Preliminary: An Empirical Analysis of Mergers Between Nonprofit and For-Profit Firms: an Application in the Hospital Industry

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1 Introduction

Predictions for the effects on prices and profits of mergers between for-profit firms are well founded in both the theoretical and empirical literature. No clear predictions exist for mergers involving nonprofit firms. In this paper I provide evidence that merging nonprofit firms behave similarly to for-profit firms in exploiting market power to increase prices and profits.

Empirical research on the topic of hospital mergers has generated ambiguous results regarding the effects of mergers on various measures of hospital financial performance. Typically, research has focused on whether merging hospitals reduced costs or raised prices. However, merger effects in these studies are most commonly assessed by including a dummy variable equal to one for a merging hospital. Dranove and Lindrooth (2003) and Dafny (2009) note that the prevalence of mixed empirical results is due to bias introduced by endogeneity between the merger decision and outcome measures. Both papers provided empirical strategies to control for this endogeneity.

My empirical analysis improves upon the hospital merger literature in several important ways. For the first time, I separately identify the short run and long run effects of nonprofit mergers. I am able to do this because I have elongated the panel of observable data to include the years 2000 until 2009. This is an important improvement because I only identify significant effects of mergers on prices and profits five or more years after a merger has occurred. Past empirical research, which generally only includes observations until the year 2000, was at best only able to identify short run effects. This suggests that previous ambiguous empirical results may be attributed to identification of insignificant short run results.

My analysis controls for endogeneity arising from selection on observable characteristics by reweighing hospitals that did not merger to balance their observable characteristics with those hospitals that did merge. This represents an improvement upon the matching methodology implemented by Dranove and Lindrooth (2003). In addition, I isolate the specific merger effect for nonprofit hospitals, and for nonprofit hospitals

merging with other nonprofit hospitals. Previous empirical literature has not considered the differing effects of the types of transitions in which a hospital participates. Finally, I am the first to analyze the effects of mergers on "net income", defined as hospital profits less contractual discounts offered to insurers.

The uncertainty surrounding the effects of nonprofit mergers is particularly relevant in the hospital industry, which is composed of approximately 60% nonprofit firms and experienced intense consolidation in the 1990s. This merger wave is believed to be a reaction to the introduction of the Prospective Payment System (PPS) in1984. The PPS reimbursed hospitals and doctors on a fee-for-service basis, replacing the previously used cost-recovery reimbursement methods. Hospital care accounted for 5.9% of GSP in 2009 and is larger than all manufacturing sectors except for the food and beverage and the tobacco industries. The magnitude of the size of the hospital industry coupled with the fact that almost all hospital mergers have involved at least one nonprofit firm underscores the importance of understanding the implications of nonprofit mergers in this sector.

I find that the effect of a hospital merger is to raise prices by as much as $500 per discharge and increase profits by as much as $3.7 million. Moreover, for nonprofit hospitals participating in a merger, prices increase by as much as $580 and profits increase by as much as $2.97 million. This provides empirical evidence that nonprofit hospitals respond to increased market power by raising prices and profits.

The paper will progress as follows. Section 2 reviews the previous literature on merger effects in the hospital industry. Section 3 contains an overview of the hospital industry and associated peculiarities of merger analysis. Seciton 4 describes the various sources of data used in my analysis. Section 5outlines the details of the methodology implemented. Section 6 presents empirical results.

2 Literature Review

Previous research on hospital mergers and acquisitions has focused on how hospital mergers affect performance measures related to both financial and health measures.

There has been a recent public policy focus on the quality of health care, however the interaction between hospital mergers and health care quality is underdeveloped. Ho and Hamilton (2000) examined the effect of mergers and acquisitions on three key patient outcome measures: inpatient mortality, readmission rates, and the early discharge of newborns (within 48 hours of birth). They found that mergers had no measurable impact on inpatient mortality, but is associated with an increase in readmission rates and in early newborn discharges. However, this study can only hope identify correlation between merger events and health outcomes because there is no attempt to model any scientific reasons for differences in health outcomes.

Given that the catalyst that drove the M&A wave of the 90s was cost reduction, it is not surprising that

several authors ask whether hospital mergers lead to lower costs. Separately identifying merger effects on costs between for-profit and non-profit hospitals, Spang et al. (2009) find that non-profit hospital costs and prices were not different than the average hospital either before or after consolidation. However, for-profit consolidating hospitals had higher costs prior to consolidation and did have lower costs than the average hospital.

Dranove and Lindrooth (2003) explores the effects of consolidation on costs, paying particular attention to whether the consolidation was a result of a merger, defined as two independent hospitals joining under one facilities license, or an acquisition, defined as one hospital joining an existing hospital system but retaining its own facility license. The econometric approach was to estimate a reduced-form cost equation in a difference-in-difference style, matching merging hospitals to "pseudo-merging" (non-merging) hospitals based on a propensity score. They find that the median system acquisition is not significantly associated with any cost reduction, however the median merger is associated with a significant cost savings of 14%.

Aside from cost reduction, the main focus of any merger analysis is on the effect that consolidation may have on prevailing prices. Lynk (1995) specifically tests the validity of the assumption that non-profit hospitals are equally motivated to exercise market power in the form of higher prices. This was an important paper from a legal stand-point since this has been referenced as justification by jurists for their acceptance of not-for-profit mergers Keeler et al. (1999) . Using OSHPD discharge data in conjunction with OSHPD hospital financial data in 1989, Lynk finds that non-profit hospitals have statistically significant lower list and net prices than their for-profit counterparts, suggesting that indeed, for-profit hospitals do behave differently than non-profit hospitals. However, Dranove and Ludwick (1999) later argue that Lynk's method suffers from endogeneity problems, leading to biased results. Other authors challenged Lynk's results because they were unable to replicate them on alternative samples. Keeler et al. (1999), seeking to improve upon Lynk's analysis methodologically, find evidence that price has played an increasingly important role in the nature of competition. The authors find that nonprofits set higher prices in less concentrated markets in comparison to their pricing behavior in more concentrated markets.

An important case study analysis was preformed by Vita and Sacher (2001) regarding the merger of Dominican Santa Cruz's acquisition of it's rival, AMI community hospital.. In this paper, the authors exploit the fact that two non-profit hospitals merged without triggering review by DOJ/FTC due to the small size of the transaction, even though the HHI increased by 1700 points to 6350 post merger. This case study allows the authors to examine the ex-post consequences of the merger. The authors preform reduced form price regression including variables such as hospital case mix index to control for the severity of patients admitted, as well as various hospital and market characteristics. In addition, they add in "peer controls" to implement a difference-in-difference analysis. Robust to all of these specifications is the result

that Dominican raised prices in the aftermath of the transaction, as did it's closest rival, Watsonville. Given that these are non-profit hospitals, the authors extend this to suggest that non-profit hospitals do behave like for-profit hospitals.

All of the previously mentioned studies asses the effect of mergers on aggregate price for a hospital. Krishnan (2001) takes a unique approach in analyzing the effects of mergers on DRG (Diagnosis-Related Group) level prices, rather than on hospital price. A DRG is a classification of diagnosis and procedure defined by the Center for Medicare and Medicaid Services, used to pay hospitals. Krishnan does not identify differences in behavior between nonprofit and for-profit firms. Krishnan looks at the effect of mergers within hospital DRGs, between hospital DRGs, and does a DRG analysis for all hospitals. He finds that robust to the state, merging hospitals used their increased market share in individual DRGs to raise prices for those DRGs. In Ohio, regardless of mergers, he found that an increase in DRG level market share was associated with increased prices, and in California he found that acquired hospitals increase prices to a greater extent in DRGs where they gained market share.

Gaynor and Vogt (2003) analyze of mergers addressed via a structural demand model, rather than through a reduced form manner. Here, the authors develop a BLP-like model to estimate demand, and then to use this demand model to simulate the effect of a merger. Their specification of the production side allowed for a different objective function for non-profit vs for-profit firms. They find that non-profit hospitals set lower prices, but have higher mark-ups than for-profit hospitals. The authors use the demand estimation to simulate the effects of a Texas hospital merger. Here, the particulars of the merger are interesting in that it was approved but required one divestiture. The merger simulation is able to predict that without the divestment there would have been a strong price effect.

In contrast to the previous literature, Dafny (2009) addressing the hypothesis through the scope of a rival's merger on own-firm prices. In this paper, Dafny makes use of a unique price measure, defined as the case-mix adjusted revenue per-patient discharge. Because one can construct this price from national hospital financial data, Dafny's measure enables a researcher to consider prices for all observable hospitals. To control for endogeneity, Dafny uses the distance between two rival hospitals to instrument for mergers as she finds that hospitals are more likely to merge the closer they are geographically. Here, with IV estimation of price regressions she finds substantial evidence of post-merger increases in prices, and finds that these increases were greater among hospitals that were closer to the merging parties.

The literature of the past two decades has identified the effects of mergers and the behavioral differences of nonprofit firms using reduced form regressions with the inclusion of a singular dummy variable identifying merging hospitals. Because the merger wave of the 90s is a recent historical event, the past literature is restricted in its ability to only identify the short-run effects of hospital mergers. Finally, save for the analysis

of Dranove and Lindrooth (2003) and Dafny (2009), the literature all but ignores issues of endogeneity between outcome measures and the hospital's propensity to merge. My paper will address all of these issues.

Methodologically, I build upon the work of Dranove and Lindrooth (2003) in implementing a reweighing matching scheme to control for merger selection based on observable hospital and market characteristics. It is important to note that Dranove and Lindrooth have not implemented a matching in the tradition of the program evaluation literature. In particular, the authors have exploited the methodology to identify a suitable comparison group, but they have not followed through by computing the appropriate weighted average treatment effect statistic, as the literature prescribes. In addition, Dranove and Lindrooth do not offer evidence that their propensity score specification achieves the balance necessary to satisfy one of two fundamental requirements of the matching methodology: the assumption of unconfoundedness. If this assumption is not satisfied, the estimates are known to be biased.

I depart from past literature in implementing an empirical strategy which identifies the effects of merger through a series of event dummies indicating the number of years before and after the merger has occurred (Jacobson et al., 1993). I observe merging hospitals up to five years before and up to nine years after the merger occurred. The panel structure of the hospital data allows me to separate the short run effects of merger from the long run effects, something that has not yet been seen in the literature. I analyze the effects of a merger on three financial outcome measures: cost, profit, and price. My analysis of cost effects will update the literature with an estimate of merger effects that controls for selection bias. To date, there has not been an analysis of the effects of a merger on hospital profit. Finally, I utilize Dafny's price measure to assess the effects of merger on national hospital prices. Each of these analyses will provide evidence as to the effectiveness of mergers in reducing costs and the ability of hospitals to translate increases in market power to increased profitability and higher prices.

3 Background

Hospital care in the United States is a major industry. According to the U.S. Census, spending on hospital care in 2009 was $759.1 billion, or 5.2% of GDP. In response to the dramatic rise in health care spending in the 90s, the landscape of political discourse has turned national focus on toward the trajectory of health care prices and costs. Historically, the hospital industry has been dominated by the nonprofit corporate form. In exchange for access to tax preferred financing and relief from income and property taxes, nonprofit firms face several legal restrictions. They cannot distribute accounting profit to equity holders and are required to promote a public purpose, although the provision of health care implicitly fulfills this requirement according

to federal IRS requirements.[1]

The hospital industry features a unique attribute in comparison to other service industries in the United States: it is largely nonprofit. Of approximately 4,000 Medicare certified hospitals in the U.S. 60% are nonprofit, 20% are for-profit, and 20% are government owned, and this industry composition is roughly constant over time. Moreover, most mergers in the hospital industry involve at least one nonprofit firm, yet there is no theoretical consensus as to their objective function and associated utility-maximizing behavior due to mergers. As a result, the typical merger analysis, which was developed for merging for-profit hospitals, is not suited for analysis of merging nonprofit firms.

Although the evidence regarding financial differences between nonprofit, for-profit, and public hospitals is mixed, Horwitz (2003) demonstrates that the mix of services provided highlights important behavioral differences. In particular, Horwitz identifies government hospitals as the "hospitals of last resort", providing unprofitable services needed by the poor and uninsured like psychiatric emergency care and burn center treatments. Quite uncontroversially, for-profit hospitals are found to be most likely to provide profitable services like cardiac care and diagnostic imaging. And finally, nonprofit hospitals are a mix of the two; they are less likely to respond to financial pressures but are also less likely to offer unprofitable services.

In the 90s, more than 900 mergers and acquisitions occurred in the hospital industry. The impetus of this merger wave is generally believed to be the introduction of the Prospective Payment System in 1984. Prior to 1984, hospitals were reimbursed on a cost-plus basis. However, the PPS paid doctors and hospitals a fixed fee for services preformed, shifting the risk of profit loss from Medicare to hospitals. In only half a decade the margins on services for Medicaid patients were more often than not negative; hospitals, faced with losses and dwindling capacity utilization rate (typically about 60%) began looking for ways to cut costs and increase efficiency. The 1990s M&A wave is understood to be a reaction to the then increasingly bleak outlook on hospital profitability and viability. The outcome of the 90s hospital mergers was a structural shift in market concentration. In 1987, the mean Herfindahl-Herschmann Index (HHI) was 2,430, and by 2006, the mean HHI has risen to 3,161. As a point of reference, the Department of Justice classifies markets as "highly concentrated" when the HHI is $\geq$ 2,500 (Gaynor and Town (2011)).

The legal justification for approving many of the mergers between hospitals has been in reference to their nonprofit status. As an example, in September 1996, a merger involving two of the largest nonprofit hospitals in Grand Rapids, MI was sanctioned by the district judge with the justification that the merging hospitals were unlikely to raise their prices even in the face of increased market concentration, citing the econometric analysis preformed by Lynk (1995). Eventually, the FTC did attempt to take up these cases retrospectively through price analyses. However, these endeavors suffered a major setback in 2007 when,

[1] For a detailed discussion of nonprofit structure, see Sloan (2000)

despite the findings that the merger of two nonprofit hospitals near Chicago, IL led to increased price "far above price increases of other comparable hospitals," an order of divestiture was overturned ((Keeler et al., 1999)). In fact, the 1990s marked a unusual pattern of losses for federal antitrust authorities in cases of hospital mergers, and these losses are generally attributed to the underlying belief that nonprofit firms are not susceptible to traditional economic theory of oligopoly and market power.[2]

Anecdotal evidence only confirms the suspicion of the antitrust authorities that nonprofit hospitals respond to market concentration with increased prices. Consider the system of hospitals owned by Sutter Health Co., located in the San-Francisco-to-Sacramento region. Sutter Health has substantial market power in the region, accounting for over a third of the market, and it is able to sustain prices between 40 and 70 % higher than its rival. Although Sutter is operated under the classification "nonprofit," it was among the most profitable hospital groups in the U.S. in 2009, earning a 5.9% operating margin with revenues of $8.8 billion. One should note that a margin of 5.9% is more than 70% higher than the median operating margin for all nonprofit hospital systems in 2009. Further, Peter V. Lee, the director for health-care-delivery-reform in the U.S. Department of Health and Human Services, claimed of Sutter that, "instead of leveraging its system to be more cost- effective, we've seen Sutter leveraging its system for monopoly pricing." (Waldman, 2010)

Sutter Health, which has been able to successfully acquire over 30 hospitals in the past 20 years, did face legal opposition in 1999 when the state's Attorney General sued in an attempt to block the acquisition of Summit Hospital in Oakland, California. However, the judge ruled against the Attorney General, claiming that there was sufficient competitive pressure to prevent Sutter from raising prices. Contrary to the judge's suspicions, an FTC staff study revealed that when looking at Sutter's prices over a range of insurers in this region two years after the merger, one would find that they have raised by as much as 72%. (Waldman, 2010)

4 Data

4.1 Hospital Data

Annual hospital-level data are from the hospital cost reports available through the Centers for Medicaid & Medicare Services (CMS) and the Healthcare Cost Report Information System (HCRIS) for the universe of Medicare certified hospitals. The cost reports contain information on facility characteristics, utilization data, and finances. [Define who is in HCRIS] I have compiled these annual reports into a twenty year panel of hospital data for the years 1990 through 2009. With this data I limit my attention to all hospitals that

[2]For a thorough summary of the antitrust peculiarities in the hospital industry, see (Gaynor and Town, 2011)

entered the panel before 1994. This full sample includes approximately 4,500 hospitals. However, considering only those hospitals with non missing data for data included in the analysis, my sample reduces to about 3,950 hospitals and 61,000 observations. In this sample, roughly 65% of hospitals remain open throughout the duration of the panel. The composition of the market between nonprofit, for-profit, and government hospitals is 60%, 10%, and 30% respectively. For a summary of pre-merger HCRIS variables measured in 1993, see Table 1. For a summary of post-merger HCRIS variables measured in 2005, see Table 2.

I consider separately two different measures of profit. The first is accounting profit, measured as the difference between total patient revenues and total costs. The second is net income, which includes other sources of hospital revenues, such as sales from cafeterias, gift shops, and investment income, and excludes contractual discounts awarded to insurers. Because net income measures accurate reflect the price negotiation process between providers and insurers, I will eventually focus on the effect of mergers on net income. In comparing the difference between accounting profit and net income, it can be seen that contractual discounts are sizable.

In general, nonprofit hospitals tend to be bigger than for-profit and government hospitals, both by comparing measures of physical size (hospital beds, discharges) and through financial measures such as Revenue and Costs. It is notable that in 1993, there was no statistical difference in net income between for-profit and nonprofit hospitals, however by 2005 the net income for nonprofits is significantly larger. If if one were to consider the Medicare Share of Discharges, government hospitals tend to have the largest proportion of Medicare discharges, and for-profit hospitals have the smallest proportion.

In calculating price, I follow the methodology suggested by Dafny (2009), which was developed with the help of CMS. The hospital-level price is an inpatient revenue per case-mix adjusted discharge.[3] This price measure is net of any contractual discounts awarded to privately insured patients, and excludes Medicare payments and discharges. This measure of price then reflects the revenue per discharge for privately insured and uninsured patients only.

Looking at the price data, which can be seen in Fig. (1), prices are roughly steady in the 90s, however, in the 2000's there is a noticeable upward trend. Fig. (1) breaks down the price data between the three different types of hospitals, and also includes the price trend for transacting hospitals. Trends for all non-transacting hospitals follows the trend for nonprofit hospitals very closely and therefore has been excluded. At first glance it seems the the trend of transacting hospital prices follows that of all non-transacting hospitals save for a level shift.

Finally, the annual trends in hospital net income can be seen in Fig. (3). All hospitals experience an increase in net income in the 2000s, however the trend for transacting hospitals appears much more dramatic

[3]Insert Actual Formula

than for non-transacting hospitals.

4.2 Market Definition

In this paper I define a hospital market according the Hospital Referral Region (HRR) defined by the Dartmouth Atlas of HealthCare. Each of the 307 HRR represents a regional health care market for tertiary medical care that generally requires a referral. The regions are defined by determining where patients are referred for major cardiovascular or neruosurgical care.

The annual average market composition can be seen in Fig. (**??**) and is roughly constant across time. Moreover, breaking down the market composition between urban and rural areas, one notices that rural markets have more government hospitals and fewer nonprofit hospitals than do urban markets. That rural markets have more hospitals is indicative of the fact that rural markets encompass larger geographic areas, as hospital referral regions are designed to encompass the patient referral region.

Given the above market definitions, I have calculated the distance between a hospital and its closest within-market neighbor. My measure of distance is an improvement upon past measures of distance seen in the literature, which are typically calculated "as the crow flies" based on exact identification of the latitude and longitude at which a particular hospital resides. In comparison, I have calculated the distance defined by the shortest driving time between two hospitals as is mapped by Google. This provides a more realistic description of the spatial location of hospitals.

4.3 Market Demographics

Demographic characteristics of the market in which a hospital operates affects the costs, pricing behavior and merging likelihood of a hospital. To this end, I have enriched the HCRIS data with county-level demographic statistics available in the Area Resource File, which is a centralized database of health-care related demographic variables compiled by the U.S. Department of Health and Human Services. Because these data are available at the county level, I am able to assign demographic data to hospitals based on the county in which they are located. A summary is shown in Table 3 For example, For-profit hospitals are located in more populous counties than nonprofit or government hospitals. Government hospitals are located in the least populous, poorest counties. Looking to driving time between hospitals, not only are for-profit hospitals located in more populous counties, but they also tend to be closer to a neighboring hospital than do government hospitals.

4.4 Transaction Data

A comprehensive list of mergers and acquisitions in the health care industry is compiled annually in Irving Levin Associates' Health Care Acquisition Reports. These reports contain detailed information about all hospital transactions occurring in a given year. The merger data can be found in the Health Care Acquisition Reports for the years 1996 through 2001. For these years, I have a complete accounting of the mergers that took place. Due to data limitations, however, I do not observe mergers from this data source in any other years.

I have classified the type of transaction that occurred based on the profit status of the hospitals involved. For example, if two non-profit hospitals merged, then the merger is classified as "N+N". The types of transactions to have occurred in each of the years 1996 through 2006 are shown in Table 4. Here, it can be seen that almost all transactions occurring in any given year involve at least one non-profit hospital, and even further it is most likely that the transaction occurs between two non-profit hospitals. Then, merger effects identified in this analysis pertain primarily to nonprofit firms. The merger wave is traditionally described to have occurred through the 90s, and indeed it can be seen that as we get into the late 90s and early 00s, the number of transactions is decreasing.

It is important to consider how the distribution of inputs differs between merging and non-merging hospitals. These variables measure in the pre-merger year of 1993 are shown in Table 5. Mean differences in inputs help to develop a model to predict which hospitals are merging which will later be useful in any matching methodology implemented. I have tested for differences in means between Merging and Non-Merging hospitals for all variables, and the difference is always significant at the 1% level. Along all measures of size, merging hospitals tend to be bigger than non-merging hospitals. This could be driven by the fact that almost all transactions involve at least one nonprofit hospital, and as Table 1 suggests, nonprofit hospitals are the largest group of hospitals as measured by all input variables.

I have here introduced the Liability to Asset Ratio as a measure of financial distress. The definition of liabilities includes both current liabilities and long term liabilities, as defined by HCRIS[4]. Not surprisingly, the liability to asset ratio is larger for merging hospitals, supporting the hypothesis that the merger decision is related to financial distress.

As a complement to hospital-level differences between transacting and non-transacting hospitals, the variation of demographic variables according to whether or not a transaction occurred can be seen in Table 6. Specifically, Table 6 considers the demographic variation for markets in which a transaction occurred. It can be seen here that at the market level, there is no statistical difference in the percent of the population

[4]Current Liabilities include payroll and accounts payable and Longterm Liabilities include mortgage payments and loans

that is uninsured, and there is marginal statical differentiation in the percentage of the population in poverty. However, the markets with a transaction tend to be bigger on measures of size like population and total market beds, but perhaps more spatially condensed based on the average driving time between hospitals.

Returning back to Fig. (1) Fig. (2), and Fig. (3), consider the area for which I can observer mergers, 1996 through 2001. The divergent upward trends start around the year 2000. There is at least a correlation between the years after the transactions have taken place and the upward trend. However, this upward trend occurs for both transacting and non transacting hospitals. Moreover, transactions occurred in 105 markets, or 34% of all markets, and in 51% of the markets affected by a transaction, more than one transaction had occurred. So, it is possible that the outcomes of even non-transacting hospitals was affected due to an overall increase in market concentration.

4.5 Hospital Closure Post Merger

All hospital facilities are required to submit their information to the HCRIS annually. This has important implications for how a hospital will appear in my dataset after a transaction has occurred. In particular, regardless of any transaction activity, if all participating hospital facilities remain open in the years after the transaction has occurred, then the transaction will be invisible without exogenous information about the transaction.

It is not atypical for both hospitals participating in a transaction to remain open after the transaction. Transactions may occur at the administrative level, for example, joining medical billings administration, and so there is no change to either physical facility. In this case, both hospitals will appear in the HCRIS both before and after the transaction. Other transactions occur because one or both facilities are in financial distress or are redundant in a given market, and in this instance, one facility may close post transaction. Any facility closures post merger are visible in the HCRIS data since these hospitals will be seen as attriting from the panel.

[I need to redo the following for the new smaller sample] Attrition amongst non-merging hospitals in the panel is low. Amongst the 7,044 hospitals in the panel who do not experience a transaction between 1996 and 2001, 69% remain open throughout. Moreover, in any given year no more than 4% of non-transacting hospitals close. Turning to the hospitals who experience a transaction, 52 transactions, or roughly 40%, have one hospital that closes within 4 years of the transaction. That is compared to 48 transactions, or 33%, in which both hospitals remain open throughout the panel.

5 Methodology–Two Stage Model

Estimating the causal effects of a hospital merger by comparing pre and post-merger outcomes of merged firms to non-merged firms will be biased if the decision to participate in a merger is related to past and expected future performance. To address this, my analysis proceeds in two stages. In the first stage, I analyze the determinants of a hospital's decision to participate in a merger by estimating. In the second stage, I consider the short run and long run effects of these mergers on profits and prices using a propensity score, developed in stage one, to control for endogeneity between the decision to participate in a merger and various outcome variables in the form of selection on observable characteristics.

5.1 Stage One: Determinants of Merger

The first stage analysis is conducted at the hospital level for 3,900 hospitals that entered the panel before 1994. I model the probability that a hospital participated in a merger as a function of both hospital-level and market-level variables. As suggested by the matching literature, appropriate variables to include in a propensity score should simultaneously influence the outcome variable and the probability of merging and must be unaffected by merger. For this reason, all time-varying determinants of merger are measured in 1993, two years before I observe the earliest mergers in my panel. The final specification of the model, shown in Table 7, was selected to ensure that the propensity score is balanced, and is described as follows:

Measures of Hospital Size. Larger hospitals have more market power, leading to higher prices and profits. Hospital costs are positively associated with hospital size. By comparing various measures of hospital size for merging hospitals to non-merging hospitals, it can be seen that merging hospitals are statistically significantly larger than non-merging hospitals. I have chosen to include the total number of discharges as a measure of absolute size in my propensity score estimation and a hospitals share of market hospital beds as a measure of relative market size, or market power.

Financial Distress. The merger wave of the 90s was blamed on changes to the prospective payment system in the late 80s that reduced payments for Medicare and Medicaid payments. Hospitals serving a large Medicare population would be more adversely affected financially by the payment change. For this reason, these hospitals are suspected to be more likely to participate in a merger. However, this story is contradicted when one notes that the average Medicare share for merging hospitals is smaller than non-merging hospitals in [table #].

Insurer Market Power. In the hospital industry, private hospital prices are negotiated between insurers and providers. As such, the presence of private insurers within a hospital market will affect a hospital's bargaining power in setting private prices. Insurer market power is measured by Medicare Advantage HMO

penetration within a given market.

Uninsured. A higher concentration of uninsured patients in a market implies hospitals within these markets are more likely to incur bad debt in the form of unpaid medical bills. This could dampen the ability of a hospital to raise prices and increase profitability. Moreover, uninsured patients seeking hospital treatment are on average sicker than insured hospital patients, increasing their cost of treatment. As a measure of the concentration of uninsured I consider the percent of the population under 65 without insurance.

Urban vs Rural. (+ 1%) Merging hospitals are overwhelmingly classified as urban hospitals. [Jill, I need some direction in explaining what one would expect here. I know that urban and rural hospitals are reimbursed differently and that most government hospitals are rural]

Travel Time to the Closest Hospital. Consumption of hospital care is driven by the proximity of a hospital to its patients. In particular, if two hospitals merge that are spatially close together, they are better able to exploit market power than are two hospitals that are further apart. See Dafny (2009). As a measure of distance, I include the driving time in minutes from a hospital to its closest neighbor.

Based on these observable characteristics, a specification is chosen based on a regression-based balancing test that guarantees that the merger event has no predictive power for the observable characteristics after having controlled for the propensity score.[5] I employ the same propensity score specification in all second stage analyses. Any observable characteristic that affects prices will likewise affect profits and the merger probability. This suggests that the set of potential covariates is the same for all outcome variables.

5.2 Stage Two: Effects of Merger

In the second stage I estimate the effect of a hospital merger occurring between 1996 and 2001 on several outcome variables likely to be related to market power, including price and profit. [I have also estimated the effect of a merger on hospital costs as a way of testing the hypothesis that the M&A wave of the 90s was caused by hospitals in financial distress.] The length of the panel data available allows for the separation of the short run effects of merger from the long run effects.

Controlling for Selection On Observables. The goal of this paper was to identify the effects of hospital merger on outcome variables associated with market power: price and profit. Let $M_{is} = 1$ if hospital i participated in a merger at date s and $M_{is} = 0$ otherwise. I define the price to be $p_{it}(M_{is})$ for hospital i

[5] In particular, I regress each covariate included in the base specification of the propensity score on the estimated propensity score itself in the following way:

$$X_k = \beta_0 + \beta_1\hat{\rho}(X) + \beta_2\hat{\rho}(X)^2 + \beta_3\hat{\rho}(X)^3 + \beta_4 M\hat{\rho}(X) + \beta_5 M\hat{\rho}(X)^2 + \beta_6 M\hat{\rho}(X)^3 + \eta$$

where M is a dummy variable indicating whether or not a hospital has experienced a merger. Balance has been achieved if the coefficients on all interaction terms equal zero since this indicates that the covariates are independent of treatment once the propensity score has been controlled for.

in period t, net income to be $\pi_{it}(M_{is})$, and costs to be $c_{it}(M_{is})$. I will generically refer to these outcome variables as $y_{it}(M_{is})$. Then the effect of the merger on merged hospitals (the average effect of the treatment on the treated, ATT, is given by

$$\mathbb{E}\left(y_{it}\left(1\right)|M_{is}=1\right)-\mathbb{E}\left(y_{it}\left(0\right)|M_{is}=1\right) \tag{1}$$

Note that I only observe $\left(y_{it}\left(0\right)|M_{is}=0\right)$, so the estimates of the ATT from Eq. (1) will be biased if outcomes vary systematically for hospitals that do and do not merge.

Considering the mean descriptive statistics in [Insert Table #], there is evidence that merging hospitals exhibit statistically significant differences among many characteristics when compared to non-merging hospitals. I control for selection based on observable characteristics by reweighting "control" hospitals based on their propensity to merge, estimated in stage one. Reweighting ensures that the distribution of observable characteristics looks the same for hospitals that merged and those that did not. In addition, I control for unobservable hospital-level characteristics that may affect whether or not a merger occurs by estimating a fixed effects panel regression. Finally, I control for any temporal variation that may induce a hospital to merge by including year fixed effects.

Implementation of a propensity score to control for selection on observables requires the assumption of *unconfoundedness*, or that the set of observable characteristics, X, are independent of the treatment assignment. This will be acheived by implementing a balanced propensity score estimation [Insert In Appendix Evidence of Balanced Propensity Score]. The second requirement for matching is the assumption of *common support*, ruling out the phenomenon of perfect predictability of M given X. [insert Kernal Density Plot]. Rosenbaum and Rubin (1983) show that if the assumption of unconfoundedness holds conditional on covariates X, then unconfoundedness also holds conditional on a propensity score, $\rho(M=1|X)$, and conditioning on a propensity score reduces the case high dimensional X vectors.

Given the previous assumptions, the ATT that controls for endogeneity based on observable characteristics is defined as

$$\mathbb{E}\left(y_{it}\left(1\right)|\hat{\rho}\left(M_{is}\right),M_{is}=1\right)-\mathbb{E}\left(y_{it}\left(0\right)|\hat{\rho}\left(M_{is}\right),M_{is}=1\right) \tag{2}$$

Now, I can compare the difference in outcome variables between a hospital that merged and a hospital that did not merge where both hospitals have the same probability of merging. In this sense, I have created a control group against which to compare merged hospitals, and the difference in these groups will be the average treatment effect of a merger on merged hospitals. Ultimately, I implement the reweighting methodology first developed by DiNardo et al. (1996), which identifies hospitals that are expected to have similar

outcomes independent of the merger event based on observable characteristics. However, it is important to note that any systematic differences between merging and non-merging hospitals that are related to unobserved characteristics may still bias my estimates of the effects of merger. I follow Hirano et al. (2003) in bootstrapping the standard errors of the estimated coefficients.

Second Stage Full Model Specification I pool information on all hospital mergers that occurred between 1996 and 2001 by introducing a series of dummy variables for the number of years before and after a merger, as in Jacobson et al. (1993). Let $M_{it}^k = 1$ if in period t hospital i experienced a merger k periods earlier and let $m_{it}^j = 1$ indicate that hospital i will experience a merger j years in the future. Similarly, $M_{it}^{9+} = 1$ is a dummy indicating a period nine or more years after a merger, and $m_{5+}^j = 1$, a dummy indicating a period five or more years before a merger. Together, these variables identify the years surrounding a merger in the panel data which are observable for all hospitals. By pooling all hospital mergers in this way, I formalize the assumption that a hospital participating in a merger in 1997 was in the same position in 2000 as a hospital that participated in a merger in 1999 was in 2002.

The basic specification is as follows

$$y_{it} = \alpha_i + \tau_t + \beta X_{it} + \delta_5 m_{it}^{5+} + \sum_{j=1}^{4} \delta_j m_{it}^j + \sum_{k=1}^{8} \Delta_k M_{it}^k + \Delta_9 M_{it}^{9+} + \upsilon_{it} \tag{3}$$

Here, δ_j and Δ_k identify the effects of merger on the outcome variable of interest, either price or profit. The vector X_{it} consists of observed time-varying characteristics of the hospital. X_{it} includes the time-varying hospital-level and market-level covariates included in the propensity score estimate: the total number of discharges, the Medicare share of discharges, the share of market hospital beds, the concentration level of the market, and the for-profit share of the market. I include year fixed effects, τ_t, to control for the general time pattern of the outcome variable in the economy. The standard errors of each of the coefficients of the model are estimated via a bootstrap with 500 replications. Finally, the model is estimated using a fixed-effects specification to summarize the impact of permanent differences among hospitals in both observed and unobserved characteristics and is estimated via reweighted ordinary least squares.

Second Stage Condensed Model Specification Given the results of the Full Model Specification, I estimate a model with condensed merger effect dummies in order to allow for the eventual estimation of marginal merger effects based on the hospital type (nonprofit, for-profit, or government) and the transaction type. In particular, the condensed model combines merger effect dummies for the short run, defined as one to four years, the long run, defined as five to eight years after a merger, and the very long run, defined as

nine or more years after a merger, as follows

$$y_{it} = \alpha_i + \tau_t + \beta X_{it} + \delta_5 m_{it}^{5+} + \delta_{1-4}^{SR} m_{1-4}^{SR} + \Delta_{1-4}^{SR} M_{1-4} + \Delta_{5-8}^{LR} M_{5-8}^{SR} + \Delta_9 M_{it}^{9+} + \upsilon_{it} \tag{4}$$

After having estimated this benchmark model, I will next interact the condensed merger effect dummies with FP_i, a dummy identifying a for-profit hospital, and G_i, a dummy identifying a government hospital. Then, the un-interacted merger effect dummies in this speficiation, $\delta_5, \delta_{1-4}^{SR}, \Delta_{1-4}^{SR}, \Delta_{5-8}^{LR}, \Delta_9$, identify the merger effect on hospital outcomes specific to non-profit hospitals.

Finally, I will estimate final specification where the condensed merger effect dummies are interacted with HETERO_i, a dummy indicating that a nonprofit hospital participated in a heterogeneous merger with either a for-profit or a government hospital, and OTHER_i, a dummy indicating no nonprofit hospitals participated in the merger. Then the un-interacted dummies in this specification, $\delta_5, \delta_{1-4}^{SR}, \Delta_{1-4}^{SR}, \Delta_{5-8}^{LR}, \Delta_9$, identify the merger effect on hospital outcomes specific to a homogenous nonprofit merger.

A word of caution regarding sample size in the previous two specifications must be noted. In particular, 86% of merging hospitals are nonprofit hospitals, while 4% are for-profit and 10% are government hospitals. Moreover, 67% of transactions observed involve two nonprofit hospitals (a homogenous merger). 26% of transactions observed involve one nonprofit hospital (HETERO_i) and only 6% of transactions do not involve any nonprofit hospital. Given the small samples size of heterogeneous and "other" transactions, and in general of for-profit and government hospitals, precise identification of the marginal merger effect in these specifications is not expected. However, by including these interaction terms, I do expect to be able to isolate the merger effect specific to nonprofit hospitals and specific to homogenous nonprofit mergers through the un-interacted dummies.

6 Results of Propensity Score

Results of the propensity score estimation can be seen in Table 7. In order to ensure that the propensity score is balanced[6], I have included squared terms for the total driving time between hospitals, and for the Case Mix Index. Locational proximity to a hospital is a primary determinant of health care demand, so hospitals which are closer together will be better able to harness increased market power. This is reflected by the negative coefficient on Total Time, and this result mirrors the negative coefficient found on the variable "Distance to Closest Hospital" included in Dranove's propensity score. As concentration in the insurance market increases, seen through the variable HMO Penetration, a hospital's probability of participating in

[6] quick description of balanced

a merger degreases. Similarly, as the population of uninsured increases, a hospital becomes less likely to participate in a merger. This is unsurprising as the population of uninsured represents potential bad debt to a hospital as these patients may be unable to pay large medical bills. Urban hospitals are more likely to participate in a merger than are rural hospitals, and nonprofit hospitals are more likely to participate in mergers than are for-profit and government hospitals.

Although several of the propensity score variables are insignificant, their sign still reflects expectations. For example, as hospitals get larger, reflected through the hospital discharge variable and the hospital bed share variable, they are more likely to participate in a merger. However, as the market gets more concentrated overall, a particular hospital is less likely to participate in a merger. Finally, the medicare share of hospital discharges was included to reflect the likelihood of financial distress in a hospital, and this indeed increases the probability of a hospital merger.

7 Price Regressions

All price regressions include a "Basic" model, which only includes merger effect dummies, a "Full" model, which includes all possible observable hospital and market characteristics, and a "Reduced" model, which excludes those hospital and market characteristics which are consistently highly insignificant.

7.1 Full Specification

First, I consider the effect of mergers on hospital prices separately for each of the years surrounding the merger in Table 8. All price effects are relative to the left-out merger effect dummy for the year in which the merger occurred. The reduced model excludes measures of market concentration including HHI and the for-profit HHI, both of which are consistently found to be highly insignificant. In general, excluding insignificant variables does not change the point estimates of the remaining coefficients, but it does reduce the corresponding standard errors.

Prices are observed to fall in the few years before the merger, which may reflect financial distress. For the first five years after the merger, the effect of merger on prices is positive, albeit small and insignificant. This is not surprising because hospitals are large, complex firms, and significant changes to operations take time to implement. Moreover, Hospitals negotiate prices with various health insurers, and this is typically not done more than once per year. This stickiness will dampen the observed effect of mergers on profits in the short run. That the short run effects of a merger are insignificant offers an explanation for why the literature consistently finds insignificant merger effects on hospital prices. Much of the previous literature was conducted at a time when only four or five post merger years were observable. Then, the previous

literature focused on a window in which merger effects are not fully realized.

As the merging hospital is able to effectively adjust to its increased market power, larger merger effects on prices are seen. Beginning six years after a merger has occurred, the hospital is able to sustain large and statistically significant increased prices. Prices in years six through eight are about $325 higher because of the merger. Given that the average price per discharge for hospitals is approximately $4,000, this represents an 8% increase in hospital prices. Because all regressions include year fixed effects, this price increase is independent of any underlying increase in price resulting from inflation.

In the very long run, defined as nine or more years after a hospital has merged, the effect of merger on prices is even larger, $500, and statistically significant. It should be noted that not all merging hospitals are observable nine years or more after a merger since some mergers occur in 2001 and the data ends in 2009. Then, the hospitals identifying these merger effects are only those that merged in the earlier years. However, if a hospital did not close within three years after merger, it is very unlikely to close. This in combination with individual and year fixed effects suggests that any bias introduced from the unbalanced panel in the the very long run effect will be minimal.

The other included hospital regressors tell an interesting story. Two measures of hospital size are included: hospital discharges, reflecting absolute hospital size, and hospital bed share, reflecting relative hospital size or market power. As a hospital's absolute size increases, its price level decreases, but as a hospitals market power increases, its price level increases. Moreover, the coefficient on the interaction between a hospital's individual market power and the overall concentration in the market is negative and significant. This suggests that although larger hospitals have higher prices, this effect decreases as the overall concentration of the market increases.

Although not significant, the presence of for-profit hospitals in the market, measured by the market for-profit HHI, and the overall concentration of the market, measured by the market HHI, enter negatively. Finally, the coefficient on the medicare share of a hospital's discharges is positive and significant. This may suggest that hospitals with a high share of Medicare patients charge higher prices to their non-Medicare patients as a way to cover financial losses.

7.2 Condensed Model

Given the patterns of statistical significance demonstrated in the full specification, I reduce the model to include short run and long run effects of the merger. In particular, I condense the first four years after the merger and define these years as the "short run", and I condense years five through eight after the merger and define these years to be the "long run". Finally, nine years or more after a merger has occurred, which

coincide with the years during which the panel becomes unbalanced, remain the "very long run". Based on the full specification and given the size of hospitals and the time required to implement changes, I expect to find that the short run effects of a merger are statistically insignificant. This result would be consistent with previous findings in the literature.

The results of the condensed regression are shown in Table 9. All results are comparable to the full specification. The short run effect of the merger on prices, $81, is not statistically significant, as expected. In the long run, prices are $290 higher. That this effect is below $300 is due to the inclusion of year five from the full specification, which was still a transition year for merging hospitals with insignificant merger effect on prices. Finally, in the very long run, prices are $500 higher due to the merger. The estimated effect of hospital and market characteristics are comparable to those seen in the fully specified model.

7.3 Condensed Model, Hospital Type

I expand upon the condensed model to isolate the effect of a nonprofit hospital merger on price, and consider the marginal effect on prices for for-profit and government hospitals. The results are shown in Table 10.

Qualitatively, the effect of mergers on prices for nonprofit hospitals are not dissimilar to the overall effect of mergers on prices for all hospitals, shown in Table 9. Comparing the point estimates of merger effects for nonprofit hospitals to the effects for all hospitals, seen in the previous specification, the merger effect on prices is higher for nonprofit hospitals, however this difference is not statistically significant. For nonprofit hospitals, prices are $350 higher in the long run after a merger has occurred, and $580 higher in the very long run. This confirms the hypothesis that nonprofit hospitals do raise prices in the long run after a merger has occurred.

Compared to nonprofit hospitals, the effect of mergers on prices for for-profit hospitals is smaller, although this difference is not different from zero. Moreover, the effect of mergers on prices for for-profit hospitals, defined as the sum of the nonprofit merger effect plus the for-profit marginal effect, although positive in the short run and the long run, is not statistically significant. For government hospitals, the effect of mergers on prices is again smaller than for nonprofit hospitals but is not statistically significant. In contrast to nonprofit and for-profit hospitals, the point estimate of merger effects on prices for government hospitals is actually negative in all post merger periods, although again, this estimate is not different from zero. Small sample size may be a contributing factor to the lack of statistical significance for these estimates.

7.4 Condensed Model, Transaction Type

I expand upon the condensed model to isolate the effect on prices of mergers that only involve nonprofit hospitals, and consider the marginal effect on prices of mergers involving one nonprofit hospital (heterogeneous merger), and mergers involving no nonprofit hospitals (other mergers). The results are shown in Table 11.

Qualitatively, the effects of a homogeneous nonprofit merger on prices are not dissimilar to the overall effects of all mergers on prices, seen in Table 9. Both the long run and the very long run effect on prices for mergers involving only nonprofit hospitals are positive and statistically significant. The point estimate of the long run effect of a homogenous nonprofit merger on prices, $302, is bigger than that of the effect of all mergers on prices, $287, but this difference is not statistically significant.

The marginal effects of a heterogeneous nonprofit merger are not significant in the short run or the long run, although the sign of the estimate is positive. This suggests that hospitals participating in a heterogenous merger are more successful at raising prices in the years after a merger than are nonprofit hospitals participating in a homogeneous merger. The overall merger effect on prices for heterogeneously merging hospitals is positive in all post-merger periods, estimated to be $380 in the long run and $690 in the very long run, however these estimates are not statistically significant. That the marginal effects are not significant is likely due to the relatively small sample size identifying this coefficient as only 28% of observed mergers involve only one nonprofit hospital.

Finally, the marginal effects of merging hospitals where neither party is nonprofit are negative but, again, are not statistically significant in the short or long run. In the very long run the marginal effect is negative and statistically significant. The overall merger effect on prices is negative in all post merger periods, and in the very long run this estimate, -$832, is statistically significant with a p-value of 5.7%. This implies a striking result that mergers without nonprofit hospitals are less successful at raising prices in the long run. This result is also consistent with the analysis of the merger effect for-profit and government hospitals, both of which are predicted to have lowered prices in the long run after a merger.

8 Profit Regressions

8.1 Full Specification

In this model I consider the effect of a hospital merger on profits identified separately for each of the years surrounding the merger in Table 12. All profit effects are relative to the left-out merger effect dummy for the year in which the merger occurred. The reduced model excludes hospital discharges, a measure of absolute hospital size, which is consistently found to be highly insignificant. In general, excluding total discharges

did not affect the point estimates of the remaining coefficients but did reduce the standard errors of some hospital level variable effects.

In the years before a merger, profits are larger than in the year a merger occurred. However, there is no stark downward trend in profit in the years preceding a merger. The general hypothesis that merging hospitals were in financial distress in the years preceding a merger is not supported by these results. For example, although profits are estimated to be $2 million higher two years before a merger has occurred, and only $1.26 million higher in the year before a merger occurs, these estimates are statistically different from each other, which would imply that profits are falling in the years before a merger occurs.

In the years immediately following the merger, profits are estimated to grow, however these estimates are small and statistically insignificant. This mirrors the pricing behavior of hospitals in the years immediately following a merger. Moving into the long run, profits grow, and this growth becomes statistically significant. Seven years after a merger has occurred, profits are $3.7 million higher than they were in the year of merger. Not only is this statistically significant, it is statistically larger than the hospital's profit levels three years before a merger occurred. This suggests merging hospitals are able to raise profits in the long run to higher levels than were seen in the pre-merger years.

Several hospital and market level variables are included in the full model. Relative market power, identified by the hospital's share of market beds, affects profits positively and is statistically significant. In fact, a 1% increase in market power will lead to an increase in profits of $.4 million. However, the effect of increases in market power diminishes as the overall level of market concentration increases, measured by the HHI. This effect is seen through the negative and statistically significant estimate of the interaction between market power and market concentration. Finally, an increase in the severity of patients treated, measured by the case-mix index, leads to higher hospital profit levels. This may suggest that treating more severe patients involves preforming procedures with high profit margins, such as cardiac care.

The effect of removing total discharges in the reduced form model leads to significant of the estimate of a hospital's medicare share of patients by reducing the standard error associated with this estimate. In particular, an increase in the Medicare share of patients by 10% leads to a $0.4 million increase in net profits. This is consistent with the positive effect of the medicare share of patients on hospital prices, and suggests that hospitals with a high share of medicare patients may be charging higher prices to their privately insured patients to cover any potential medicare losses.

8.2 Condensed Model

Given the patterns of statistical significant demonstrated in the full specification, I reduce the model to include short run and long run effects of the merger. In particular, I condense the first four years after the merger and define these years as the "short run", and I condense years five through eight after the merger and define these years to be the "long run". Finally, nine years or more after a merger has occurred, which coincide with the years during which the panel becomes unbalanced, are defined to be the "very long run". Based on the full specification, shown in Table 12, I expect to find statistically significant effects of mergers in all post-merger periods.

The results of the condensed model are shown in Table 13. All results are comparable to the full specification. The short run effect of a merger is to increase profits by $1.33 million, and this result statistically significant at the 10% level. In the long run, profits are $2.85 million, and not only is this effect significant at the 1% level, it is larger than the short run effect at the 5% level. Profits in the very long run are no different from the long run, suggesting that perhaps hospitals eventually exhaust the ability to raise profits because of a merger about one decade after a merger has occurred.

8.3 Condensed Model, Hospital Type

I expand upon the condensed model to isolate the effect of a nonprofit hospital merger on profit, and consider the marginal effect on profit for for-profit and government hospitals. The results are shown in Table 14. Nonprofit hospitals involved in a merger raise profits by as much as $3 million in the long run, although in the very long run this effect reduces to $2.2 million. The difference between the long run merger effect and the very long run merger effect is not statistically significant.

Compared to nonprofit hospitals, the marginal effect of a merger for a for-profit hospital is smaller in the short run and long run, although this estimate is not statistically significant. The overall effect of the merger for for-profit hospitals is also to reduce profits relative to the year in which a hospital merged in both the short run and the long run, although again likely due to sample size this estimate is not statistically significant. That the merger effect for for-profit hospitals is to lower profits is not consistent with the statistically insignificant estimate of slowly growing prices for for-profit hospitals in the years after merger.

In contrast, government hospitals are estimated to raise profits by more than nonprofit hospitals in the all post-merger years, although these estimates are not statistically significant. Merging government hospitals are estimated to increase profits by $3.8 million in the long run and $6.8 million in the very long run, and these estimates are marginally significant with p-values of 0.15 and 0.12 respectively in the full model. The prediction that government hospitals successful increase profits is a surprising one, especially in contrast

with the (statistically insignificant) prediction that Government hospitals lower prices.

8.4 Condensed Model, Transaction Type

I expand upon the condensed model to isolate the effect on profits of mergers that only involve nonprofit hospitals, and consider the marginal effect on profits of mergers involving one nonprofit hospital (heterogeneous merger), and mergers involving no nonprofit hospitals (other mergers). The results are shown in Table 15. Nonprofit hospitals merging with nonprofit hospitals are shown to raise profits by $2.3 million in the long run and the very long run, and these results are statistically significant.

Compared to nonprofit hospitals merging with nonprofit hospitals, nonprofit hospitals involved in heterogeneous mergers are more successful at increasing profits. In the long run, these hospitals raise profits by $4.5 million, and this estimate is statistically significant with a p-value of 0.014. Similarly, mergers excluding nonprofit hospitals also raise profits by more than homogeneous nonprofit mergers, although these marginal effects are not statistically significant, nor are the overall merger effects.

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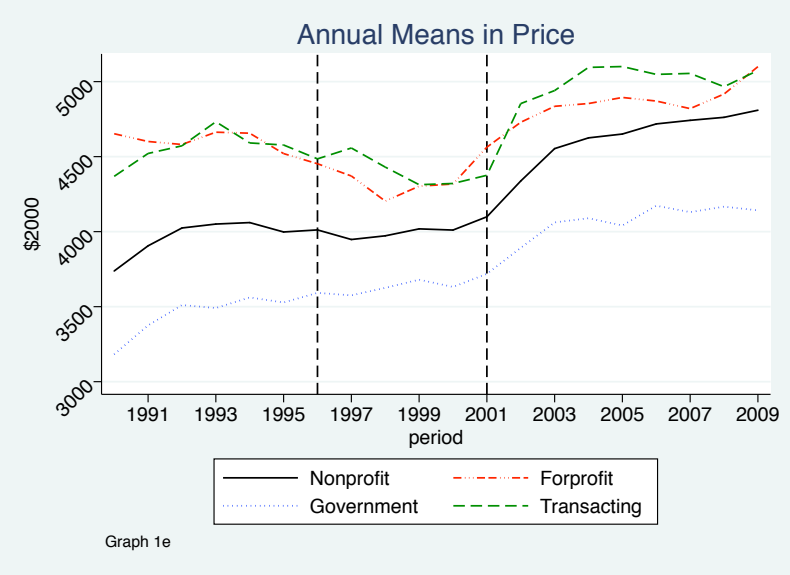

Figure 1: Inpatient Revenue per case-mix adjusted discharge in $2000

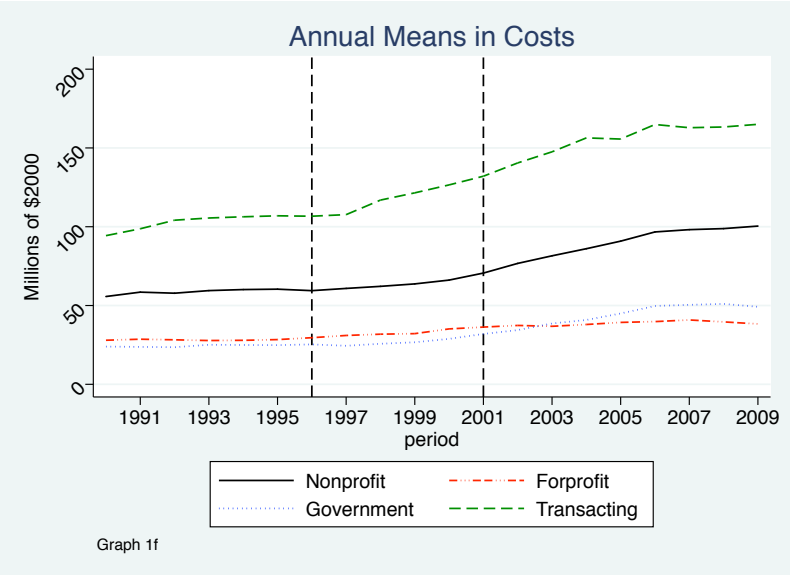

Figure 2: Hospital Costs in $2000

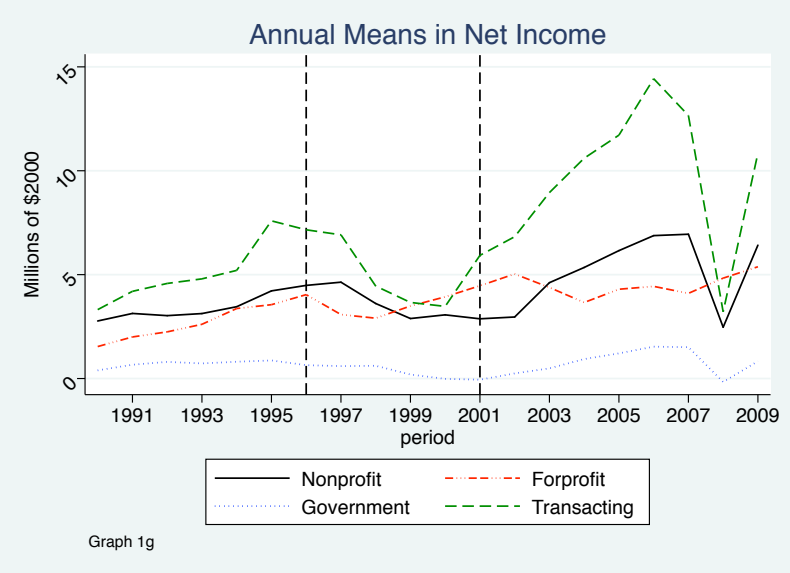

Figure 3: Hospital Profits in $2000

Table 1: **HCRIS Means in 1993**
p-values for differences from Nonprofit means in parentheses
omitted if p-value=0.00

	All	NonProfit	For-Profit	Government
# of Hospitals	3,965	2,337	535	1,093
Inputs				
Labor	522	655	339	320
Teaching	–	–	–	–
Size				
Beds	146	169	131	101
Discharges	4,772	5,934	3,707	2,777
Medicare Discharges	1,697	2,104	1,388	999
Medicare Share of Discharges	0.41	0.41	0.4 (0.22)	0.43
Finances ($2000)				
Total Patient Revenue	75,365	91,688	66,670	43,217
Total Costs	43,369	53,747	31,569	26,036
Accounting Profit	31,897	38,519	33,165	16,185
Net Income (Profit)	2,107	2,469	2,515 (0.78)	1,164
Liability to Asset Ratio	0.47	0.49	0.61	0.37
Quality				
Case Mix Index	1.23	1.26	1.31	1.14

variables measured in 1993
source: table15.do

Table 2: **HCRIS Means 2005**
p-values for differences from Nonprofit means in parentheses
omitted if p-value=0.00

	All	NonProfit	For-Profit	Government
# of Hospitals	3,006	1,835	564	607
Inputs				
Labor	805	969	459	628
Teaching	0.30	0.39	0.13	0.18
Size				
Beds	153	170	130	123
Discharges	7,308	8,471	5,509	5,446
Medicare Discharges	2,662	3,114	2,057	1,881
Medicare Share of Discharges	0.42	0.42	0.4	0.43 (0.06)
Finances ($2000)				
Total Patient Revenue	243,677	282,069	198,480	165,237
Total Costs	86,044	103,578	52,106	64,188
Accounting Profit	156,311	175,789	141,495	108,093
Net Income (Profit)	4,685	5,402	4,252	2,917
Liability to Asset Ratio	0.48	0.48	0.56	0.41
Quality				
Case Mix Index	1.30	1.32	1.28	1.22

variables measured in 2005
source: table16.do

Table 3: **Descriptive Statistics: ARF Sample Means**

p-values for differences from Nonprofit means in parentheses
omitted if p-value=0.00

	All	**NonProfit**	**For-Profit**	**Government**
# of Hospitals	3,862	2,206	538	1,118
Demographics				
Population	393,861	419,849	565,456	211,221
Median Age	36.3	36.4	35.1	36.7
Per-Capita Income	27,233	28,500	27,784	23,794
% in Poverty	11.7	11.1	12.4	12.6
Insurance				
HMO Penetration	11.4	12.4	15.7	6.3
% Under 65 No Insurance	16.5	15.6	18.3	17.5
Geographic				
Drive Time (minutes)	18.2	17.3	12.9	24
Miles	10	9.1	6.4	14.5

source: table12.do

Table 4: **Annual Summary of Hospital Transactions**

	N+N	**N+F**	**N+G**	**F+F**	**F+G**	**G+G**	**Total**
1996	32	3	10	2	0	0	47
	68.09%	6.38%	21.28%	4.26%	0%	0%	
1997	45	2	9	0	0	0	56
	80.36%	3.57%	16.07%	0%	0%	0%	
1998	28	7	3	0	1	1	40
	70.00 %	17.50%	7.50%	0%	2.50%	2.50%	
1999	21	10	7	2	4	0	44
	47.73 %	22.73%	15.91%	4.55 %	9.09%	%	
2000	13	11	4	0	0	2	31
	45.16%	35.48%	12.90 %	0%	0%	6.45%	
2001	8	1	4	0	1	0	14
	57.14 %	7.14%	28.57%	0%	7.14%	0%	

source: Annual Health Care Acquisitions Reports by Irving Levin Associates

Table 5: **Descriptive Statistics: HCRIS Sample Means**
p-values for mean differences in parentheses
omitted if p-value=0.00

	Merging	Non-Merging
# of Hospitals	184	3,965
Inputs		
Labor	937	502
% Teaching (2000)	52	24
Size		
Beds	226	142
Discharges	8,320	4,610
Medicare Discharges	2,926	1,642
Medicare Share of Discharges	0.38	0.42
Case Mix Index	1.34	1.22
Finances ($2000)		
Revenue	138.65	72.47
Costs	76.26	41.88
Profits	58.36	30.69
Net Income	3.56	2.04
Liability to Asset Ratio	0.53	0.47
% Urban (2000)	85	56

source: table13.do

Table 6: **Descriptive Statistics: Area Resource File Demographics by Market**

Year 2000 Demographics

p-values for differences from markets without in parentheses

	All Markets	**with Transaction**	**without Transaction**
# of Markets	307	104	203
Market Composition			
number of firms			
Nonprofit	9.8	14.1	7.8
		(0.000)	
Forprofit	3.4	5.0	2.5
		(0.003)	
Government	4.5	5.3	4.0
		(0.118)	
Total	17.8	24.4	14.4
		(0.000)	
Income Statistics			
Per-Capita Income	26,197	28,619	24,974
		(0.00)	
% in Poverty	12.2	11.4	12.6
		(0.013)	
Insurance Statistics			
HMO Penetration (%)	11.5	13.9	10.2
		(0.016)	
No Insurance (%)	17.2	16.7	17.4
		(0.228)	
Demographics			
Population	439,404	647,318	334,428
		(0.014)	
Median Age	36.4	36.4	36.5
		(0.690)	
Drive Time	24.6	20.4	26.7
in minutes		(0.00)	

source: Do-File Table 8

Table 7: Propensity Score Specification

Marginal Effect Evaluated At Mean

Total Time	-0.0241 ***
	(0.0080)
Total Time^2	0.0000 **
	(0.0000)
Hospital Discharges	0.0797
	(0.0602)
Medicare Share of Discharges	0.0001
	(0.0003)
Hospital Bed Share	0.0003
	(0.0006)
HMO Penetration	-0.0008 ***
	(0.0003)
% Population <65, no Ins	-0.0019 **
	(0.0008)
Urban Hospital	0.0569 ***
	(0.0166)
Case Mix Index	0.2125
	(0.1345)
Case Mix Index^2	-0.0568
	(0.0440)
HHI	-2.87E-06
	(0.0000)
FP	-0.0096 **
	(0.0037)
G	-0.0057 *
	(0.0031)

propScore8c.do

Table 8: Full Specification: Effect of Merger on Prices

Standard Errors Presented in Parenthesis

	Basic Model	**Full Model**	**Reduced Model**
Merger Effects			
5 Years or More Before	292.28 **	267.79 **	270.03 **
	(145.98)	(130.69)	(130.48)
4 Years Before	151.76	222.35 **	224.40 **
	(122.29)	(111.62)	(111.16)
3 Years Before	303.30 **	360.25 ***	362.68 ***
	(133.05)	(126.21)	(125.81)
2 Years Before	187.63 *	192.23 *	193.40 *
	(111.05)	(101.81)	(101.75)
1 Year Before	52.42	41.94	42.81
	(94.15)	(84.24)	(84.27)
1 Year After	107.07	117.13	118.59
	(106.38)	(98.49)	(98.85)
2 Years After	-9.37	21.17	21.77
	(133.36)	(120.22)	(120.42)
3 Years After	51.39	94.16	93.41
	(153.92)	(142.38)	(142.47)
4 Years After	43.66	91.31	90.49
	(146.26)	(138.71)	(139.25)
5 Years After	146.05	196.12	195.32
	(161.64)	(157.64)	(157.76)
6 Years After	303.04 *	353.86 **	352.74 **
	(174.32)	(164.43)	(163.52)
7 Years After	237.83	321.36 *	320.00 *
	(189.66)	(176.74)	(175.92)
8 Years After	265.37	326.99 *	325.73 *
	(190.11)	(176.44)	(176.09)
9 Years or More After	493.68 **	519.40 **	516.57 **
	(218.86)	(210.14)	(209.14)
Hospital Characteristics			
Total Hospital Discharges		-63.33 ***	-63.35 ***
		(11.60)	(11.61)
Medicare Share of Discharges		90.47 ***	90.49 ***
		(6.11)	(6.12)
Hospital Bed Share		45.57 ***	45.45 ***
Market Power		(12.89)	(12.87)
HHI		-0.01	
		(0.09)	
FP HHI		-0.10	
		(0.10)	
MktPower*HHI		-0.006 ***	-0.006 ***
		(0.002)	(0.002)
Constant	4262.21 ***	1160.90 ***	1142.41 ***
	(82.96)	(321.34)	(294.12)

matchingPrice23.do

Table 9: Condensed Specification: Effect on Prices

Standard Errors Presented in Parenthesis

	Basic Model	**Full Model**	**Reduced Model**
Merger Effects			
5 Years or More Before	282.27 **	247.91 *	250.12 **
	(142.22)	(127.35)	(127.21)
1-4 Years Before	165.60 *	191.26 **	192.90 **
	(95.92)	(89.12)	(88.89)
Short Run	53.04	81.88	82.25
	(111.07)	(103.25)	(103.56)
Long Run	233.73	287.61 *	286.74 *
	(158.14)	(149.46)	(148.89)
9 Years or More After	485.61 **	504.05 **	501.44 **
	(213.20)	(205.12)	(204.06)
Hospital Characteristics			
Total Hospital Discharges		-63.27 ***	-63.29 ***
		(11.60)	(11.61)
Medicare Share of Discharges		90.38 ***	90.40 ***
		(6.11)	(6.12)
Hospital Bed Share		45.31 ***	45.13 ***
		(12.86)	(12.83)
HHI		-0.005	
		(0.088)	
FP HHI		-0.11	
		(0.10)	
MktPower*HHI		-0.006 ***	-0.006 ***
		(0.002)	(0.002)
Constant	4257.26 ***	1159.20 ***	1142.82 ***
	(82.24)	(321.06)	(293.97)

matchingPrice26.do

Table 10: Condensed Specification, Hospital Type: Effect on Prices

Standard Errors Presented in Parenthesis

	Basic Model	**Full Model**	**Reduced Model**
Nonprofit Merger Effect			
5 Years or More Before	164.19	130.47	139.21
	(142.06)	(130.78)	(129.96)
1-4 Years Before	12.61	32.24	37.83
	(103.58)	(99.79)	(99.27)
Short Run	41.02	92.60	92.30
	(112.53)	(102.60)	(102.45)
Long Run	290.94 *	356.64 **	353.47 **
	(166.49)	(154.13)	(153.45)
9 Years or More After	516.59 **	584.45 ***	576.56 ***
	(220.21)	(212.55)	(211.58)
For Profit Marginal Merger Effect			
5 Years or More Before	2035.29 ***	1660.20 ***	1627.64 ***
	(612.51)	(600.30)	(602.16)
1-4 Years Before	1607.35 ***	1433.90 ***	1418.70 ***
	(423.47)	(425.40)	(427.02)
Short Run	630.08	456.12	464.83
	(730.42)	(639.94)	(652.16)
Long Run	-397.96	-256.50	-250.87
	(717.81)	(646.05)	(658.78)
9 Years or More After	-412.25	-264.98	-234.06
	(676.78)	(497.04)	(504.67)
Government Marginal Merger Effect			
5 Years or More Before	-413.62	-233.66	-243.26
	(477.98)	(430.15)	(430.28)
1-4 Years Before	203.21	334.79	324.45
	(340.73)	(309.69)	(310.26)
Short Run	-506.13	-539.93 *	-539.31 *
	(355.57)	(320.53)	(320.27)
Long Run	-728.13	-801.00	-797.33
	(548.50)	(510.58)	(510.40)
9 Years or More After	-738.09	-1177.51	-1170.67
	(834.80)	(763.74)	(764.62)
Hospital Characteristics			
Total Hospital Discharges		-63.61 ***	-63.72 ***
		(11.34)	(11.37)
Medicare Share of Discharges		90.14 ***	90.20 ***
		(5.90)	(5.93)
Hospital Bed Share		41.14 ***	41.48 ***
		(12.29)	(12.46)
HHI		-0.04	
		(0.09)	
FP HHI		-0.19 *	
		(0.11)	
MktPower*HHI		-0.005 ***	-0.006 ***
		(0.002)	(0.002)
Constant	4273.99 ***	1264.77 ***	1198.99 ***
	(82.52)	(306.60)	(282.70)

matchingPrice24.do

Table 11: Condensed Specification, Transaction Type: Effect on Prices

Standard Errors Presented in Parenthesis

	Basic Model	**Full Model**	**Reduced Model**
Merger Effects			
(NP+NP Merger)			
5 Years or More Before	60.86	48.69	53.10
	(149.74)	(135.40)	(134.82)
1-4 Years Before	23.29	65.10	68.24
	(117.44)	(109.23)	(108.96)
Short Run	21.43	61.35	59.60
	(123.88)	(115.29)	(115.26)
Long Run	204.96	302.48 *	298.96 *
	(167.42)	(159.03)	(158.61)
9 Years or More After	432.38 *	491.76 **	485.51 **
	(220.77)	(210.47)	(209.91)
Heterogeneous NP Marginal Effect			
5 Years or More Before	573.78	539.80 *	538.35 *
	(390.40)	(317.72)	(319.01)
1-4 Years Before	396.80	393.41 *	390.87 *
	(250.29)	(227.57)	(228.21)
Short Run	102.67	98.15	101.77
	(293.08)	(262.83)	(263.87)
Long Run	231.03	85.59	87.21
	(467.66)	(415.01)	(414.23)
9 Years or More After	342.83	198.40	200.08
	(605.31)	(567.32)	(565.10)
Other Marginal Effect			
5 Years or More Before	706.31	519.49	512.92
	(787.54)	(634.21)	(634.62)
1-4 Years Before	594.18	318.83	315.11
	(409.83)	(335.27)	(336.09)
Short Run	-15.49	-132.80	-129.24
	(597.52)	(526.55)	(525.66)
Long Run	-717.88	-767.80	-758.83
	(594.99)	(640.29)	(639.32)
9 Years or More After	-1301.16 ***	-1323.76 ***	-1310.54 ***
	(475.63)	(483.98)	(482.58)
Hospital Characteristics			
Total Hospital Discharges		-62.33 ***	-62.45 ***
		(11.57)	(11.58)
Medicare Share of Discharges		90.15 ***	90.18 ***
		(5.88)	(5.90)
Hospital Bed Share		41.46 ***	41.88 ***
		(12.82)	(12.95)
HHI		-0.03	
		(0.09)	
FP HHI		-0.12	
		(0.10)	
MktPower*HHI		-0.006 ***	-0.006 ***
		(0.002)	(0.002)
Constant	4259.86 ***	1233.20 ***	1176.71 ***
	(81.70)	(308.98)	(282.90)

Table 12: Full Specification: Effect of Merger on Profits

Standard Errors Presented in Parenthesis

	Basic Model	**Full Model**	**Reduced Model**
Merger Effects			
5 Years Before	1.71 ***	1.72 ***	1.72 ***
	(0.66)	(0.65)	(0.65)
4 Years Before	1.41 **	1.51 **	1.52 **
	(0.60)	(0.61)	(0.59)
3 Years Before	2.06 ***	2.12 ***	2.12 ***
	(0.65)	(0.67)	(0.66)
2 Years Before	2.00 ***	2.04 ***	2.04 ***
	(0.66)	(0.67)	(0.66)
1 Year Before	1.33 ***	1.26 **	1.27 **
	(0.51)	(0.52)	(0.51)
1 Year After	0.90	0.87	0.87
	(0.60)	(0.61)	(0.60)
2 Years After	0.79	0.66	0.66
	(0.75)	(0.77)	(0.76)
3 Years After	2.59 ***	2.49 ***	2.48 ***
	(0.90)	(0.94)	(0.92)
4 Years After	1.93 *	1.73	1.73
	(1.06)	(1.09)	(1.07)
5 Years After	3.06 ***	2.89 ***	2.89 ***
	(1.06)	(1.09)	(1.08)
6 Years After	3.49 ***	3.34 ***	3.34 ***
	(1.16)	(1.21)	(1.19)
7 Years After	3.79 ***	3.70 ***	3.70 ***
	(1.09)	(1.11)	(1.10)
8 Years After	1.97	1.88	1.88
	(1.21)	(1.22)	(1.21)
9 Years After	2.79 **	2.70 **	2.70 **
	(1.24)	(1.23)	(1.23)
Hospital Characteristics			
Total Hospital Discharges		0.003	
		(0.23)	
Medicare Share of Discharges		0.04	0.04 **
		(0.03)	(0.02)
Hospital Bed Share		0.42 ***	0.42 ***
		(0.14)	(0.08)
Case Mix Index		4.90 ***	4.91 ***
		(1.80)	(1.84)
HHI		-0.0004	-0.0004
		(0.0003)	(0.0003)
FP HHI		0.001	0.001
		(0.001)	(0.001)
MktPower*HHI		-0.00005 ***	-0.00005 ***
		(0.00002)	(0.00001)
Constant	4.10 ***	-7.18 **	-7.21 **
	(0.44)	(3.42)	(2.85)

Table 13: Condensed Specification: Effect on Profits

Standard Errors Presented in Parenthesis

	Basic Model	**Full Model**	**Reduced Model**
Merger Effects			
5 Years or More Before	1.66 ***	1.65 ***	1.66 ***
	(0.64)	(0.63)	(0.62)
1-4 Years Before	1.67 ***	1.69 ***	1.69 ***
	(0.49)	(0.51)	(0.49)
Short Run	1.44 **	1.33 *	1.33 **
	(0.66)	(0.69)	(0.68)
Long Run	2.98 ***	2.85 ***	2.85 ***
	(0.90)	(0.92)	(0.91)
9 Years or More After	2.77 **	2.67 **	2.67 **
	(1.21)	(1.20)	(1.20)
Hospital Characteristics			
Total Hospital Discharges		0.003	
		(0.23)	
Medicare Share of Discharges		0.04	0.03 **
		(0.03)	(0.02)
Hospital Bed Share		0.42 ***	0.42 ***
		(0.14)	(0.08)
Case Mix Index		4.97 ***	4.98 ***
		(1.81)	(1.85)
HHI		-0.0004	-0.0004
		(0.0003)	(0.0003)
FP HHI		0.0010	0.0010
		(0.0009)	(0.0009)
MktPower*HHI		-0.00005 ***	-0.00005 ***
		(0.00002)	(0.00001)
Constant	4.17 ***	-7.19 **	-7.23 **
	(0.45)	(3.44)	(2.86)

matchingPi27.do

Table 14: Condensed Specification, Hospital Type: Effect on Profit

Standard Errors Presented in Parenthesis

	Basic Model	**Full Model**	**Reduced Model**
Nonprofit Merger Effect			
5 Years or More Before	1.25 *	1.32 *	1.33 *
	(0.73)	(0.71)	(0.71)
1-4 Years Before	1.86 ***	1.87 ***	1.88 ***
	(0.56)	(0.57)	(0.56)
Short Run	1.48 **	1.33 *	1.33 *
	(0.73)	(0.74)	(0.73)
Long Run	3.15 ***	2.97 ***	2.97 ***
	(1.02)	(1.03)	(1.02)
9 Years or More After	2.27 *	2.18 *	2.18 *
	(1.28)	(1.27)	(1.27)
For Profit Marginal Merger Effect			
5 Years or More Before	1.81	1.15	1.14
	(1.83)	(1.93)	(1.95)
1-4 Years Before	-1.87 *	-2.30 **	-2.30 **
	(1.07)	(1.10)	(1.14)
Short Run	-2.28	-2.06	-2.06
	(2.53)	(2.64)	(2.70)
Long Run	-4.80 *	-4.44	-4.45
	(2.67)	(2.72)	(2.73)
9 Years or More After	0.90	1.28	1.28
	(3.56)	(3.14)	(3.27)
Government Marginal Merger Effect			
5 Years or More Before	2.12	1.83	1.81
	(1.58)	(1.56)	(1.54)
1-4 Years Before	-0.05	0.14	0.13
	(1.63)	(1.64)	(1.64)
Short Run	0.58	0.89	0.90
	(2.40)	(2.45)	(2.42)
Long Run	0.43	0.89	0.89
	(2.85)	(2.89)	(2.85)
9 Years or More After	4.45	4.71	4.72
	(4.78)	(4.59)	(4.64)
Hospital Characteristics			
Total Hospital Discharges		0.003	
		(0.23)	
Medicare Share of Discharges		0.03	0.03 *
		(0.03)	(0.02)
Hospital Bed Share		0.41 ***	0.42 ***
		(0.14)	(0.08)
Case Mix Index		5.02 ***	5.03 ***
		(1.79)	(1.82)
HHI		-0.00004	-0.00005
		(0.0003)	(0.0003)
FP HHI		-0.0004	-0.0004
		(0.001)	(0.001)
MktPower*HHI		0.0009 ***	0.0010 ***
		(0.00002)	(0.00001)
Constant	4.05 ***	-7.03 **	-7.06 **
	(0.45)	(3.41)	(2.84)

matchingPi28.do

Table 15: Condensed Specification, Transaction Type: Effect on Profit

Standard Errors Presented in Parenthesis

	Basic Model	Full Model	Reduced Model
Merger Effects			
5 Years or More Before	1.18 *	1.19 *	1.20 *
	(0.68)	(0.67)	(0.66)
1-4 Years Before	1.77 ***	1.81 ***	1.82 ***
	(0.58)	(0.61)	(0.58)
Short Run	0.99	0.79	0.78
	(0.76)	(0.77)	(0.76)
Long Run	2.57 **	2.33 **	2.33 **
	(1.11)	(1.11)	(1.11)
9 Years or More After	2.44 *	2.21 *	2.21 *
	(1.33)	(1.31)	(1.30)
Heterogenous NP Merger Effects			
5 Years or More Before	0.04	0.09	0.08
	(1.39)	(1.33)	(1.34)
1-4 Years Before	-0.66	-0.67	-0.68
	(1.03)	(1.06)	(1.05)
Short Run	0.51	0.72	0.72
	(1.41)	(1.47)	(1.46)
Long Run	1.91	2.18	2.18
	(2.12)	(2.12)	(2.13)
9 Years or More After	0.75	1.37	1.35
	(3.32)	(3.23)	(3.29)
Other Merger Effects			
5 Years or More Before	7.76 ***	7.48 ***	7.47 ***
	(2.74)	(2.67)	(2.65)
1-4 Years Before	2.04	1.84	1.83
	(2.62)	(2.58)	(2.56)
Short Run	5.61	6.24	6.25
	(4.62)	(4.59)	(4.59)
Long Run	-0.14	0.52	0.53
	(4.82)	(4.85)	(4.87)
9 Years or More After	2.84	3.56	3.57
	(5.79)	(5.80)	(5.75)
Hospital Characteristics			
Total Hospital Discharges		0.003	
		(0.23)	
Medicare Share of Discharges		0.03	0.03 *
		(0.03)	(0.02)
Hospital Bed Share		0.42 ***	0.42 ***
		(0.14)	(0.08)
Case Mix Index		5.05 ***	5.06 ***
		(1.78)	(1.82)
FP HHI		-0.00004	-0.00004
		(0.0004)	(0.0003)
FP HHI		-0.0005	-0.0004
		(0.0009)	(0.0009)
MktPower*HHI		0.0010 ***	0.0010 ***
		(0.00002)	(0.00001)
Constant	4.18 ***	-7.13 **	-7.16 **
	(0.45)	(3.42)	(2.85)