration is often achieved by acquiring independent retail outlets, which compete primarily on price. Therefore, a pattern of higher retail gasoline prices in areas with more vertical integration may be explained by a decrease in the presence of independent outlets rather than the increase in vertical integration.[22]

Hastings employs a DID approach based on the observation that some of the Thrifty retail outlets leased by ARCO were converted to ARCO company-operated outlets and some were converted to dealer-operated outlets. She exploits this fact to test for the impact of independent retailers on local prices while controlling for the market share of company-operated outlets. Hastings' results suggest that the presence of an independent outlet lowers local prices by five cents per gallon for those stations competing with a Thrifty outlet prior to its conversion to ARCO.[23]

However, Taylor, Kreisle, and Zimmerman[24] raise questions about the identification strategy used in the Hastings paper, noting that Hastings did not adequately control for other events and economic factors that may have affected retail prices in Southern California at the time of the ARCO/Thrifty transaction. The authors report that over half of the Thrifty outlets involved in the transaction were already being supplied by ARCO prior to the transaction. Furthermore, another independent retailer in Southern California signed a branding agreement with Exxon around the same time as the ARCO/Thrifty transaction.[25] Taylor, Kreisle, and Zimmerman (2007) present results which suggest that the ARCO/Thrifty transaction did not lead to higher prices, and conclude that if there was any price effect, it was smaller than the effect identified by Hastings in her earlier study.[26]

The study released by the GAO in 2004 analyzed the effect of eight mergers on wholesale (rack) gasoline prices. These eight mergers include the two mergers analyzed by Taylor and Hosken and Simpson and Taylor. In total, the paper assessed the following mergers:[27]

- **Tosco-Unocal:** Tosco's 1997 purchase of Unocal's West Coast refining and marketing assets.
- **UDS-Total:** Ultramar Diamond Shamrock's (UDS) 1997 merger with Total.
- **MAP:** Marathon's 1998 joint venture with Ashland, creating Marathon Ashland Petroleum LLC (MAP).
- **Equilon:** Shell's 1998 joint venture with Texaco (Equilon) to combine their refining and marketing (wholesale and retail) businesses mainly in PADDs II, III, IV, and V.
- **Motiva:** Shell's 1998 joint venture with Texaco and Star to combine their refining and marketing assets mainly in PADDs I, II, and III.
- **BP-Amoco:** British Petroleum's (BP) 1998 merger with Amoco.
- **Exxon-Mobil:** Exxon's 1999 merger with Mobil.
- **MAP-UDS:** MAP's 1999 purchase of UDS assets located in Michigan.

The analysis of the GAO is different from that performed by Taylor and Hosken and Simpson and Taylor in two important ways. The first is that the GAO analysis does not attempt to pick pure control cities to match with the merger cities. Instead, it uses as controls every non-merger city in the data set. The second is that the analysis attempts to study the effect of the eight mergers on prices in all cities in a single regression rather than examining the price effect of a single merger on each city with a separate regression. This pooled regression approach may complicate the ability to create effective controls for the affected cities. However, the GAO analysis is much more than the simple before-after analysis described above. It attempts to control for supply and demand factors by including price movements in all rack cities assumed not to be affected by the mergers. In addition, the GAO analysis included three controls for factors that might affect supply and demand conditions: a PADD level inventory ratio; a national refinery utilization rate; and two production disruptions. Also because the GAO was measuring the effect on wholesale gasoline prices net of crude prices, it was also able to control for changes in the price of crude oil.

The GAO looked at conventional gasoline, reformulated gasoline, and CARB gasoline depending on the merger. The results can be summarized as follows:

	Price Effect (+/–)		
Merger	**Conventional**	**Reformulated**	**CARB**
Tosco-Unocal	n/a	n/a	Mixed
UDS-Total	–	–	n/a
MAP	+	+	n/a
Equilon	+	n/a	-
Motiva	–	Mixed	n/a
BP-Amoco	+	+	n/a
Exxon-Mobil	+	+	n/a
MAP-UDS	+	n/a	n/a

The results for the MAP joint venture are generally consistent with the comparable analysis performed by Taylor and Hosken, in that they both find increases for RFG rack prices as a result of the merger. The analysis performed by Simpson and Taylor on the MAP-UDS transaction is less comparable as it is limited to retail prices. However, it is interesting that the GAO study found that wholesale (rack) prices rose while Simpson and Taylor found that retail prices did not change.

The GAO analysis attracted a significant amount of attention and criticism from the FTC, which led to a series of detailed public communications between the two agencies. The main concerns of the FTC were summarized by FTC Chairman Timothy Muris in a statement made in May 2004 after the release of the final GAO report. Chairman Muris stated that the report did not include important controls for supply and demand factors, such as changes in gasoline formulations, many other supply disruptions, and seasonal dummies. He also stated that the report was not robust to different specifications (conducted by the GAO but omitted from the final report). One of these criticisms is noteworthy when comparing the GAO analysis to the Taylor and Hosken study. As discussed above, Taylor and Hosken also found that the MAP joint venture led to an increase in wholesale prices, but they attributed that increase in prices to a change in required gasoline formulation as opposed to the merger.

Consumer Product Industries

Analysis of mergers in many packaged consumer product industries is facilitated by the availability of retail scanner data, which provide information on the weekly dollar and volume sales in particular retail channels and geographic areas.

Ashenfelter and Hosken[28] use retail scanner data to analyze five consumer product mergers that took place between 1997 and 1999: the Guinness and Grand Metropolitan merger (spirits), Pennzoil's acquisition of Quaker State (motor oil), Proctor & Gamble's acquisition of Tambrands (feminine hygiene products), General Mills' acquisition of Ralcorp (ready-to-eat cereals), and Aurora Food's acquisition of Log Cabin (breakfast syrups). This time period reflected the period covered by their data set. Within that time period, the authors chose these particular mergers because, although they were permitted by the agencies, they appeared to be problematic and therefore "marginal" cases. Accordingly, the authors argue, their results provide an upper bound on the price effects of permitted mergers and a lower bound on the price effects of mergers that are stopped.

Ashenfelter and Hosken use the DID approach. As a control for the prices of the branded products of the merging parties, they use the prices of products that were not involved in the merger. Two alternative groups of control products were considered: private label products and other branded products. The idea here is that these products are subject to many of the same cost and demand factors that were likely to have affected the prices of the products of the merging parties, while being less subject to (or at least less affected by) the competitive effects of the merger.

The authors found that four of the five mergers led to increases of 3 percent to 7 percent for weighted averages of the merging parties' products' prices.[29] The one exception was the Aurora acquisition in breakfast syrups, for which Ashenfelter and Hosken found no price increase.

Ashenfelter and Hosken also analyzed post-merger changes in the merging parties' shares. As discussed above, using share as the focus of the analysis allows one, in principle, to account for changes in competitive variables other than price, including advertising and promotion, new product introductions, and product repositioning. For example, if price increases while share also increases, it is likely that the price increase reflects increased cost or increased demand from product improvements (which would also be driving the increasing

share) rather than the anticompetitive effects of a merger. Ashenfelter and Hosken's results for market share are somewhat mixed. For example, the Pennzoil acquisition appears to have led to an increase in combined market share for the brands of the merging parties, while the Proctor & Gamble acquisition appears to have led to a decrease in market share for the brands of the merging parties.

The authors caution against drawing broad conclusions from their results. First, in some cases (e.g., spirits) the retail scanner data account for only a small percentage of all sales of the product. Price changes in the channels not covered by the retail scanner data may well have been substantially different. Second, their analysis is focused on branded products in consumer product industries, which represent only a small percentage of all industries. The competitive effects of mergers in other industries with different demand, cost, and competitive conditions could well be different than in branded consumer product industries. Finally, the authors' analysis focuses on the relatively short run effects of the mergers. Efficiencies, for example, may take the merging firms a longer time to develop fully.

A less formal retrospective study of the Whirlpool/Maytag merger is described by then-DOJ Assistant Attorney General Thomas O. Barnett.[30] Barnett points out that the wholesale price of washing machines, as measured by the Bureau of Labor Statistics, has fallen slightly since the merger, and retail prices at big box retailers like Best Buy have been flat. At the same time, the cost of inputs used in the production of washing machines has increased significantly. Barnett interprets this as evidence that the merger generated significant efficiencies that were then passed onto consumers, thereby offsetting what would otherwise have been price increases due to the cost increases.[31] While this picture appears compelling, it would be helpful to know what percentage the input costs are of the retail price—if the input costs make up only a small percentage of the price, even a significant increase in them would have only a small percentage effect on price. In addition, it would be even more compelling if a DID analysis were performed, with a control group for washing machines. For example, if another type of household appliance, using the same production inputs and facing similar demand conditions but not produced by the merging parties, were to show price increases, a stronger case could be made that the merger led to price decreases.

Railroads

Two recent papers have analyzed the large rail merger between Union Pacific (UP) and Southern Pacific (SP). These include the 2002 paper by Karikari et al.[32] and the 2004 paper by Breen.[33] The first paper assessed the impact of the merger on rail rates while the second assessed the realization of claimed merger efficiencies.

The merger between UP and SP in 1996 was the first major rail merger in over a decade to involve any significant overlap and pose any associated competitive concerns.[34] The merger was cleared with one major remedy imposed by the Surface Transportation Board (STB). On routes where shippers would have only had the option of UP or SP prior to the merger, the STB required the parties to grant trackage rights to a third railroad, Burlington-Northern Santa Fe (BNSF), after the merger.

Karikari et al. analyze the effect of this merger (with the imposed remedy) for shipments into and out of the Salt Lake City area, one of the overlap areas of the merger. They used rail rates contained in the Carload Waybill Sample as collected by the STB. Because UP and SP were the only Class I rail operators in the Salt Lake City area before the merger,[35] this analysis constitutes a before-after analysis, as opposed to the more complete DID approach discussed above. As such, this analysis does not have a control from a set of shippers unaffected by the merger and, thus, must more carefully include controls for other factors that could affect price. The Carload Waybill Sample provides information that allowed the authors to control for a national measure of variable costs, the distance and size of each shipment, popularity of the route shipped, the ownership of the railcar, and whether the route had a contract price or not. The authors did not appear to have any pure demand-related controls for price.

The analysis also included two variables to account for the merger. One indicated if the shipment occurred after the merger and the second indicated if the shipment was carried by the third-party railroad BNSF (which also could only occur after the merger). The analysis found that when BNSF carried the freight, prices were lower by 3 to 16 percent. For those non-BNSF shipments, the authors also found that for shipments leaving Salt Lake City, prices were lower after the merger by between 6 and 9 percent. For shipments into Salt Lake City, prices were higher or not statistically significantly different depending on the specification used. The authors conclude that the remedy was successful as prices for shipments handled by BNSF were consistently lower. However, they found that the overall effect of the merger was mixed with some prices increasing and others decreasing.

The paper by Breen, while examining the post-merger situation of the UP/SP merger, is careful to note that it does not assess the effect of the merger on prices or welfare. Rather the author examines the extent to which efficiencies claimed by the merging parties were actually realized after the merger. Breen notes that this is a good case for retrospectively analyzing efficiencies because there are good data both on the efficiency claims as well as the efforts to realize those efficiencies after the merger. Such an analysis would also be highly relevant for this merger due to the attention that efficiencies were afforded by the STB in its review and approval of the merger.[36]

The parties to the merger claimed a number of categories of merger efficiencies, including from labor and operational savings. Some of these would be expected to be fixed cost in nature and thus not likely to be passed onto shippers, while

others would be expected to be related to marginal or variable costs. The latter included operational savings from more efficient routings, reduced interchange delays, decreased maintenance costs, and others. In addition, there were a number of savings that would accrue directly to shippers through reduced logistics costs.

While the STB did perform a review of the merger efficiencies and confirmed their realization, Breen cautions that the STB reports were not very detailed and little backup information was provided as support. Breen looked both at public information (company filings) and private company documents that could be used to support realization of the merger efficiencies. These documents suggest that the merger resulted in a total of over $800 million in savings over five years. The largest portion of these savings (about one quarter) came from operational savings, including shorter routes, directional running, reduced interchange of cars between railroads, better car utilization, combined freight yards and shops, and reduced offices and office systems. Many of these savings would be variable cost in nature and would be expected to be passed on to consumers. Breen found this analysis of efficiencies plausible and concluded that UP did in fact realize significant savings that were public in nature and specific to the merger.

Airlines

The Department of Transportation maintains a ticket price database, and this has provided the basis for a number of economic studies of airline mergers. The most recent of these studies is by Peters.[37] Peters studies five mergers that occurred between August 1986 and November 1987. One interesting aspect of the mergers during this period is that they were subject to review by the Department of Transportation, not the antitrust agencies. Peters states that the DOJ objected to two of the mergers.[38] Thus, the threshold applied to these mergers was likely well above that applied to the mergers that are the subject of most retrospective studies.

Peters examines price changes on "overlap" routes where the merging parties both operated flights pre-merger. He uses a DID approach, where the control for the price change in each overlap route is an industry average price change for routes of the same distance. He finds that the price on the average overlap route increased by an amount ranging from 7 percent to 29 percent across the five mergers.[39] Although the DID approach controlled for industry average price changes, Peters also demonstrates that changes in economic conditions (e.g., demand) specific to the overlap routes cannot explain the price increase on those routes. Other studies have examined the same mergers and found similar results.[40]

Armantier and Richard[41] study the 1999 code-sharing arrangement between Continental Airlines and Northwest Airlines. They use a DID approach, but they employ consumer surplus rather than price as the dependent variable for their analysis to capture the effects of the arrangement on both price and quality. Of course, consumer surplus is not directly observable. Armantier and Richard therefore first estimate a structural model of consumer demand and then use this demand model to calculate consumer surplus before and after the code-sharing went into effect. The changes in consumer surplus are compared between origin-destination pairs affected by the code-sharing arrangement and origin-destination pairs that were unaffected. Armantier and Richard find that overall consumers were unaffected by the code-sharing arrangement, although this aggregate neutral outcome is the result of consumer welfare losses on non-stop flights being offset by consumer gains on connecting flights.[42]

Hospitals

A number of studies have analyzed mergers in the hospital industry, most likely because data on a price variable is readily available from public sources.[43] However, this industry has a number of idiosyncrasies—such as the large number of not-for-profit entities and the third-party payor system—that caution against generalizing any conclusions from the hospital industry to other industries. Nevertheless, several of the hospital studies provide interesting results.

Connor et al.[44] use the DID approach to analyze mergers among short-term general hospitals that occurred during the 1986 to 1994 period. Specifically, their dependent variable is the percentage change in price between 1986 and 1994.[45] Hospitals involved in mergers are compared to a control group consisting of hospitals not involved in a merger during the period. The authors use other characteristics of the hospitals as additional control variables. They found that prices decreased by 5 percent in merging hospitals relative to non-merging hospitals.[46]

Another useful purpose of merger retrospective studies is to examine the extent to which mergers generate efficiencies. Hospital mergers are often justified on the basis that they will bring substantial cost savings. In addition to analyzing price, Connor et al. also analyze costs, and find that costs decreased by about 5 percent in the merging hospitals as compared to non-merging hospitals. This result would appear to explain their price decrease result: hospital mergers during this period led to cost decreases, which were then passed on in lower prices. Sinay[47] analyzed the changes in the cost structure of hospitals that had been involved in mergers between 1987 and 1990 and compared them to the changes in the cost structure of control hospitals not involved in mergers; a DID approach. He found that hospital mergers generated significant economies of scale and scope.

Vita and Sacher[48] performed a case study of a 1990 merger between two hospitals in Santa Cruz, California. What is interesting about this merger is that it fell below the HSR filing threshold, so that it was closed without having to undergo agency review.[49] Vita and Sacher used the DID approach to compare price changes in the acquiring hospital to price changes of a control group of hospitals and found a price increase of approximately 25 percent for the acquiring hospital.[50] They investigated whether cost changes at the acquir-

ing hospital (relative to the control hospitals) could explain the price result and found that it could not. Finally, Vita and Sacher analyzed the share of Santa Cruz hospitals among Santa Cruz patients. They found that, post-merger, the share declined, consistent with an anticompetitive effect of the merger.

Dafny[51] studied hospital mergers that took place between 1989 and 1996. She took a DID approach, but with two important modifications. She notes that the incidence of a merger may well not be independent of the unobserved supply and demand conditions of the hospitals. Recall that this is one of the conditions required for the DID approach to provide a reliable estimate of the merger effects. For this reason, Dafny focused on the effects of the merger on the prices charged by rivals to the merging hospitals, rather than the merging hospitals themselves. In addition, Dafny used "instrumental variables" to account for the potential dependence between the incidence of a merger and the unobserved characteristics of the hospitals. She found that a merger increased the price charged by rival hospitals by approximately 40 percent.[52] As a basis of comparison, she ran the basic DID approach (based on ordinary least squares instead of instrumental variables) and found no effect of a merger on rivals' prices (similar to the results of, e.g., Connor et al.). The difference in results between Dafny's modified DID approach and the basic DID approach is so striking that, subject to the econometric validity of the instrument Dafny used, the assumptions of the basic DID approach are called into question for this data set.

Banks

Prager and Hannan[53] used a DID approach to analyze the effect of bank mergers on the interest rates paid by banks to their customers on deposits. They studied mergers that occurred during the January 1992 to June 1994 period, and divided these mergers into two groups: "substantial" mergers involving substantial increases in concentration as measured by the HHI, and "lesser" mergers. Prager and Hannan compared changes in interest rates for banks in local markets where mergers occurred to banks in local markets where no merger occurred. They estimated both a "pre-merger" and a "post-merger" effect of the mergers they studied. Because the pre-merger effect may reflect economic conditions other than the merger, we focus here on the estimated post-merger effect.

Prager and Hannan found that substantial mergers led to a 9 percent decrease in the interest rate (a decrease in the interest rate reduces consumer welfare) for those accounts where supply and demand are most local in nature (e.g., checking accounts), and no effect on the interest rate for those accounts where supply and demand are less local (e.g., certificate of deposits).[54] Lesser mergers were found to have no post-merger effect on interest rates, consistent with these mergers generating cost-savings that were passed on to customers.[55]

Academic Journals

McCabe[56] analyzed the effects of seven mergers involving publishers of biomedical journals that occurred in the 1990s. He used a DID approach. Like the GAO study of oil and gas mergers, he used all non-merging biomedical journals as controls for each journal of the merging parties, and he estimated the effects of multiple mergers in a single regression model. The data covered the period from 1988 to 2001. McCabe found that the mergers led to price increases of 2 percent to 10 percent.[57]

Conclusion

As we stated at the outset, researchers seeking to perform merger retrospective studies have been subject to various limitations. As a result, the mergers that have been analyzed cannot in any sense be claimed to represent a random sample of all mergers or even "marginal" mergers, which have been closely scrutinized by the agencies. Nevertheless, the results from the studies reviewed here are mixed. Some studies find price increases and others find price decreases, as one might expect from a group of marginal mergers. While the results of these studies are of interest, a more systematic analysis along the lines suggested by Dennis Carlton should be conducted to better evaluate merger review policy by the antitrust agencies. As Carlton points out, an assessment of the effectiveness of merger enforcement must evaluate and compare the agencies' predicted price effects to actual price effects. Furthermore, while sophisticated econometric approaches are available for assessing mergers, our review suggests that an analysis must carefully assess and, where possible, test the validity of the assumptions required by these approaches. In both the GAO MAP joint venture analysis and in the Connor et al. hospital merger analysis it appears that the statistical analyses did not adequately control for all economic factors that affect prices, casting doubt on the results of both the regression analysis performed by the GAO as well as the DID analysis by Connor et al. ■

[1] *See* Jonathan B. Baker & Carl Shapiro, *Detecting and Reversing the Decline in Horizontal Merger Enforcement*, ANTITRUST, Summer 2008, at 29; Timothy J. Muris, *Facts Trump Politics: The Complexities of Comparing Merger Enforcement over Time and Between Agencies*, ANTITRUST, Summer 2008, at 37; John D. Harkrider, *Antitrust Enforcement During the Bush Administration—An Econometric Estimation*, ANTITRUST, Summer 2008, at 43.

[2] Dennis W. Carlton, The Need to Measure the Effect of Merger Policy and How to Do It, EAG Discussion Paper 07-15 (2007); Thomas O. Barnett, Current Issues in Merger Enforcement: Thoughts on Theory, Litigation Practice, and Retrospectives, Lewis Bernstein Memorial Lecture (June 26, 2008), *available at* http://www.usdoj.gov/atr/public/speeches/234537.pdf.

[3] Carlton, *supra* note 2.

[4] Two of the studies we review below analyze mergers that were not subject to agency review because they fell below the HSR filing requirements or because another governmental agency had jurisdiction. In both cases, it appears that the agencies were opposed to the mergers in question. Since the studies find that these mergers led to substantial price increases, the agencies' assessments appear to have been accurate in these cases.

[5] This is analogous to the "output test" for analyzing the competitive effects of vertical restraints. *See* Richard Posner, *The Next Step in the Antitrust Treatment of Restricted Distribution: Per Se Legality*, 48 U. Chi. L. Rev. 6 (1981). As in the case of vertical restraints, an output increase is necessary, although not sufficient, for the merger to be procompetitive.

[6] Other reviews of merger retrospective studies include Matthew Weinberg, *The Price Effects of Horizontal Mergers*, 4 J. Competiton L. & Econ. 433, 447 (2008); Michael D. Whinston, Lectures on Antitrust Economics (2006); and Paul A. Pautler, *Evidence on Mergers and Acquisitions* (FTC Working Paper No. 243, 2001), *available at* http://www.ftc.gov/be/workpapers/wp243.pdf.

[7] One merger retrospective study that we did not address given our focus on the DID approach is Laurence Schumann et al., *Case Studies of the Price Effects of Horizontal Mergers* (FTC Bureau of Economics Staff Report 1992). This paper examines three mergers in three different industries, in each case using a before-after approach that controlled for changes in supply and demand conditions after the merger. It finds that one merger had no effect, one merger led to lower prices due to efficiencies, and one merger led to higher prices. *See id.* at viii–xii.

[8] For a discussion of the DID method, and other econometric approaches to program evaluation, see Guido W. Imbens & Jeffrey M. Wooldridge, *Recent Developments in the Econometrics of Program Evaluation* (NBER Working Paper No. 14251, 2008).

[9] FTC v. Whole Foods Market, Inc. 502 F. Supp. 2d 1 (D.D.C. 2007).

[10] FTC v. Staples, Inc., 970 F. Supp. 1066 (D.D.C. 1997).

[11] Christopher T. Taylor & Daniel S. Hosken, *The Economic Effects of the Marathon-Ashland Joint Venture: The Importance of Industry Supply Shocks and Vertical Market Structure*, 55 J. Indus. Econ. 419, 451 (2007).

[12] John Simpson & Christopher Taylor, *Do Gasoline Mergers Affect Consumer Prices? The Marathon Ashland Petroleum and Ultramar Diamond Shamrock Transaction*, 51 J.L. & Econ. 135, 152 (2008).

[13] U.S. General Accounting Office, Energy Markets: Effects of Mergers and Market Concentration in the U.S. Petroleum Industry (2004).

[14] *See* Taylor & Hosken, *supra* note 11, at 426.

[15] *Id.* at 428.

[16] Hosken and Taylor also analyze the impact of the joint venture in Fairfax and Richmond, Virginia, and conclude that the joint venture did not lead to an increase in either retail or wholesale prices in those two cities.

[17] Note that the GAO analysis of the MAP joint venture suggested that wholesale RFG prices in the cities where Marathon and Ashland post prices rose by an average of 0.7–0.9 cents per gallon due to the merger.

[18] *See* Simpson & Taylor, *supra* note 12, at 136.

[19] Simpson and Taylor analyzed the effect of the MAP-UDS transaction on retail prices in Flint, Lansing, Saginaw/Bay City, Grand Rapids/Muskegon, Jackson, and Kalamazoo/Battle Creek.

[20] Note that the GAO study concluded that the MAP-UDS merger was responsible for wholesale gasoline price increases between 1.4 and 2.6 cents per gallon in the cities in which MAP and UDS post prices.

[21] Justine S. Hastings, *Vertical Relationships and Competition in Retail Gasoline Markets: Empirical Evidence from Contract Changes in Southern California*, 94 Am. Econ. Rev. 317, 328 (2004).

[22] *Id.* at 317.

[23] *Id.* at 325.

[24] Christopher T. Taylor et al., *Vertical Relationships and Competition in Retail Gasoline Markets: Comment* (FTC Working Paper No. 291, 2007), *available at* http://www.ftc.gov/be/workpapers/wp291.pdf.

[25] *Id.* at 3.

[26] We should note that Taylor et al. do not use the exact same data that Hastings used in her study. Taylor et al. provide evidence that the data they use are comparable to the data used by Hastings, but acknowledge that differences in the data may explain in part differences in results.

[27] GAO, *supra* note 13, at 111–12.

[28] Orley Ashenfelter & Daniel Hosken, *The Effect of Mergers on Consumer Prices: Evidence From Five Selected Case Studies* (NBER Working Paper No. 13859, 2008), *available at* http://nber.org/papers/13859.

[29] *Id.* at 28.

[30] Barnett, *supra* note 2.

[31] *Id.* at 19.

[32] John Ageyi Karikari et al., *The Union Pacific/Southern Pacific Railroads Merger: Effect of Trackage Rights on Rates*, 22 J. Reg. Econ. 271 285 (2002).

[33] Denis A. Breen, *The Union Pacific/Sothern Pacific Rail Merger: A Retrospective on Merger Benefits* (FTC Bureau of Economics Working Paper No. 269, 2004), *available at* http://www.ftc.gov/be/workpapers/wp269.pdf.

[34] Karikari et al., *supra* note 32, at 272.

[35] *Id.* at 278.

[36] Breen, *supra* note 33, at 3.

[37] Craig Peters, *Evaluating the Performance of Merger Simulation: Evidence From the U.S. Airline Industry*, 49 J.L. & Econ. 627, 649 (2006).

[38] *Id.* at n.4.

[39] *Id.* tbl. 3.

[40] *See* Severin Borenstein, Airline Mergers, *Airport Dominance, and Market Power*, 80 Am. Econ. Rev. 400, 404 (1990); Gregory J. Werden et al., *The Effects of Mergers on Price and Output: Two Case Studies From the Airline Industry*, 12 Managerial & Decision Econ. 341, 352 (1991); E. Han Kim & Vijay Singal, *Mergers and Market Power: Evidence from the Airline Industry*, 83 Am. Econ. Rev. 549, 569 (1993).

[41] Olivier Armantier & Oliver Richard, *Domestic Airline Alliances and Consumer Welfare*, 39 Rand J. Econ. 875, 904 (2008).

[42] *Id.* at 4.

[43] In addition to the studies we discuss below, a number of other studies also analyze hospital mergers. *See, e.g.*, Michael G. Vita & Laurence Schumann, *The Competitive Effects of Horizontal Mergers in the Hospital Industry: A Closer Look*, 10 J. Health Econ. 359, 372 (1991); William J. Lynk, *Nonprofit Hospital Mergers and the Exercise of Market Power*, 38 J.L. & Econ. 437, 461 (1995).

[44] Robert A. Connor et al., *The Effects of Market Concentration and Horizontal Mergers on Hospital Costs and Prices*, 5 Int'l J. Econ. Bus. 159, 180 (1998).

[45] One weakness of the Connor et al. study, which is shared by other hospital studies, is that price is defined as hospital revenue divided by admissions or number of patient days. One would prefer to analyze the prices for specific services rather than this highly aggregated "price."

[46] Connor et al., *supra* note 44, at 174.

[47] Ugur Tony Sinay, *Pre- and Post-Merger Investigation of Hospital Mergers*, E. Econ. J. 83, 97 (1998).

[48] Michael G. Vita & Seth Sacher, *The Competitive Effects of Not-For-Profit Hospital Mergers: A Case Study*, 49 J. Indus. Econ. 63, 84 (2001).

[49] The FTC subsequently reviewed the merger, but decided that a divestiture was not feasible. *See id.* at 64.

[50] *Id.* tbls. II and III.

[51] Leemore S. Dafny, *Estimation and Identification of Merger Effects: An Application to Hospital Mergers* (NBER Working Paper No. W11673, 2005), *available at* http://www.nber.org/papers/w11673.

[52] *Id.* at 20.

[53] Robin A. Prager & Timothy H. Hannan, *Do Substantial Horizontal Merger Generate Significant Price Effects? Evidence From the Banking Industry*, 46 J. Indus. Econ. 433, 452 (1998). Two other recent studies of banking mergers are Paola Sapienza, *The Effects of Banking Mergers on Loan Contracts*, 57 J. Fin. 329, 367 (2002); and Dario Focarelli & Fabio Panetta, *Are Mergers Beneficial to Consumers? Evidence from the Market for Bank Deposits*, 93 Am. Econ. Rev. 1152, 1172 (2003). However, as these studies analyze bank mergers in Italy and our focus is on the United States, we do not review them here.

[54] Prager & Hannan, *supra* note 53, tbl. III.

[55] *Id.* tbl. V.

[56] Mark J. McCabe, *Journal Pricing and Mergers: A Portfolio Approach*, 92 Am. Econ. Rev. 259, 269 (2002).

[57] *Id.* at 265, 267.