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ABSTRACT

In May 2007 the Federal Trade Commission failed to win a preliminary injunction in U.S. District Court that would have blocked the merger of two refiners that served Albuquerque, NM and surrounding areas. This study compares estimates of the post-merger price effect to the price effects predicted by economic experts on both sides of the case. I find little scope to interpret the evidence as consistent with an anticompetitive post-merger price effect. I also highlight difficulties involved in econometrically identifying small effects even with an abundance of pricing data.

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1. Introduction

As noted by Carlton (2009) and others, the value of retrospective merger analysis lies not only in understanding the impact of a particular merger – or, more speculatively, the likely impact of similar mergers – but also in evaluating the accuracy of prospective merger analysis by the relevant antitrust authority. However, this evaluation can only take place when the antitrust authority has precisely stated its forecast of any post-merger competitive effect. In that vein, this paper reflects upon Western Refining's acquisition of Giant Industries in May 2007 after a U.S. District Court denied the Federal Trade Commission's request for a preliminary injunction to stop the transaction. During the trial, both the FTC and the merging parties employed economic experts who made predictions on the public record as to the merger's likely impact on the wholesale price of gasoline in and around Albuquerque, New Mexico. Therefore, in addition to assessing the narrow question of whether this particular merger affected prices, I can also address the broader issue of how any such impact aligned with the Commission's (or the parties') predicted effect.

I also use this merger to compare empirical methods in retrospective merger estimation. Petroleum prices often exhibit nonstationarity, so I compare two versions of my difference-in-differences approach, each of which theoretically produces consistent estimates but which in practice often disagree. First, I run OLS regressions using autocorrelation-consistent standard errors (Newey-West). Second, I explicitly estimate an autoregressive term in the error (Prais-Winsten). I exploit an abundance of pre-merger data to compare these approaches both for the actual merger effect and for various placebo merger dummies in the pre-merger period to investigate the ability of either econometric procedure to identify small price changes reliably.

This particular merger is also unusual because the FTC predicted that an ongoing output expansion project at Giant would lower prices in the absence of the merger. If that characterization is correct, then the relevant question for this study is not just whether prices increased relative to some control market. Even if prices fell, anticompetitive harm could still be inferred if they did not fall "enough" relative to the FTC's predicted effect from the output expansion. Indeed, the econometric evidence generally suggests that gasoline and diesel prices did, in fact, decline at both the wholesale and retail levels, although not quite to the most extreme level the FTC predicted could arise in the but-for world. While this finding leaves some room to infer an anticompetitive merger effect, it hinges crucially on whether the FTC's theory of the counterfactual seems most plausible.

The following section describes the antitrust case and what has happened to the acquired assets after the merger. Ensuing sections describe the research design, and analyze the robustness of the results across products, control cities, and estimation method. In an attempt to understand the mechanism by which prices may have declined, I also use firm-specific pricing in Albuquerque to look for changes in downstream behavior after the merger. The final section offers concluding thoughts on the extent to which the retrospective evidence conflicts with the theories put forth by both the FTC and the merging parties.

2. The Competitive Overlap

The ability of the Western/Giant transaction to affect competition lies in Albuquerque's relative isolation with regard to petroleum product supply, as summarized in Figure 1.[1] Sitting at or near the end of three pipelines, only five refiners had direct access to Albuquerque. Giant delivered product to Albuquerque by truck from its two Four Corners refineries, which had a total capacity of 37,000 barrels per day. Western supplied Albuquerque from its 124,000 barrel-per-day refinery in El Paso, Texas via the common carrier Plains Pipeline. ConocoPhillips, Valero, and Holly also delivered products to Albuquerque on their own proprietary pipelines from refineries similar in size to Western's. However, the FTC pointed to marketing and supply constraints that limited the supply responsiveness of these three refiners. Likewise, while many large, sophisticated refineries on the Gulf Coast near Houston could reach El Paso by pipeline, capacity constraints on the Plains Pipeline restricted their ability to reach Albuquerque.

In the eyes of the FTC, the merger raised competitive concerns because these supply constraints gave Giant the ability and incentive to expand production and lower Albuquerque prices, which would diminish with the merger with Western. Declining crude oil production in the Four Corners area had caused Giant's refinery utilization rate to fall from 72 percent in 2002 to 60 percent in 2006.[2] To combat this problem, Giant acquired a pipeline capable of delivering crude oil from West Texas that it expected to place in service in 2007. The FTC argued that, given Albuquerque's supply constraints, Giant's output expansion was likely to substantially lower prices in the absence of the merger. Based on documentary evidence and analysis from its economic expert, Hal White, the FTC argued that Albuquerque prices would decline between 6 and 10 cents per gallon (cpg) in the absence of the merger.[3] The upper end of that range would be large by the standards of the existing literature on refinery mergers, which is summarized in Table 1. The FTC's theory, then, was that the Western/Giant transaction would reduce the incentive to increase product supplied to Albuquerque, and effectively eliminate the entirety of the impending 6-10 cpg price decline.

By contrast, the merging parties and their expert, Joseph Kalt, claimed that neither the output expansion nor the merger would have any effect on price. They pointed to the potential for Gulf Coast supply, including trucking product from El Paso to avoid capacity constraints on the Plains Pipeline, as limiting Albuquerque prices both before and after Giant's output expansion.[4] Notably, they estimated that the amount of gasoline trucked from El Paso to the Albuquerque area exceeded the FTC's predicted incremental product supply from Giant after its output expansion. If Giant's post-expansion production simply displaced some but not all of this

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[1] All facts described herein are publicly available. Key sources include the FTC's *First Amended Complaint* (hereinafter, "Complaint") and the FTC's *Memorandum of Points and Authorities* (hereinafter, "Points and Authorities"), both available at http://www.ftc.gov/os/caselist/0610259/index.shtm; and the district court's *Memorandum Opinion, Findings of Fact, Conclusions of Law, and Order* (hereinafter, "Opinion"), cited as *FTC v. Foster, et al.*, 2007 WL 1793441 (D.N.M. Apr. 29, 2007), which can be found by entering 07cv00352 in the case number field at http://www.nmcourt.fed.us/Drs-Web/input.

[2] Opinion, ¶ 34.

[3] See Opinion, ¶ 423 and 442, and p. 6 of the Court's April 12, 2007 *Memorandum Opinion and Order* granting the FTC's application for a temporary restraining order. The latter is available at http://www.ftc.gov/os/caselist/0610259/order.pdf; it erroneously cites an effect of "six to eight percent" which instead should be an effect in cents per gallon.

[4] Opinion, ¶ 259-262; 447-453.

trucking from El Paso, then Giant's supply is inframarginal and Albuquerque prices would continue to be determined by the cost of trucking from El Paso.

Consequently, the state of affairs was such that both the FTC and the merging parties claimed that Albuquerque prices would not change if the merger were to proceed. The FTC, however, argued that the merger would prevent an imminent and substantial decline in Albuquerque prices. For the purposes of this study, then, a finding of any post-merger price increase would contradict the predictions put forth by both sides. A sufficiently large price decrease might suggest that the FTC was correct to predict that the increased output after Giant's output expansion would indeed affect Albuquerque prices, while the merging parties were correct to predict that existing competition would maintain the merged firm's incentive to send additional production to Albuquerque.

Ultimately, while the Court agreed that the market was concentrated, it appeared to believe the parties rebutted any presumption that the merger would have anticompetitive effects.[5] Thus, on May 31, 2007, Western closed its acquisition of Giant. Western followed through with the output expansion at the Giant refineries, commencing pipeline deliveries in August 2007. But at some point in 2008 it reversed course and shut the pipeline down.[6] In November 2009, Western ceased production at one of the two Giant refineries altogether.[7] However, declining demand in the wake of the 2008-09 recession and increased use of renewable fuels, rather than changed incentives resulting from the merger, might justifiably have led to the closures of these relatively small and isolated refineries.

3. Data and Research Design

The data for this study come from the Oil Price Information Service (OPIS). The data consist of weekly observations on rack (wholesale) and retail prices for both gasoline and diesel. The trial itself focused on gasoline, but the FTC initially alleged anticompetitive harm in the market for all light petroleum products – comprising gasoline, diesel, and jet fuel – as well.[8] The FTC's predicted price effects on the public record are for gasoline only. Nevertheless, since diesel supply largely mirrors that for gasoline in the Albuquerque area, analysis of diesel prices provides a useful comparison for understanding the merger's competitive effects. Jet fuel typically is sold under long-term contracts directly into airports, so its price is not similarly observable.

Another useful dimension for comparison is looking at both rack and retail price effects. Economic analysis in the case generally focused on rack prices at petroleum terminals, which are the first observable prices downstream of the competition between Giant's and Western's refineries.[9] Yet, the FTC's predicted price effects were understood to apply to both rack and

[5] Opinion, ¶ 219-221.
[6] See Western's 2008 Form 10-K, p. 7. In December 2011 Western sold the southernmost 80 miles of the pipeline while the rest of it remains unused; see Western's 2011 Form 10-K, p. 4.
[7] See Western's 2009 Form 10-K, p. 4.
[8] Points and Authorities, pp. 10-16.
[9] While vertical contracting varies substantially across states, in New Mexico in 2007 over 78 percent of refiner sales of gasoline occurred at the rack. See http://www.eia.gov/dnav/pet/pet_cons_refmg_c_SNM_EPM0_mgalpd_a.htm. By contrast, rack prices

retail, and retail prices reflect consumer impact more directly.[10] While pass-through from rack to retail should be close to one in the long run (see Chesnes (2010) for evidence), Table 1 shows that existing studies have found varying effects across these levels. For that reason I look at both rack and retail prices, with rack as a baseline since that was the focus of the case.

As in many other merger retrospectives, I employ difference-in-differences to estimate the price effect of the merger. Ashenfelter, Hosken, and Weinberg (2009) provide an overview of this literature, including a discussion of several refinery mergers. As is well known, the validity of the difference-in-differences approach hinges on the selection of a control market. The research design requires that any control city be sufficiently different from the treatment city so that the merger impact is not felt in the former, yet sufficiently similar that identical demand and cost shocks can be netted out by differencing. If Albuquerque is the treatment city T, then for any control city C the estimating equation is:

$$p_t^T - p_t^C = (\alpha^T - \alpha^C) + \sum_{m=1}^{11} (\delta_m^T - \delta_m^C) D_{mt} + \beta^T \cdot PostMerger_t + (\varepsilon_t^T - \varepsilon_t^C) \quad (1)$$

This specification allows for seasonal shifts in demand, represented by monthly dummy variables D_{mt}, to affect prices differently across cities, i.e. $\delta^T \neq \delta^C$.

For this study, the most compelling control city is El Paso, the largest nearby city with a pipeline connection to Albuquerque. The ability of refiners from the highly competitive Gulf Coast region to reach El Paso by pipeline should ensure that El Paso prices reflect competitive levels before and after the merger. Because Giant did not supply El Paso from its Four Corners refineries, neither the merger nor Giant's output expansion should affect prices there. Thus, the interpretation of β^T depends on which theory of the counterfactual one believes. Under the FTC's theory, in which the merger prevents an imminent decline in Albuquerque prices, the merger would be anticompetitive unless β^T is sufficiently large and negative. Under the merging parties' theory, β^T should be zero since the marginal supply to both El Paso and Albuquerque would not change with either the merger or the output expansion.

For robustness, I also consider Amarillo and Flagstaff as potential control cities. Pipelines connect Amarillo to both Albuquerque and El Paso (Figure 1), and neither Giant nor Western delivered product to Amarillo so the merger should have no impact there. However, Amarillo is less similar in population to Albuquerque and El Paso and served by fewer refineries (see Table 2). Flagstaff suffers similar problems, but its appeal as a control city lies in its status as one of Giant's primary destination markets, along with Albuquerque and the local Four Corners area.

Figure 2 plots price levels in Albuquerque against each of the three potential control cities. The most striking feature is the rapid rise and descent of prices in 2008. As Figure 3 shows, however, price differentials between Albuquerque and each control city are noticeably better behaved. Not only is the amount of variation smaller, but the variation is relatively similar in the pre- and

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may be less meaningful in places like California, where the equivalent figure is less than 20 percent at the time of the mergers considered in Hosken, Silvia and Taylor (2011).

[10] Opinion, ¶ 250.

post-merger periods, as documented in Table 3. These features of the data support estimating equation (1) in differences rather than levels. Additionally, differences across control cities support estimating equation (1) pairwise rather than pooling all four cities into a single equation.[11]

Estimating equation (1) in differences also ameliorates nonstationarity problems often apparent in petroleum price data. Dickey-Fuller tests cannot reject the null hypothesis that each weekly gasoline rack price series (pABQ, pELP, pAMR, pFLG) has a unit root over the June-2005 to May-2009 period. However, Dickey-Fuller tests for each gasoline rack price differential (dELP=pABQ-pELP, etc.) reject the null of a unit root at the 95 percent confidence level. To address the degree of autocorrelation that remains, Figure 4 plots the first 52 (i.e. up to one year) autocorrelation coefficients and partial autocorrelation coefficients for each price differential. These plots exhibit characteristics of an AR(1) process: autocorrelation coefficients that decay to zero, whether monotonically or in a sinusoidal pattern, and partial autocorrelation coefficients that, for all lags beyond the first period, abruptly drop to zero and essentially remain there; see Hamilton (1994). Similar patterns emerge in the analysis of the residuals from OLS estimation of equation (1). Examination of price differentials for retail gasoline prices, and rack and retail diesel prices also suggests they follow an AR(1) process.

There are two standard approaches for autocorrelation in the merger retrospective literature. One approach, as in Hosken, Silvia, and Taylor (2011), recognizes that OLS remains unbiased and consistent in the presence of autocorrelation and simply employs the Newey-West standard error correction up to some lag. A second approach, as in Taylor and Hosken (2007), is to model the autocorrelation explicitly using a generalized least squares method such as Prais-Winsten, which should be more efficient. However, in estimating the coefficient on a merger dummy variable using Prais-Winsten, a concern could be that the merger dummy in Prais-Winsten becomes translated from something like {0, 0, 0, 1, 1, 1} to {0, 0, 0, 1, $1-\rho$, $1-\rho$}. As the autocorrelation coefficient ρ approaches one, identification of the merger effect can hinge on a single observation. However, a Monte Carlo study suggests Prais-Winsten performs reasonably well under these conditions. Figure 5 compares average Newey-West (OLS) and Prais-Winsten coefficient estimates from 10,000 simulations in which the dependent variable is equal to a constant plus a dummy variable (with an actual coefficient of 5) and an AR(1) error term. The dummy variable turns on in the middle of 200 observations, approximating the conditions of the current study. While neither approach is unambiguously better at identifying the true coefficient across all levels of autocorrelation, Prais-Winsten actually has a notable edge at $\rho = 0.99$.

4. Results

Table 4 reports results of Newey-West and Prais-Winsten estimation of equation (1) for rack and retail prices of gasoline and diesel relative to El Paso. The estimated merger coefficients are all

[11] As an alternative estimation method, I have employed a simple linear version of the White (2006) dynamic estimator, which attempts to avoid issues in control city selection. That approach searches for the combination of lagged dependent variables, input prices, and demand/cost shifters, such as employment and weather, that best predicts various subsets of pre-merger data. It uses the optimal regression to simulate a hypothetical post-merger counterfactual price series, but tends to predict poorly unless control cities are included, in which case the results do not materially differ from those presented here using the standard difference-in-differences approach.

negative. However, recall that under the FTC's theory, gasoline prices should have fallen 6-10 cpg in the absence of the merger due to the output expansion at Giant's refineries. While the Newey-West estimates are generally larger than those using Prais-Winsten, they are in fact generally in the range the FTC's theory would predict in the absence of the merger. This suggests the merger itself would not be associated with an anticompetitive effect. That said, the results display some notable inconsistencies, apart from just differences in the coefficient estimates for each econometric method. The retail effects tend to be larger than the rack effects, with the exception of the diesel results using Prais-Winsten. It is difficult to envision a mechanism by which, for instance, a 4cpg decrease in the rack price of gasoline leads to an 8cpg price decrease at retail.

Table 5 and Table 6 present results when using Amarillo and Flagstaff as control cities. The results are generally either negative or statistically indistinguishable from zero, with the results for gasoline prices relative to Flagstaff as the notable exception. One possible explanation is that if Giant constitutes the marginal supply to Flagstaff, then Flagstaff prices might arguably reflect the impact of Giant's output expansion as well. In that case the estimate of β^T could reflect only the merger effect, since Flagstaff prices would already incorporate the effect of the output expansion. Unfortunately, there were no statements on the public record as to the output expansion's effect on Flagstaff prices. In addition, the differences between gasoline (all coefficient estimates positive) and diesel (all negative) suggest that, whether or not it controls for the effects of the output expansion, Flagstaff is not a particularly good control for Albuquerque. The Amarillo results tell a story similar to those from El Paso, suggesting that Albuquerque prices declined by several cents per gallon at rack, and by somewhat larger (in absolute value) amounts at retail. However, the El Paso results in Table 4 tend to tell the most consistent story across estimation method (Newey-West and Prais-Winsten), product (gasoline and diesel), and distribution level (rack and retail) relative to both Amarillo and Flagstaff.

Table 7 reports some basic robustness checks of the baseline Newey-West results for Albuquerque rack gasoline prices relative to El Paso. The baseline results, as in Table 4, use four years of weekly data surrounding the merger. Table 7 demonstrates that the result does not change substantially when estimated on four alternative sets of data. First, I drop the first year of post-merger data, to ignore the intermediate period when Western was incorporating all of Giant's assets under its control. Second, I include dummy variables for various events that could potentially have altered the El Paso/Albuquerque pricing dynamic.[12] Third, I use all weekly data from January 2000 through May 2009. Finally, I use the original four-year period aggregated up to the monthly level, where serial correlation is less prevalent (e.g. a Prais-Winsten regression on monthly data generates an estimate of ρ at 0.46). The results are similarly robust to these changes when using Prais-Winsten estimation. Price effects at retail (instead of rack) exhibit similar robustness as well.

[12] These events include expansion of the Kinder Morgan pipeline from El Paso to Phoenix in June 2006, as well as a separate event for a delay in the opening of that pipeline between February and June 2006; Gulf Coast refinery closures after Hurricanes Katrina and Rita from late August to mid-November 2005; a fire at Valero's Amarillo refinery that shut production from mid-February to mid-April 2007; Western's use of the crude pipeline to expand output at Giant's former refineries between August 2007 and December 2008; Gulf Coast refinery closures due to Hurricanes Gustav and Ike between September and early October 2009; and Holly's 15,000 barrel per day expansion at its Artesia, NM refinery after April 2009. The Petrocast database from Industrial Info Resources identifies no other significant (more than 30-day) unplanned outages at the five major refineries supplying Albuquerque over this four year period.

As another robustness check I also ran a series of regressions using various four-year subsamples of the data and testing for placebo merger effects in each week of the data prior to the actual merger. Figure 6 plots the coefficient estimate and confidence interval for each placebo merger dummy, estimating equation (1) by OLS with Newey-West standard errors for Albuquerque gasoline rack prices relative to El Paso. For example, the first point on the chart represents the coefficient estimate (and 95 percent confidence interval) for a placebo merger dummy that occurs on January 1, 2002, using data from January 1, 2000 to January 1, 2004. The final point on the chart uses data from May 31, 2003 to May 31, 2007 with a placebo merger occurring on May 31, 2005.

The results graphed in Figure 6 show that Albuquerque prices often shifted relative to El Paso in the pre-merger period, and by an order of magnitude (as high as 4cpg) similar to the estimated merger effect in Table 4 and the FTC's predicted 6-10 cpg effect. Using Newey-West standard errors, the placebo results were statistically significant a large majority of the time as well. The frequency of such false positives casts doubt on the validity of this particular research design. One potential explanation might be that there are numerous events in either Albuquerque or El Paso that shift the competitive dynamic in ways similar to the Western/Giant transaction but which are not accounted for in the placebo regressions. However, including controls for such events does not substantially reduce the rate of false positives, at least when using the Newey-West approach.[13] Table 8 shows that including controls for known events in the pre-merger period increases the frequency with which the hypothesis of a null effect cannot be rejected from 16 percent to only 34 percent for gasoline rack prices. The remaining rows of Table 8 show similar patterns for retail and diesel prices under Newey-West.

By contrast, the right side of Table 8 shows that employing Prais-Winsten estimation, especially in conjunction with the inclusion of control variables, increases the rate at which the placebo merger dummies are statistically insignificant to relatively acceptable levels. This finding restores some faith in the validity of El Paso as a control market. Figure 7 plots the Prais-Winsten estimates and confidence intervals corresponding to those in Figure 6 for gasoline rack prices. While Prais-Winsten does appear to do better in terms of fewer false positives, Figure 7 shows how it also appears particularly sensitive to shifting the time domain one week at a time. Point estimates (and confidence intervals) can shift considerably from week-to-week; the largest jumps appear correlated with jumps in the Prais-Winsten estimate of the AR(1) coefficient in the error term, which is also plotted in Figure 7. Thus, while Prais-Winsten may be preferable in terms of minimizing false positives, Newey-West appears less sensitive to small changes in the data sample. While the comparison is not exactly analogous, Prais-Winsten was far more effective than Newey-West at including the true effect within the 95 percent confidence interval of the coefficient estimate in the Monte Carlo experiments conducted for Figure 5. With $\rho = 0.9$, Prais-Winsten correctly failed to reject the null hypothesis in 91 percent of the experiments, while Newey-West did so only 46 percent of the time. Prais-Winsten's success rate only improved over Newey-West's as the AR(1) coefficient grew larger.

[13] In addition to the pre-merger events described in footnote 12, I have included controls for the expansion of the Amarillo-to-Albuquerque pipeline in January 2002 and the opening of the Longhorn pipeline from Houston to El Paso in January 2005. The pattern of false positives when using Amarillo or Flagstaff as the control market is roughly the same as in Table 8.

Ultimately, El Paso remains the best available control city. While the placebo tests using Newey-West standard errors raise some concern about its overall validity as a control, the results using Prais-Winsten (especially while controlling for known events in the pre-merger period) are more reassuring. Since the actual merger effect estimates in Table 4 do not differ substantially across estimation method, at least for gasoline and diesel rack prices (while retail prices point in the same direction), El Paso appears to be a viable control market. In addition, since the result persists across the various subsamples of the data in Table 7, it seems fair to conclude that the El Paso results provide a reasonable estimate of the change in Albuquerque prices after the merger – including, potentially, effects from the output expansion at Giant.

The El Paso results suggest that the Western/Giant merger was associated with a decline in prices of about 3-4cpg at rack and 4-8cpg at retail. These estimated price declines fall short of the FTC expert's predicted 10cpg decline that would have occurred but for the merger, but are more consistent with the documentary evidence that suggested a 6-8cpg decline. The larger point, however, is that at trial both sides predicted prices would not change at all in the wake of the merger. Because prices did not fall to the levels envisioned by the FTC but for the merger, there remains some scope for inferring an anticompetitive price effect, but only narrowly. Moreover, because the 10 cpg effect is large by the standards of previous retrospective merger analysis in the refinery industry (see Table 1), it becomes even more difficult to see these results as consistent with an anticompetitive merger effect.

Lastly, in an attempt to understand the mechanism by which Albuquerque prices may have declined, I also compared firm-specific pricing at the Albuquerque rack pre- and post-merger. Table 9 lists the frequency at which each seller at the rack posted the lowest gasoline price in a given week (technically, the Thursday of that week) during each of the four years surrounding the merger. Table 10 does the same for diesel prices. I chose this specific comparison since, in some of its pre-trial filings, the FTC claimed that Giant was a "maverick" competitor.[14] However, analysis of the median difference between each firm's price and the lowest weekly price reveals similar trends. An important caveat is that this analysis excludes Holly's terminal, from which sellers tend to offer a discount to compensate for its location 40 miles east of Albuquerque.

Interestingly, Western was the lowest-priced rack seller of gasoline more often than was Giant in the two years before the merger (note that Giant's branded rack sales were under the Mustang brand, which Western subsequently acquired). Moreover, the combined number of weeks that Giant or Western was the low-priced rack seller of gasoline in the year preceding the merger (23) is substantially exceeded by the number of weeks that Western (including the Mustang brand) was the lowest-priced seller in the year afterward (30). In the second year after the merger, the frequency with which Western was the lowest-price seller drops considerably. As for diesel, while Western was not a rack seller of diesel prior to the merger, after taking over Giant's business it appears to be the lowest-priced rack seller about as (in)frequently as Giant was prior to the merger. Thus, this simple exercise does not appear to suggest any particular harm from the elimination of potentially disruptive behavior by Giant. Western appears to have priced about as aggressively as Giant did prior to the merger.

[14] See Opinion ¶ 458, and the FTC's Points and Authorities, p. 13. Recall that this connotation has a specific meaning in the context of section 2.1.5 of the DOJ/FTC *Horizontal Merger Guidelines*, in which a maverick is defined as "a firm that plays a disruptive role in the market to the benefit of customers."

5. Conclusions

During the same month as the Western/Giant trial, the Director of the FTC's Bureau of Economics testified in Congress regarding the Commission's "particularly vigilant" enforcement in the petroleum industry: "Unlike in other industries, the Commission has brought enforcement actions (and obtained merger relief in many cases) in petroleum markets that are only moderately concentrated."[15] Thus, the Western/Giant merger presents an interesting case for retrospective analysis due not only to the Commission's unsuccessful challenge, thereby creating a data point for a consummated merger that exceeded the agency's threshold for likely consumer harm, but also because that threshold is admittedly low for the petroleum industry. Such a policy seems worthy of scrutiny, even if this merger retrospective provides only a single observation regarding its effectiveness.

Moreover, this retrospective is also informative about the tools of prospective merger analysis. The evidence suggests that, if anything, Albuquerque prices declined in the wake of the merger, at least relative to El Paso. Both the Commission and the merging parties predicted that prices would remain unchanged after the merger, although the Commission's analysis did admit the possibility for prices to fall. The parties' assertion that pre-merger supply was highly (if not perfectly) elastic – that any additional production at Giant's refineries would simply be backed out by other suppliers (Opinion ¶ 442) – appears inconsistent with the observed decline in prices by several cents per gallon. For its part, the Commission may have underestimated the willingness of other suppliers to increase shipments to Albuquerque, which could be the source of the price decrease. Unfortunately, the firm-specific quantity data that might identify the source of any such increased production is proprietary. As was expected at the time of the merger (Opinion ¶ 121), Holly completed a 15,000 bpd expansion of its Navajo refinery in early 2009 – roughly the size same as Giant's output expansion – although that appears to be too late to explain the entirety of estimated price effect.

Finally, this study also provides some perspective on econometric methods in retrospective merger analysis. Estimating equation (1) by OLS with autocorrelation-consistent (Newey-West) standard errors may be overly precise, in terms of the frequency with which many of the placebo merger dummies were statistically significant, but appears less sensitive to small changes in the underlying data than does the explicit inclusion of an AR(1) error term estimated by Prais-Winsten. In this particular instance, Newey-West and Prais-Winsten produced sufficiently similar estimates that permit at least some tentative inference about the path of post-merger prices. However, the difficulties inherent in reaching even this simple conclusion highlight the challenges facing antitrust authorities in petroleum markets, in which relatively small yet hard to identify price effects of a few cents per gallon can lead to millions of dollars of consumer harm on an annual basis.

[15] See "Prepared Statement of the Federal Trade Commission: Petroleum Industry Consolidation" by Michael A. Salinger, May 23, 2007, available at http://www.ftc.gov/os/testimony/070523PetroleumIndustryConsolidation.pdf.

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Figure 1: Refined Products Supply to Albuquerque.

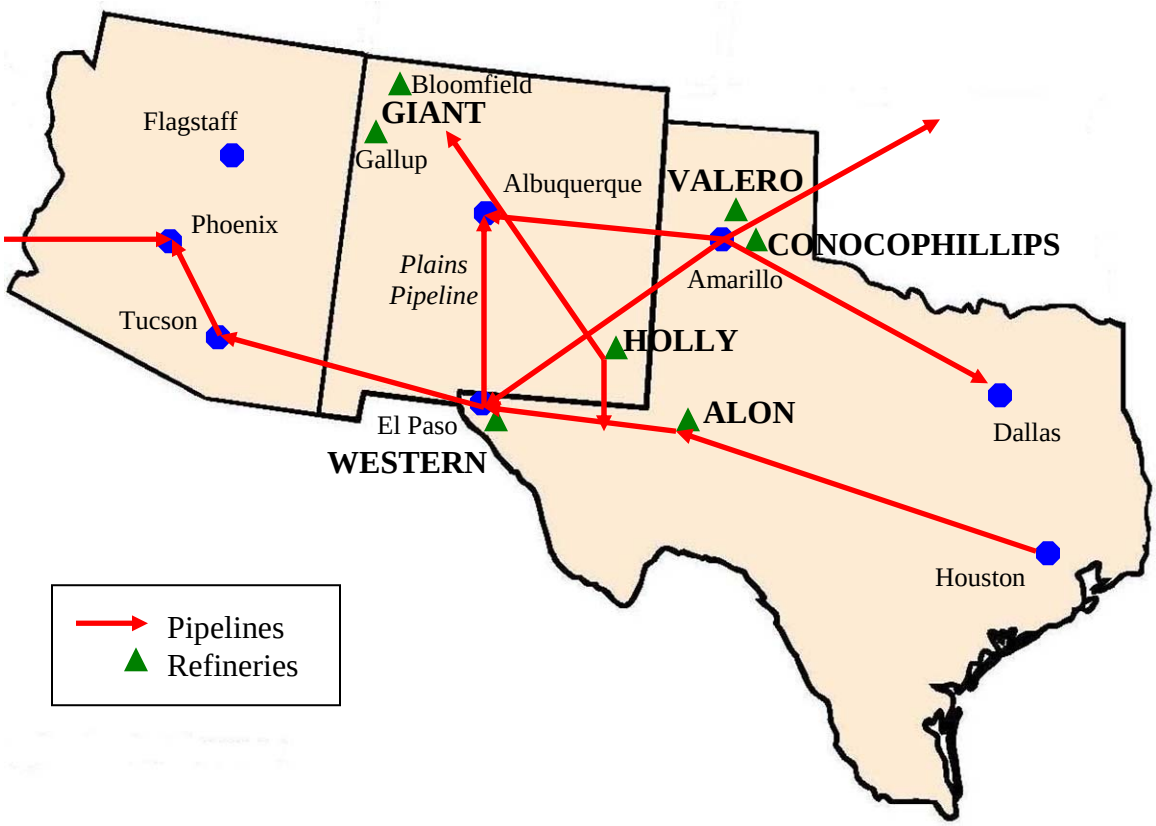
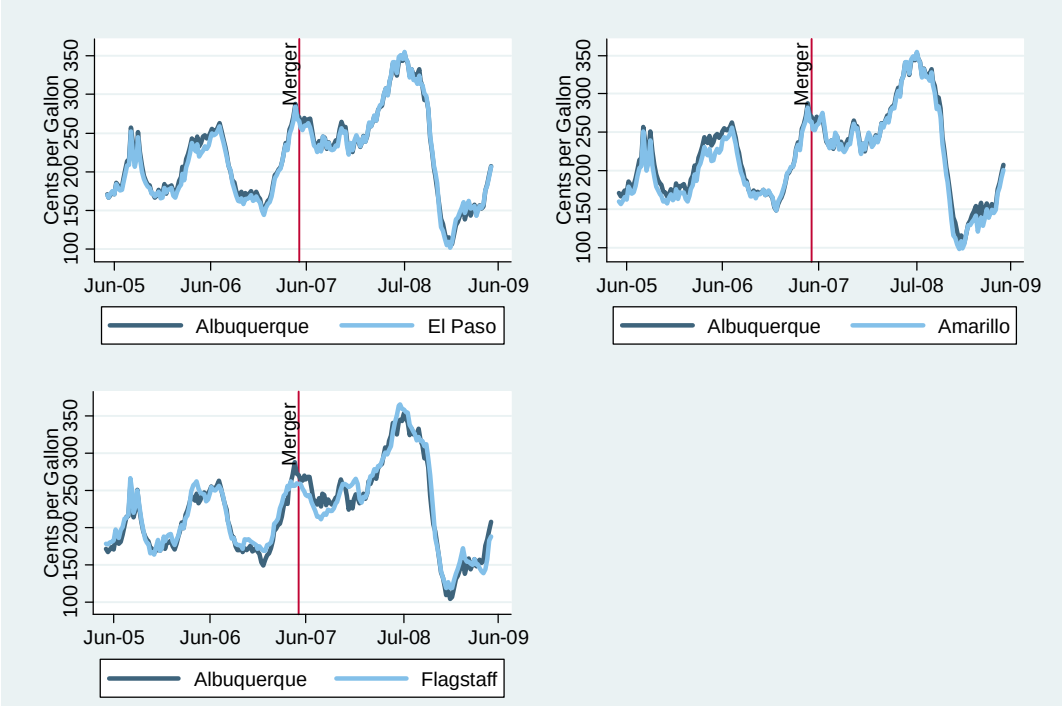
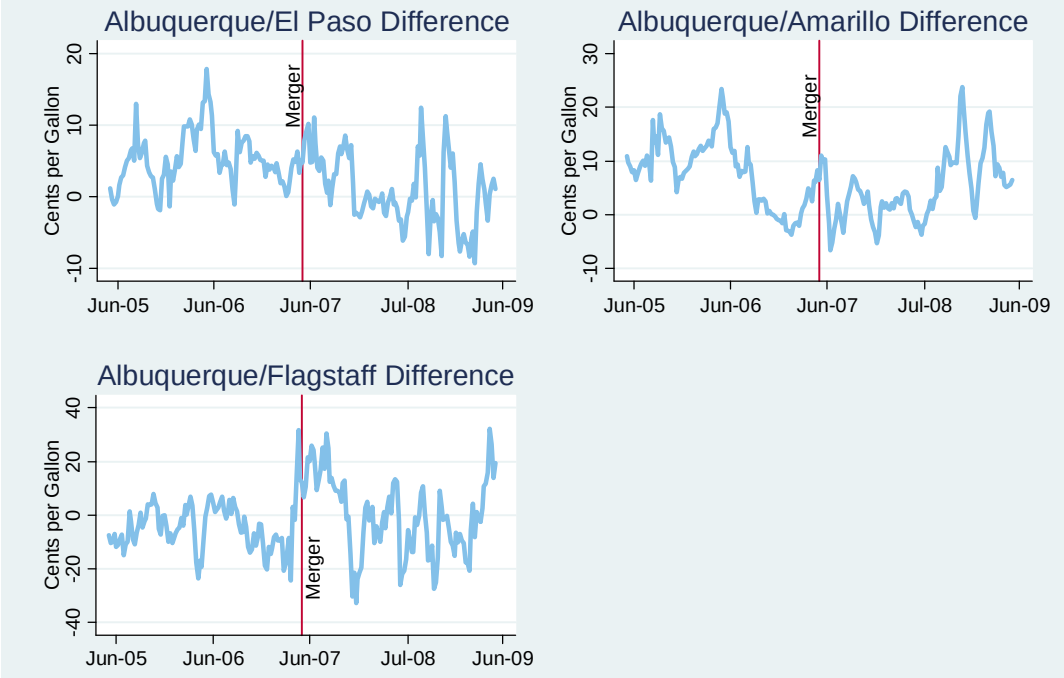


Figure 2: Weekly Gasoline Rack Price Levels in Albuquerque and Control Cities



Source: OPIS

Figure 3: Weekly Gasoline Rack Price Differentials between Albuquerque and Control Cities.



Source: OPIS

Figure 4: Autocorrelations and Partial Autocorrelations of Weekly Gasoline Rack Price Differentials.

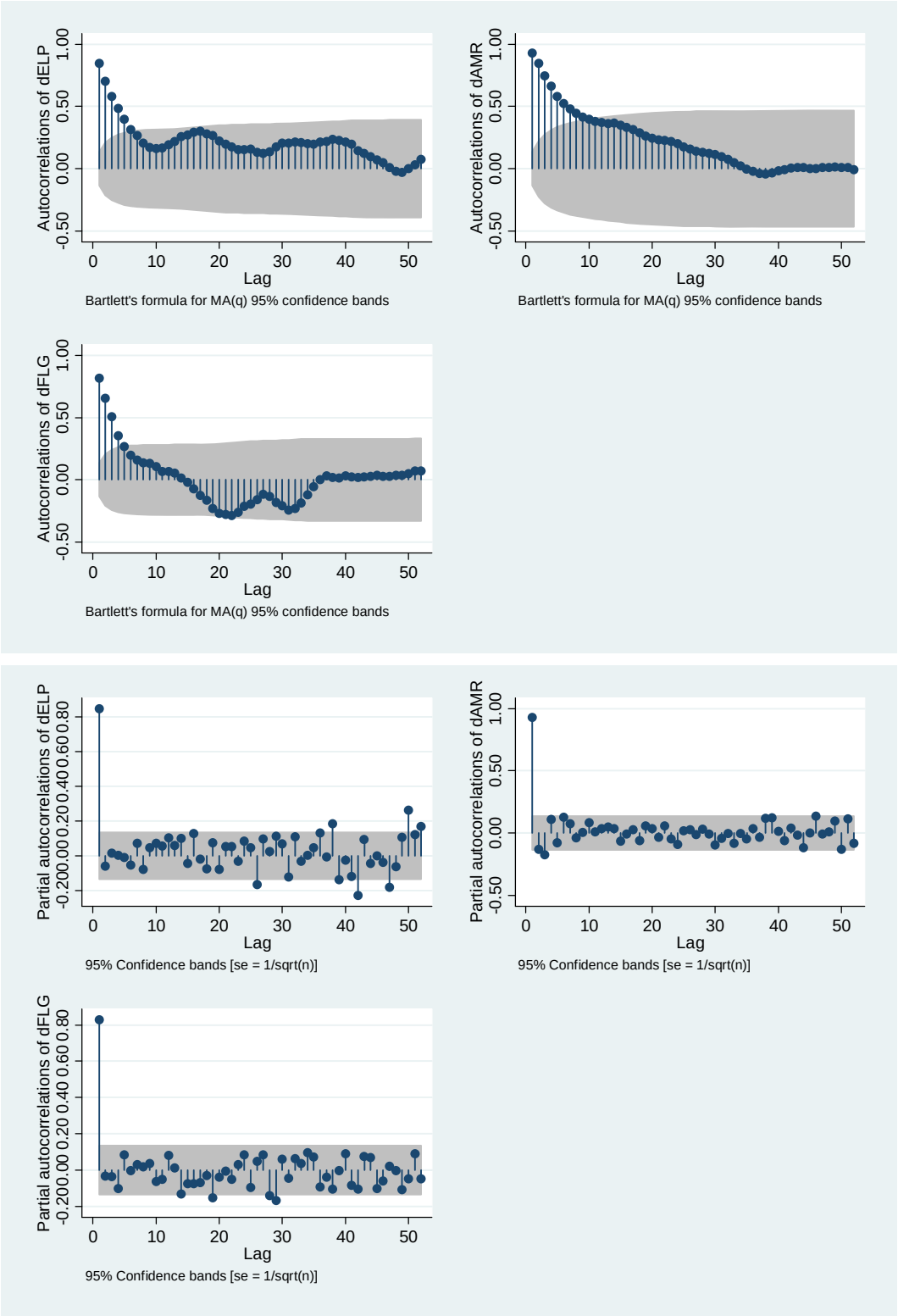


Figure 5: Monte Carlo Comparison of Newey-West and Prais-Winsten, N=200.

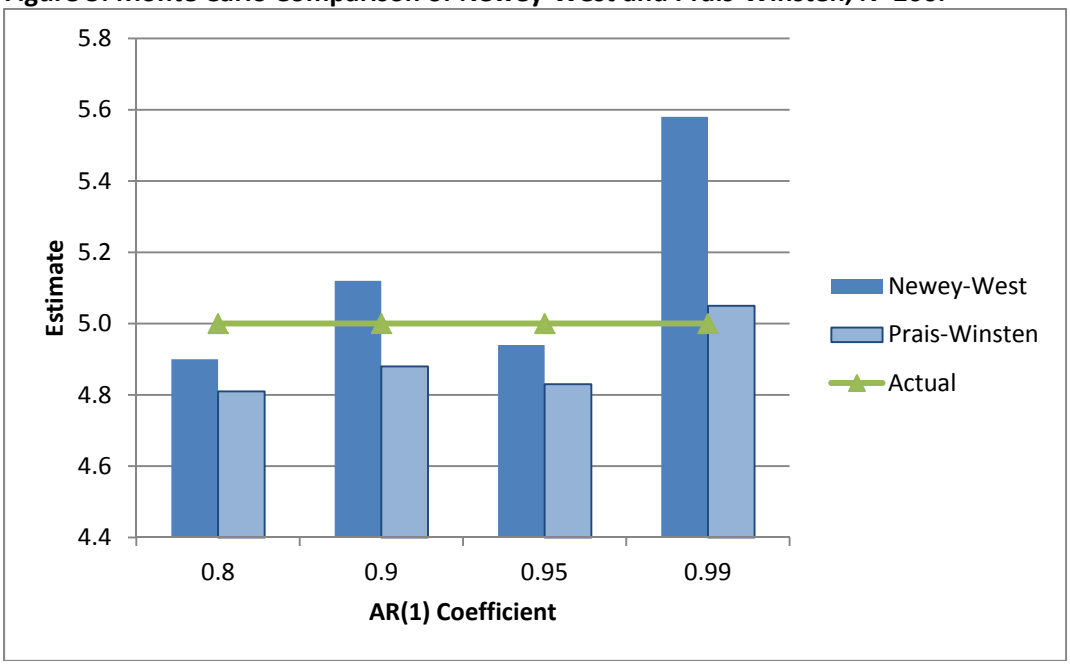


Figure 6: Placebo Merger Dummies, Rack Gasoline Prices Relative to El Paso, Newey-West Estimation.

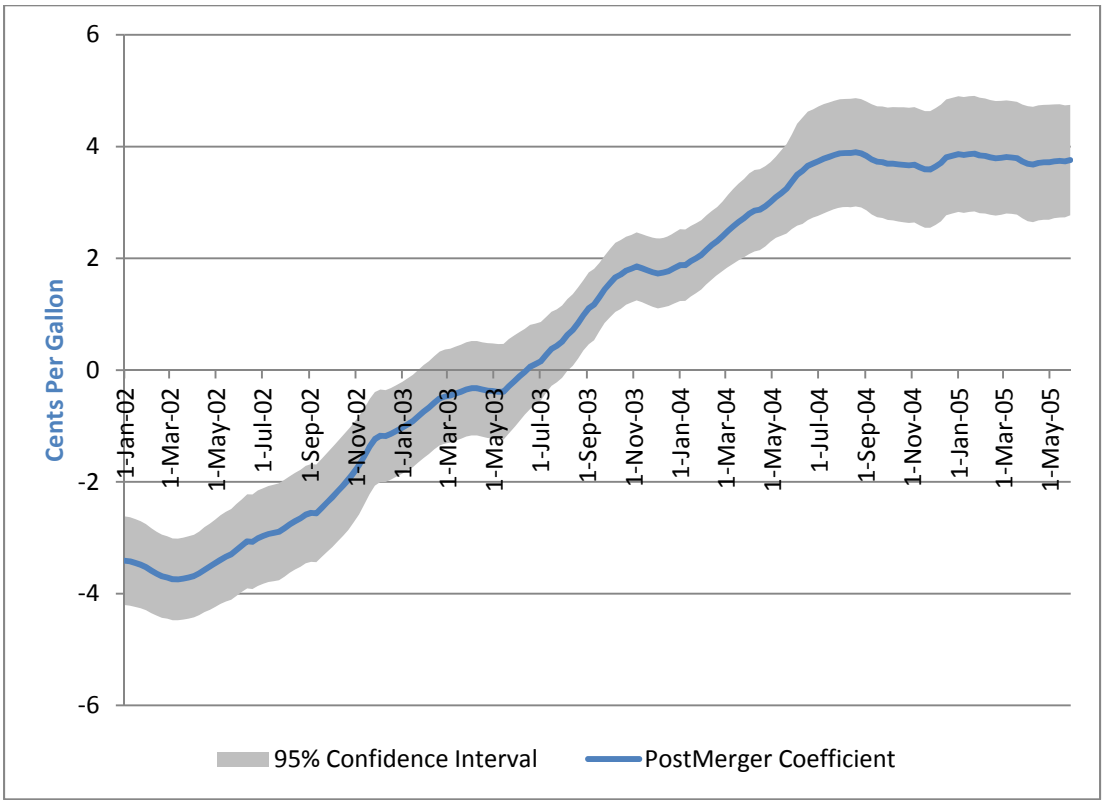


Figure 7: Placebo Merger Dummies, Rack Gasoline Prices Relative to El Paso, Prais-Winsten Estimation.

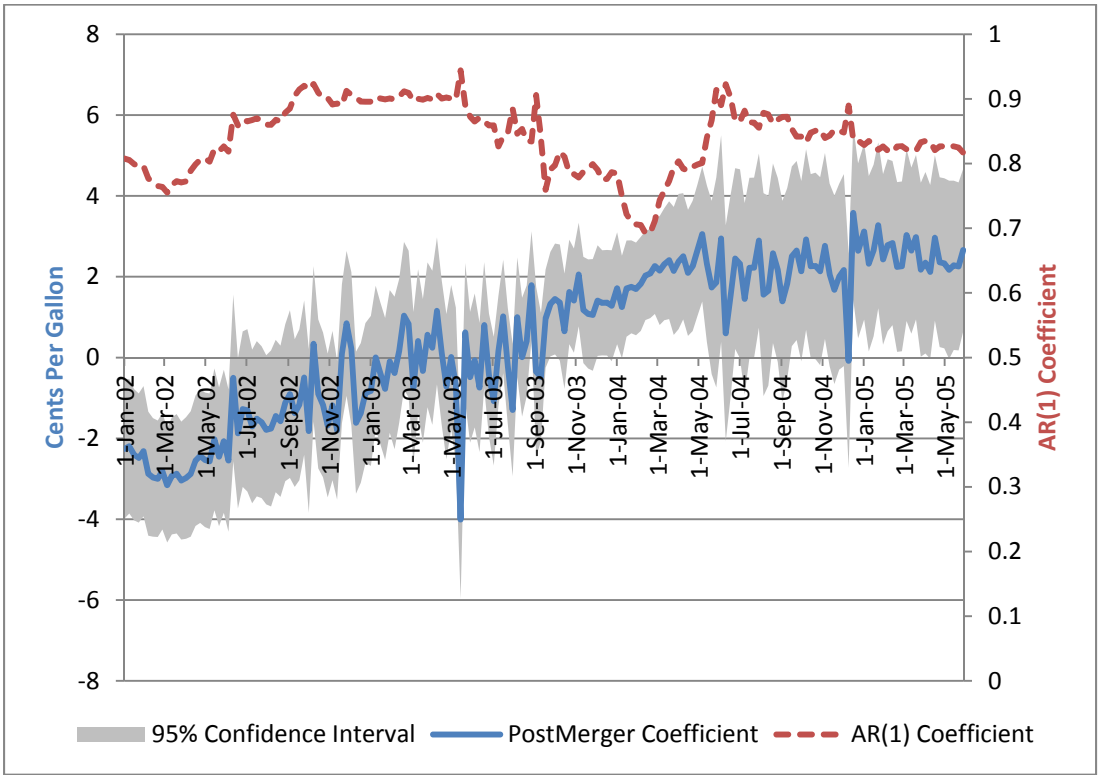


Table 1: Summary of Retrospective Studies of Refinery Mergers.

Transaction	Year	Retrospective Study	Estimated Price Effects (cents per gallon)
Tosco-Unocal	1997	GAO (2004)	CARB rack: branded +6.9, unbranded insignificant.
		Hastings & Gilbert (2005)	CARB rack: Tosco unbranded +0.4 where greater independent retail competition
		Hosken, Silvia & Taylor (2011)	CARB rack: branded -3.6 to -1.3, unbranded insignificant to +1.4. Retail: insignificant.
UDS-Total	1997	GAO (2004)	Conventional rack: branded -0.9, unbranded -1.3.
Marathon-Ashland	1998	GAO (2004)	Branded rack: conventional +0.7, RFG +0.7. Unbranded rack: conv. +0.4, RFG +0.9.
		Taylor & Hosken (2007)	Rack: +3.1 to +6.8 in two of four cities, others insignificant. Retail: insignificant.
Shell-Texaco I	1998	GAO (2004)	Branded rack: conv. +1.0, CARB -0.7. Unbranded rack: conv. +1.1, CARB insignificant.
Shell-Texaco II	1998	GAO (2004)	Branded rack: conv. -1.8, RFG -0.4. Unbranded rack: conv. -1.2, RFG insignificant.
BP-Amoco	1998	GAO (2004)	Conventional rack: branded +0.4, unbranded +1.0. RFG rack: insignificant.
MAP-UDS	1999	GAO (2004)	Conventional rack: branded +1.4, unbranded +2.6.
		Simpson & Taylor (2007)	Retail: insignificant.
Exxon-Mobil	1999	GAO (2004)	Branded rack: conventional +3.7, RFG +1.6. Unbranded rack: conv. +5.0, RFG +1.0.
UDS-Tosco	2000	Hosken, Silvia, & Taylor (2011)	CARB rack: branded -2.1 to -5.5; unbranded -2.4 to -5.7. Retail: insignificant. Note: This merger decreased market concentration.
Chevron-Texaco	2001	GAO (2009)	Rack: branded and unbranded insignificant.
Phillips-Tosco	2001	GAO (2009)	Rack: branded and unbranded insignificant.
Valero-UDS	2001	GAO (2009)	Rack: branded +1.0, unbranded insignificant.
Shell-Texaco	2002	GAO (2009)	Rack: branded and unbranded insignificant.
Phillips-Conoco	2002	GAO (2009)	Rack: branded -1.6, unbranded -1.1.
Premcor-Williams	2003	GAO (2009)	Rack: branded and unbranded insignificant.
Valero-Premcor	2005	GAO (2009)	Rack: branded insignificant, unbranded +1.1.
		Silvia & Taylor (2013)	Rack and retail: generally, no significant change.
Sunoco-El Paso	2004	Silvia & Taylor (2013)	Rack and retail: generally, no significant change.

Table 2: Comparison of Treatment and Control Cities, May-2005 to May-2009.

	Albuquerque	El Paso	Amarillo	Flagstaff
Avg rack price, pre-merger	203.8	198.6	195.7	208.0
Avg rack price, post-merger	236.6	235.8	231.7	236.9
# firms posting at rack	12	11	10	3
Population	515,107	602,672	185,743	59,280
Miles from Albuquerque	--	266	289	323
Primary refinery supply				
Giant refineries	X			X
Western refinery	X	X		
Conoco/Valero refineries	X	X	X	
Holly refinery	X	X		X
Pipelines from Gulf	*	X		

Sources: OPIS, U.S. Census Bureau.
*Note: In practice, the FTC argued that pro-rationing of the Plains pipeline limited the ability of Gulf Coast bulk suppliers to deliver product to Albuquerque.

Table 3: Standard Deviations of Gasoline Rack Prices Before and After 2008.

	sd(pABQ-pELP)	sd(pABQ-pAMR)	sd(pABQ-pFLG)
May-05 to Dec-07	3.7	6.4	12.1
Jan-08 to May-09	4.5	6.4	12.1

Table 4: Impact of Merger on Albuquerque Prices Relative to El Paso.

	Product	Gasoline		Diesel	
	Level	Rack	Retail	Rack	Retail
OLS	Merger Effect	-4.370***	-8.265***	-6.695***	-11.907***
	Newey-West s.e.	(0.751)	(1.239)	(0.830)	(1.425)
Prais-Winsten	Merger Effect	-2.779*	-3.879	-4.989***	-0.246
	s.e.	(1.546)	(2.816)	(1.421)	(3.452)
	AR(1)	0.804	0.894	0.763	0.949

Notes: N = 209. Each regression includes month fixed effects. Diesel regressions include dummy variables controlling for differences in the Albuquerque specification of diesel between March 2005 and December 2006. Asterisks indicate significance at the 90, 95, and 99 percent levels.

Table 5: Impact of Merger on Albuquerque Retail Prices Relative to Amarillo.

	Product Level	Gasoline Rack	Gasoline Retail	Diesel Rack	Diesel Retail
OLS	Merger Effect	-3.082***	-6.409***	0.478	-12.003***
	Newey-West s.e.	(1.161)	(1.522)	(1.876)	(1.193)
Prais-Winsten	Merger Effect	2.661	-3.267	-3.843	-8.767***
	s.e.	(2.466)	(3.403)	(2.603)	(2.462)
	AR(1)	0.941	0.861	0.868	0.811

Notes: N = 209. Each regression includes month fixed effects. Diesel regressions include dummy variables controlling for differences in the Albuquerque specification of diesel between March 2005 and December 2006. Asterisks indicate significance at the 90, 95, and 99 percent levels.

Table 6: Impact of Merger on Albuquerque Retail Prices Relative to Flagstaff.

	Product Level	Gasoline Rack	Gasoline Retail	Diesel Rack	Diesel Retail
OLS	Merger Effect	3.869*	0.327	-8.518***	-3.102*
	Newey-West s.e.	(2.023)	(2.025)	(3.057)	(1.615)
Prais-Winsten	Merger Effect	3.574	0.800	-2.093	-2.290
	s.e.	(3.950)	(4.516)	(4.740)	(3.366)
	AR(1)	0.794	0.908	0.813	0.863

Notes: N = 209. Each regression includes month fixed effects. Diesel regressions include dummy variables controlling for differences in the Albuquerque specification of diesel between March 2005 and December 2006. Asterisks indicate significance at the 90, 95, and 99 percent levels.

Table 7: Robustness of Merger Impact on Albuquerque/El Paso Gasoline Rack Price Differential across Various Subsamples.

	Baseline, 2005-2009	Drop 1st Year Post-merger	Event Dummies	All Data, 2000-2009	Monthly Data, 2005-2009
Merger Effect	-4.370***	-5.738***	-4.693***	-2.139***	-4.266***
Newey-West s.e.	(0.751)	(0.745)	(1.732)	(0.610)	(1.317)
N	209	157	209	490	49

Notes: Each regression includes month fixed effects. Asterisks indicate significance at the 90, 95, and 99 percent levels.

Table 8: Frequency with which Confidence Interval on Placebo Merger Dummies Includes Zero.

Estimation Method	Newey-West		Prais-Winsten	
Include controls?	No	Yes	No	Yes
Gasoline Rack	16%	34%	53%	81%
Gasoline Retail	23%	45%	59%	94%
Diesel Rack	36%	20%	97%	97%
Diesel Retail	31%	44%	84%	95%

Notes: Using El Paso as the control city. Each entry refers to the percent of regressions over 178 four-year subsamples of the weekly data from January 2000 to May 2005.

Table 9: Frequency of Having Lowest (Weekly) Rack Gasoline Price.

Firm	Brand Indicator	Jun-05 to May-06	Jun-06 to May-07	Jun-07 to May-08	Jun-08 to May-09
COP	Branded	0	4	2	2
COP	Unbranded	8	3	6	1
Chevron	Branded	4	5	1	8
DiamondShamrock	Branded	0			
Exxon	Branded	3	3	1	1
Giant	Unbranded	6	5		
Mustang	Branded	0	2	8	
Shamrock	Branded	5	3	2	2
Shell	Branded	4	2	0	0
Shell	Unbranded				10
Sinclair	Branded	0	4	1	3
Texaco	Branded	3	0	1	8
ValeroDS	Branded	0	0	0	0
Valero	Unbranded	19	7	13	22
Western	Unbranded	3	16	22	3

Notes: Excludes Fina (Alon) and Navajo (Holly). Mustang is a retail brand owned by Giant and acquired by Western. Totals may sum to more than 52 weeks due to ties.

Table 10: Frequency of Having Lowest (Weekly) Rack Diesel Price.

Firm	Brand Indicator	Jun-05 to May-06	Jun-06 to May-07	Jun-07 to May-08	Jun-08 to May-09
COP	Branded	1	15	1	2
COP	Unbranded	18	9	10	16
Chevron	Branded	8	12	6	3
Citgo	Branded	0	0		
DiamondShamrock	Branded	0			
Exxon	Branded	0	0	0	1
Giant	Unbranded	2	3		
Mustang	Branded	2	1	2	
Shamrock	Branded	0	0	0	0
Shell	Branded	0	1	0	1
Shell	Unbranded		1	13	13
Sinclair	Branded	0	2	3	0
Texaco	Branded	10	1	2	3
ValeroDS	Branded	0	0	0	0
Valero	Unbranded	14	8	17	14
Western	Unbranded			2	2

Notes: Excludes Fina (Alon) and Navajo (Holly). Mustang is a retail brand owned by Giant and acquired by Western. Totals may sum to more than 52 weeks due to ties.