Can Empirical Demand Models Assist in CON Comparative Reviews? A Case Study in Florida [†]

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Abstract

Potential adverse effects of Certificate-of-Need (CON) programs for new hospital construction arise out of difficulties in the comparative review process for competing applications. We trace the problems to conflicts in evaluative criteria and other well known special interest effects. At the same time, however, empirical analysis of revealed preferences using data on patient choices of hospitals can be useful in understanding the relative merits of competing proposals.

We adopt the Willingness-to-Pay (WTP) method that based on conditional logit models of patient choice of hospitals to estimate the *additional* contribution of a hospital to patients' utility. Empirical results obtained provide measures of the *net* benefit of a hospital to the community.

We evaluate the set of competing CON applications in Clay County, Florida in 2005 to illustrate how the WTP method may be constructively incorporated in the review process. We then simulate the welfare effects of the proposed hospitals and predict how prices of hospital care would likely be affected by the choice of applicant. We show that the WTP method has its limitations, however; proposals can not be uniquely ranked without more information on the efficiency of the proposed facilities and their quality of care.

Key words: Certificate-Of-Need, Patient Choice, Willingness-To-Pay, Conditional Logit

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1. Introduction

Despite its intended purpose of restraining health care costs in hospitals, Certificate of Need (CON) laws have largely failed, according to many researchers, policy makers and experts in the field. Since the 1987 Congressional repeal of mandated CON, 14 states have dropped these programs altogether. Today, the 36 states that practice CON laws have made them more flexible by raising the review threshold in terms of dollars and limiting the scope of services subject to regulation.

In this paper we explore the comparative review process that is typically used to select proposals for new hospital construction. 25 of the 36 states with CON programs use a comparative review process to select project proposals, under which competing applications for the CON in the same local market are evaluated. Evaluative criteria may become vulnerable to special interest effects from incumbent firms. For instance, incumbent hospitals who oppose a new hospital in their local market can often argue that there is a surplus of hospital beds and sufficient capacity. Incumbent hospitals are known to use CON appeals to block the entry of new competing hospitals and protect themselves against competition.

Moreover, the evaluative criteria can grow over time, to encompass conflicting objectives. For instance, in one state (Florida) the review criteria have been expanded to include whether the project would be accessible to all residents, whether the new project would increase competition and improve quality and cost-effectiveness, and the history of applicants providing services to Medicaid patients and the indigent. Problems with these multi-faceted criteria are discussed in the next section.

While economic analysis has in the past been employed in limited ways, we argue here that empirical demand models of patient choice of hospitals can be useful in understanding the relative merits of competing proposals. This approach uses conditional logit models of patient choice to estimate the *additional* contribution of a hospital to patients' utility or Willingness-to-Pay (WTP); in other words, it measures the *net* benefit of a hospital to the community. These benefits are derived from the match between the services proposed by the applicant, its location, and the location and preferences of patients in the service area. In addition, prices for hospital care can be affected when applicants currently own hospitals in the local market, thus the selection of an applicant should recognize the post-entry market structure. In a related study we find that this method provides reliable predictions of post-merger price increases in local hospital mergersFournier and Gai (2007).

In this study, we adapt the method to simulate welfare effects and price impacts that would likely occur based on the selection among CON applicants. The method, while discarding some inferior applicants, does not guarantee that one applicant dominates all others. In those instances, more evidence on the cost efficiency or quality of care of the proposals may be required to make a further selection.

The paper is organized as the following: we first discuss previous research on the impacts of CON laws and the criteria used in the comparative review process. Data and variables used in this paper will be discussed. We focus on the CON applications in Clay County, Florida in 2005 to illustrate how to incorporate these empirical methods in the review process. We examine how the selection among applicants would be likely to affect the performance in the local market. We then simulate the welfare effects of the proposed hospitals based on the expected benefits to the community and their predicted effects on the prices of hospital services.

2. Literature Review and the CON Comparative Review Process

While many studies have shown the ineffectiveness of CON programs in health care cost control,[1] the question of the efficiency of allocations resulting from comparative review has its own literature. These studies provide empirical evidence that CON regulations may have increased hospital market power by restricting entry of competitors. "Barriers presented by CON regulations may then allow a greater measure of allocative inefficiency to persist unchecked by competitive forces" (Eakin (1991)).

A leading empirical study on the anti-competitive effects of CON regulations is Wendling and Werner (1980). Employing a logit model to explain state legislative actions on CON laws for the hospital industry, these authors study three possible outcomes: enactment, defeat or no legislative actions on the CON laws. The conditional probability of the enactment of CON regulations is found to be greatest when the hospital market concentration measured by HHI is high, i.e. when the local market is dominated by a few large firms. When the market is highly concentrated, the cost to organize hospitals to support CON enactment is low and the potential benefits accruing to hospitals as a result of increased protections from competition by CON regulations are large; thus, hospitals are more likely to support the enactment of CON regulations.

[1] In one of the earliest and landmark studies, Salkever and Bice (1976) assessed the effects of CON regulations on investment in hospital facilities.[2] Their results suggest that CON programs did not reduced total hospital investment but merely altered its composition, restricting investment in new beds while stimulating investment in existing equipment and facilities.

While not providing empirical evidence, Havighurst (2005) and Feldstein (1988) express similar views that incumbent hospitals use CON laws as a lawful way to fend off competitors, either keeping a monopoly status in the local hospital market or at least facilitating local cartels. Sloan (1982) conjectured that hospitals may apply for the CON without a credible intention to invest, but rather to prevent their competitors from doing so. Ford and Kaserman (1993) analyzed impacts of CON regulations on entry into dialysis industry from 1980 to 1989 and found that these regulations have constrained entry and expansion, leading to a decrease in the quality of care and higher costs for dialysis. Cases where existing health care providers use CON regulations as a barrier to direct market competition are abundant in newspapers and journals.[3]

Many factors contribute to the anti-competitive tendency of the CON regulations. From a legal standpoint, the CON comparative review process may satisfy due process considerations and appear to be objective, employing a committee making the decision based on a set of defined standards. Nevertheless, final decisions can be affected by various factors, especially when interest groups exert pressure on the review board. With multiple, conflicting criteria for evaluation, each component objective can be given very different weights depending on the preferences of the board or agency. For instance, in Posner (1972), the author suggested agencies may use their regulatory power to compel firms to provide services that otherwise would not be provided, or not in the desired quantity. As he called the mechanism "internal subsidy", whereby a firm provides services at a loss, which it recoups by charging a higher price for other services.

This view was examined empirically in Campbell and Fournier (1993) and Fournier and Campbell (1997). In their studies, regulators use the licensing power to create entry barriers and give incumbent providers higher than normal profit in order to subsidize indigent care and related merit services. Hospitals with high indigent care are more likely to be awarded the certificate (e.g. 79% of the CON applications by high indigent providers were approved). Miller and Hutton (2000) similarly found that state health agencies gave hospitals with a high volume of Medicaid and indigent patients more favorable treatment in the CON review process. While this method of financing indigent care may be preferred by legislators who do not want to face the political consequences of

[3] A further example is the Community Tracking Study, conducted by the Center for Studying Health System Change, Solomon (1998) explored the impact of CON on local health care systems in a sample of twelve U.S. communities. The first round of site visits was conducted in 1996 and 1997 in the form of interviews with key player in local health care markets. Although there were considerable differences in the way state and local officials implemented similar policies, several overarching themes emerged, one of which was the finding that incumbent health care providers used CON laws to their advantage. For instance, the largest hospital in in Greenville, South Carolina, and the only one with a CON license to perform open heart surgery, leveraged its monopoly position to secure managed care contracts and become an exclusive hospital provider.

rasing taxes to pay for the service, the undesirable effects of restraining the provision of hospital services must be taken into account. A CON decision based on the policymakers' social objectives may protect the monopoly status of hospitals in the local market, leading to higher hospital prices and insurance premiums. The welfare loss from increased prices may outweigh the benefits of indigent care provision. Furthermore, if the objective is to provide indigent care, it should be accomplished by policies designed specifically for this purpose, rather than cross-subsidized through hidden charges induced by CON restrictions on competition.

Beauty Contests. Like many other allocation methods, CON assigns property rights to operate in the market. In these cases, a choice is made among one or more companies from a pool of applicants to allocate the rights to serve consumers in a local community. There are many ways a government can allocate these assets: auctions (franchise bidding), beauty contests, lotteries, first-come-first-served etc. The first two are often preferred to other alternatives that lack justified social or economic foundations.

A "beauty contest", a term attributed to Janssen (2004), is an allocation mechanism where firms submit proposals on how to use the assets and services that they will provide in the future and show that they have credentials to carry out the project as specified in the proposal. Similar proposals are judged and compared by a government agency and the right to provide new services will be granted to the one that meets the criteria or preferences best. The goal of such contests is an efficient market where the public needs are met and the competition of firms leads to an efficient allocation of resources and lower prices.[4] The CON comparative reviews are thus a form of beauty contests.

The difference between an auction and a beauty contest is that the former has a specified algorithm that determines the outcome, while the latter contains multiple criteria that can not be easily quantified into a scalar score or ranking. In Posner (1972), the auction was perceived as a superior allocation mechanism to other regulation methods. Each bidder submits a price-quality package and as long as there is more than one bidder and there is no collusion, the most attractive package would win and the auction process would drive price down and quality up, thus eliminating monopoly pricing. However, as Williamson (1976) pointed out there are many problems with

[4]In many cases, an additional goal of the contest is to raise revenues to alleviate financial difficulties in the government. If this is the main goal of the allocation mechanism, then one measure of the efficiency of the process is to look at the total combined surplus of the government and the winner of the license.

franchise bidding in practice, including executing and designing the contract, and he finds that the process would likely require extensive ongoing regulation, thus, not improve upon more traditional selection mechanisms, i.e. the beauty contest.[5] Under certain circumstances, however, a beauty contest may be preferred to an auction. In a beauty contest price is not the only relevant item; other aspects such as fairness, equity and quality are also part of the consideration. It is best suited for projects with multi-dimensional attributes that pertain to the particular needs in the community, and about which there are reasons why terms cannot be fully specified and fixed in advance.

Despite its widespread use in procurement and allocation (such as television franchise, defense procurement, land development), research on beauty contest is almost non-existent in economic literature. The following discussion is based on the few studies that address the issue of the design of beauty contestsJanssen (2004), Cabizza and De Fraja (1998) and Dodgson et al. (2003). The first one provides a basic framework and an introduction to this allocation mechanism; while the later two analyze the design of a beauty contest in more detail.

In Janssen (2004), beauty contests are divided into two categories: the unweighted and the weighted contest. In an unweighted contest, bidders know what the criteria are but do not know how important each criterion is. Each bidder is uncertain about how each criterion is weighted. The CON review might be seen as an unweighted beauty contest.

In a weighted contest, in contrast, bidders know in advance both the criteria and the weight on each one; the standards are substitutable and a lower score on one criterion can be offset by high scores in other criteria. Although beauty contests can be made more transparent and objective by defining weights for different aspects beforehand,[6] for various reasons it is often difficult to do so. The most important reason is information asymmetry; applicants often have private information and the application process itself is a revelation process that helps the awarding authority make inferences. Furthermore, service requirement vary from project to project, a fixed weighting scheme

[5]In single-attribute auctions, a scalar objective measure, e.g. the lowest bid, is used to determine who wins. However most auctions are multi-attribute auctions where firms compete not only in bid prices but also in other dimensions such as quality. With multiple standards the process can become very complicated. For example, in the CATV bidding case in Williamson (1976), quality aspects have to be factored in and controlled. Williamson (1976) used the Oakland CATV auction to illustrate his point: the city specified minimum quality requirements each bidder was required to meet in the auction. Firms then competed mainly in terms of rates. It turned out that quality requirements were misspecified and omitted important considerations. The results revealed many problems in the execution and regulation of the winning contract.

[6]To some extent, the pre-defined weights discipline the actions of awarding agencies so that they would not judge applications on a few criteria and base the scoring on personal preferences or beliefs.

will limit the ability of the agency to seek innovative projects to meet the particular needs of the community.[7]

In either type of beauty contests, scoring on each item is subjective and would reflect the views of the relevant authority. For example, a certificate of need may be awarded to the wrong party if the additional demand (or benefits) for a new obstetric program perceived by the agency differ from what is determined by the market conditions and patients' preferences in the community. Furthermore, because of its subjective nature, the evaluation process can be manipulated by interest groups. It was suggested early on that hospital executives with more political skills were more likely to obtain the CON license.[8] Of course, an optimal decision might still be reached if one applicant dominates others by performing at least as well as the others on all criteria and strictly better than them on at least one criterion. In principle, one option might dominate all others, but in practice it is unlikely and the judgement of regulatory authority will often determine the outcome.

There are two allocation mechanisms proposed as alternatives to beauty contests: the stated preference method and revealed preference method. These two are often used to measure the benefit of public projects, environmental and natural resources.[9] The essence of these methods is to measure the willingness-to-pay for each alternative and compare these values across available options. Despite their different methodologies, Brookshire et al. (1982) and Carson et al. (1994) have shown that the two methods yield similar willingness-to-pay for a variety of environmental improvements.

Contingent valuation is the most prevalent example of the stated preference method. With contingent valuation, researchers seek direct consumer valuations of different options by asking individuals about their willingness-to-pay for different proposals. This method has a great attraction for public policy: it considers the gains and losses to all consumers in the affected area; and more

[7] Dodgson et al. (2003) provides a constructive proposal, called Multi-Criteria Analysis (MCA), for the design of a beauty contest. MCA describes a structured approach that assigns scores and weights to determine overall preferences among alternative options. In essence, MCA is a weighted beauty contest. The actual value of indicators are based on the quantitative scoring and ranking of a wide range of impact criteria. The design of MCA brings a degree of structure, openness and renders the evaluation more explicit. Thus, the choice of criteria and weights are subject to public scrutiny, feedback and revision in response to input from the community. It still relies, however, on the judgment of decision makers in establishing objectives and criteria, estimating relative importance weights and in scoring each performance criterion. Thus, many of the ambiguities inherent in unweighted beauty contests remain.

[8] In many beauty contests, the track record of the applicant often plays a main role in the process. Applicants' experience, expertise in the line of business, accreditation, quality of existing firms and connection with the regulatory authority can 'create a favorable impression or, more precisely, to affect the agency's subjective probabilistic belief'(Spence (1973)). This partly explains why incumbent hospitals are more likely to be granted the CON since they have more experience in the local market and have more information about the local community.

[9] These methods are widely used in measuring the welfare effects of public policies such as reducing air pollution, converting a wetland into cultivation, removing a fishing site, oil spill, reopening a national park and protecting endangered species.

importantly, it creates a single scalar value for comparisons among applicants, and it is based on the public preferences, not the regulator's personal tastes. The idea was mentioned in Posner (1972) as a method to choose among different cable companies when they differ in types and levels of cable services, costs and quality. Instead of allowing regulatory officials to infer consumers' preferences and sometime substitute their own, consumers should decide the preferred price-quality mix. There would be an "open season" in which franchise applicants would seek to obtain actual commitments from potential subscribers and the applicant who received the most commitments, i.e. the most preferred applicant by consumers in aggregate, would be awarded the franchise. Consumers and the winning applicant would be required to carry out the contract as specified earlier.

There are several problems associated with the stated preference method. First, relevant data may not be available or may be too expensive to collect. Second, the outcome can be very sensitive to the design of questionnaires and survey procedures. Questions must be designed in a way that can be easily understood by the respondent. Framing effects, due to how questions are posed, can elicit different answers. For example, different results may occur if the question is open ended such as "How much are you willingness to pay for this improvement" or instead, "Choose an amount from this list of values". Finally, people might feel more strongly negative about a project that imposes both environmental and social costs than would be estimated by adding separate valuations of the two costs.

The second alternative, the revealed preference method, deals explicitly with uncertainty and multi-criteria assessment. It is based on the multi-attribute utility theory in Von Neumann and Morgenstern (1947). It is assumed that there is a range of options to choose from, that only one of these options must be chosen, and that, because of uncertainty about exactly what the future will be, different options will have potentially different values (utilities) to the decision maker, depending on what future state of the world eventually occurs. To give an example of hospital care, once patients diagnoses are known, the same hospital would have different values to different patients. Yet, all patients face uncertainty about their future state of health and what kind of health care will be required. With the revealed preference method, utility is calculated under all future states of the world that are relevant to this decision. The final measure is the possibility weighted average of all outcomes.

If rational individuals behave consistently with the axioms established by Von Neumann and Morgenstern (1947), they should choose the option that has the maximum expected utility value, and researchers are able to express the decision makers' overall valuation of an option.Green et al. (1995), McFadden (1994) and McFadden (1998)[10]

This approach has become popular in health economics with the help of widespread digital recording of patients' discharge information. With detailed patient and hospital information, researchers can now estimate how important each hospital is to the local residents in terms of the incremental utility it brings to the community. The pioneers in this methodology are the Town and Vistnes (2001) and Capps et al. (2003) studies that estimate the additional contribution of each hospital to the total utility of the community based on the actual choice behavior. Thus, when local hospitals engage in mergers, the effect is to increase their joint bargaining position and value to the community; further, these changes may lead to an increase in the negotiated private prices for hospital care. The reliability of this method's out-of-sample predictions is tested further in Fournier and Gai (2007).

In this paper, to evaluate the benefits to the community of a new hospital or new services based on the empirical parameters from the random utility model. Details such as the range of hospital services, location and many other characteristics of the new hospital are all included in the proposed CON application. Incorporating these attributes into the model, we can predict the change that is likely to occur in patient allocations for each applicant. This imputation provides a simulation of the welfare change in the local community, to identify applicants with the highest welfare gains. We are able to account for multiple criteria because this methodology incorporates how all attributes of the project taken jointly affects consumers' utility. Finally, the model helps to control for the uncertainty problem by aggregating patients' utility across all possible medical diagnoses weighted by the conditional probability of each.

[10]A common assumption in this method is the random utility model which consists of a deterministic linear function of observable attributes and an idiosyncratic error term. Assuming that the error term follows extreme value distribution, one can estimate the parameters in the utility function by a conditional logit model. Though this makes computation easier and feasible, it introduces the Independence of Irrelevant Alternatives (IIA) property, which implies that the relative probability of choosing between any two alternatives is independent of all other alternatives. The relative probability of choosing between options will remain constant even if a perfect substitute is introduced. Nested logit models and mixed logit models help to address the IIA property, but at the cost of computational difficulty**?**.

3. Data and Variables

The relevant hospitals in the local area for this study are the three applicants for the CON to build a new hospital in Clay County, Baptist Medical Center (BMC), Orange Park Medical Center (OPMC), and St Vincent's Medical Center (SVMC), and 4 other hospitals in the area, i.e. Health Planning District 4 including Baker, Clay, Duval, Nassau and St. Johns Counties. Figure 2 is a map of these hospitals including the proposed new ones.

Inpatient discharge data and hospital financial data from 2002 to 2005 are collected from Florida Agency for Health Care Administration (AHCA). Patient characteristics in the data include detailed clinical and demographic information. Patients' diagnoses and procedures are coded in Diagnosis Related Groups (DRG) which are aggregated up to Major Diagnosis Codes (MDCs). Also included are the patient's length of stay, payer category (Medicare, Medicaid, HMO, PPO etc.), demographics (age, race, sex etc.), and patient residential zip code location. Attributes of each hospital include its control type (for profit, not for profit, or government), teaching status, nursing intensity, capital intensity, and an inventory of services offered.

Patient income data by race and zip code for 2000 are from US Census 2000 Summary File 3 (SF 3) - Sample Data at http://www.census.gov/main/www/cen2000.html. The travel time from patient's home to each hospital are estimated from www.mapquest.com.

It must be noted at the outset that the sampling design is subject to certain considerations. We use the choice based sampling strategies to select relevant hospitals and patient and to construct zip code specific choice sets. Consistent with patient flow analysis, the service area should be self-contained for each hospital under study. This means, first, that the analysis should not overlook any other "outside" hospitals where evidence reveals that patients in the local area are able to choose, and sometimes actually choose, for hospital care. These outside hospitals are a source of competition for local hospitals. Second, the data set should include substantially all of the patients that received services from the local hospitals, without restricting those patients by how far away they reside from the hospital. In short, we construct diverse zip-code level choice sets. Varying the hospital choices by small areas allows for considerable heterogeneity across the total service areas of any given hospital.

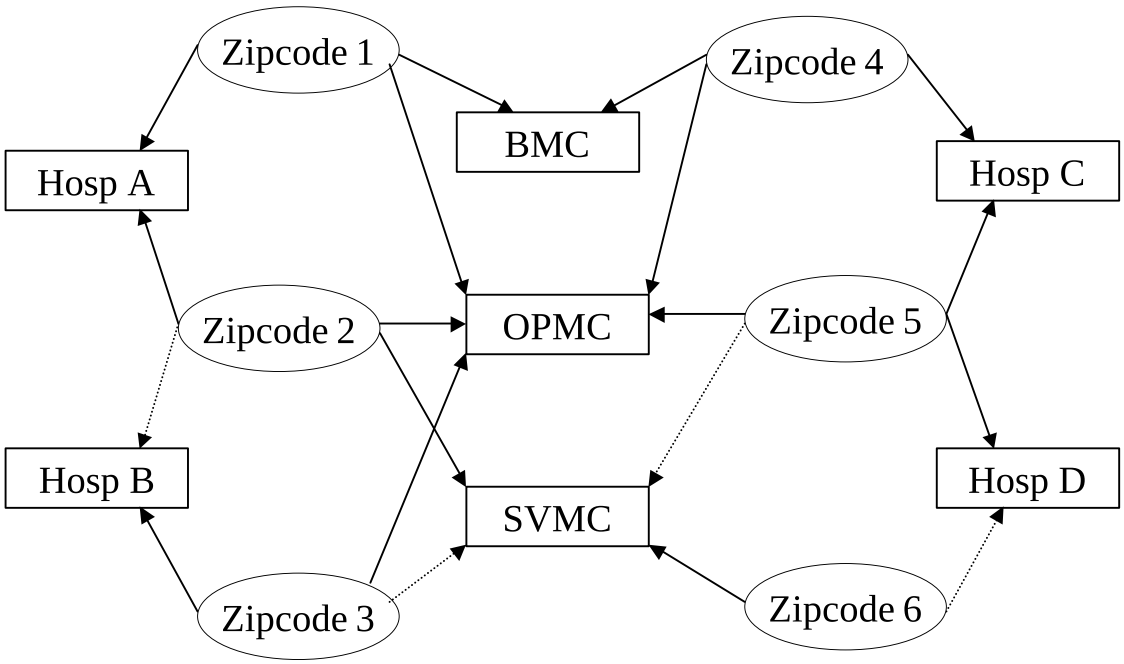

FIGURE 1. Hospital market area for the CON case

Figure 1 illustrates, in principle, how the market is defined. The three boxes in the middle represent the three proposed new hospitals. First, identify all the zip codes for the patients who were discharged from these three hospitals. In this example, patients from zip code $1, 2, 3, 4, 5$ and 6 received care at the three hospitals. Then, looking at each zip code, the choice set includes all hospitals that draw patients from these locations. In the figure, patients from the 6 zip codes also visited hospitals A, B, C and D. Some zip codes were excluded if very small numbers of patients were drawn to the three focal hospitals (note the dotted line in figure 1).[11]

In the final sample, we have 439,076 patients from 67 zip codes and 26 hospitals. We are able to cover 88.07% (131922 out of 149799) of patients discharged from the 7 existing hospitals (3 local hospitals currently owned by the CON applicants plus 4 other hospitals in District 4). [12]

[11] To reduce the sample to a manageable size, we require a minimum of 50 patients to be included in each step. In Fournier and Gai (2007), we discuss these sampling issues at length and explore the sensitivity of the model's predictions to changes in the sampling design.

[12] Memorial Hospital Jacksonville has the highest coverage rate of 93.79% and St. Luke's Hospital has the lowest coverage rate of 68.2% because it is affiliated with the Mayo Clinic and 13% of its patients are out of state.

Table 1 is a list of the 26 hospitals and the corresponding coverage rates. In table 2 are the hospital control types and services offered at these hospitals.

While we can readily determine the actual choices patients make in the data, we cannot identify for certain the exact choice set for each patient. For instance, if an HMO payer restricts hospital choices, while Medicare does not, we might overstate the range of choices for the former from data including the latter. However, we find that there are identical choice sets obtained by zip code when constructed for Medicare patients and for the private payer categories. Even so, if there are more than one HMO available locally, different HMO patients could potentially face different choices and this method would identify the union of all HMO choices.

Information for the three proposed new hospitals comes from the application material and show differences in the range of services they plan to offer. The proposed BMC Clay, OPMC Clay and SVMC Clay offer services in magnetic resonance imaging, cardiac care, respiratory system disorder. None of the three proposed hospitals have organ transplant services or neurological surgeries. While OPMC Clay and SVMC Clay offer obstetric care, BMC Clay does not include obstetric care in the proposal; unlike the others, BMC Clay offers psychiatric care services. The three proposed hospitals also differ in their locations, which are shown in figure 2. Descriptive statistics on the patient discharge sample are included in table 3.

4. Analysis of the Pricing of Hospital Services

We begin with an analysis of the pricing history of the 7 focal hospitals that constructs composite indexes and examines whether the levels of prices significantly vary among the existing hospitals owned by the applicants in the situation prior to the entry of a new hospital.

We use similar methods in Keeler et al. (1999) and Melnick and Keeler (2007) to construct hospital-specific price indexes or "standardized prices". The authors create hospital-specific "standardized prices" for each year from 1986 to 1994 in California and from 1999 to 2003, respectively in the two studies. The authors first compute the net revenue for patients in each hospital within each of the 10 common DRGs by multiplying each patient's listed charges by the hospital's average discount factor for private-pay patients at the hospital.[13] The discount factor is calculated as the ratio of net revenue to gross charges from the hospital financial data for private-pay patients.[14]

The logarithm of the net revenue per patient day within each DRG in each year is regressed on hospital dummy variables, patient age, gender, race, whether case routine, mortality of the patient, and length of stay. By regressing prices separately by DRGs, we control for potential differences in prices due to different hospitals offering diverse mixes of services. In addition, the regression controls for patient differences within DRGs across hospitals that may affect prices. Such adjustments are obviously important, since even within the same DRGs, patients who are in more severe conditions (those who died in the hospital) would require intensive care and lead to higher charges. The 10 selected DRGs represent common diseases that can be treated without highly specialized equipment or skill; thus they are performed by the greatest percentage of all hospitals. The 10 fixed effects (the hospital-DRG dummy coefficients) for each hospital are combined into a single "standardized price index" weighted by the average proportion of patients in that DRG in the entire sample. We can infer price differences across hospitals from these standardized price indexes, and are able to create price indexes for nine sets of DRGs.

From inpatient discharge data of 2002 to 2005, we select only those patients with commercial HMO, commercial PPO or other commercial insurance. Charges for private pay patients are negotiated in bargaining between hospitals and payers, and hence are more likely to be affected by conditions affecting hospital competition. In contrast, Medicare and Medicaid prices are set exogenously by federal reimbursement policy and are unlikely to be influenced by hospital market power.

It is infeasible to incorporate every DRG in the index construction, especially since the proposed hospitals plan to treat a limited range of patients; consequently four alternative sets of price indexes are constructed. The first two are based on regressions including only the top-50 and

[13] The 10 DRGs are: 14 Cerebrovascular; 89 Pneumonia; 96 Bronchitis; 127 Heart Failure; 174 GI hemorrhage; 182 esophageal/gastric digestive disease with cc; 183 same without cc; 243 Back problems; 296 Nutritional/metabolic disorders with cc; 320 Kidney/UTI with cc.

[14] The present study has the advantage of using discharge data from more recent years, 2002 to 2005; consequently instead of average discount rates for all patients, we can use a more accurate measure of the discount rate for private pay patients only. Ideally, one would like to use, as a measure of hospital prices, the actual payment for each patient by private insurers and managed care organizations. But data the actual prices paid for patient care are not generally available, and this alternative measure is often used as a rough estimate.

top-10 "most widely treated" DRGs in the state. [15]. Alternatively, we select DRGs for inclusion in the index from top-50 and top-10 DRGs with the "largest discharge frequency" statewide.[16] We eliminated 11 DRGs from the top-50 DRGs with the "largest discharge frequency" that were not present in the discharge records of the 7 focal hospitals, leaving 39 DRGs.

A further set of regression-based indexes differ in terms of whether patient discharge frequencies are compiled from the data on local patients alone or from patients across the whole state. The first group includes DRGs are based on patients in District 4 including Baker, Clay, Duval, Nassau and St. Johns Counties, the main service areas for the 7 hospitals. We selected top-50 and top-10 "most widely treated" DRGs in this local market; top-50 and top-10 DRGs with the "largest discharge frequency". [17] A final category of indexes we report match the 10 DRGs used in Keeler et al. (1999), Melnick and Keeler (2007) and Lynk (1995).

For each DRG category, we regress the log of net price per day:

$$\ln(netp/los)_{ijd} = x'_{ijd}b + \alpha_{jd}hosp_j + \varepsilon_{ijdt} \tag{1}$$

where observations are on patient i in DRG category d at hospital j. The dependent variable, $netp/los$, is an estimate of the net price per day.[18] The explanatory variables x_{ijd} control for length of stay (los), patient demographics (gender, race and age), discharge status, source and the year of admission. $hosp_j$ is a dummy variable for hospital j. α_{jd} is the fixed effect for hospital j in DRG d. A weighted average of the fixed effects, α_{jd}, will be used to obtain the price index for hospital j: $P_j = \sum_d wt_d \alpha_{jd}$, where wt_d are weights by patient volume.

Table 4 lists the price indexes based on the nine sets of DRGs. In each regression, OPMC is the ommited hospital and the hospital specific effects are relative to it. OPMC was awarded the CON in the initial ruling by the agency. The weighted fixed effects for each hospital thus give us the price differences, relative to OPMC after controlling for patient attributes. The first four columns are indexes based on DRGs of statewide patient discharges. Column 5 to 8 are based on DRGs of patient discharges in the local market. The last column is the result using the 10 DRGs in Keeler

[15]These DRGs are defined the same as in Keeler et al. (1999) and Melnick and Keeler (2007): DRGs treated by the largest number of hospitals in the state. The reason for this "most widely treated" approach was to capture patients in DRGs that could be given hospital care without specialized professionals or equipment and could be served by most community hospitals.

[16]As a robustness test, we select DRGs ranked by the largest discharge frequency in the state.

[17]We eliminated 3 DRGs from the top-50 'most widely treated" DRGs that were not present in the data and 9 from the top-50 DRGs with the "largest discharge frequency".

[18]The net price is calculated as the gross charges for each discharge discounted by the hospital-specific ratio of revenue deduction to total gross revenue for private pay patients in the reporting period.

et al. (1999), Melnick and Keeler (2007) and Lynk (1995). Compared to OPMC, both SVMC and BMC charge significantly less for the same services across all the selected DRG categories, although it is inconclusive which of these two charges the lowest price. For instance, for the top-50 DRGs with the "largest discharge frequency" statewide, SVMC and BMC charge 24% and 22% less than OPMC respectively. The largest difference is for the statewide top-50 "most widely treated" DRGs (36% and 32% for SVMC and BMC respectively); while the smallest difference is found in the top-10 DRGs with the "highest discharge frequency" in the local market (15% and 13% for SVMC and BMC respectively). In each case, the difference is significant at 1% confidence level.

In 7 out of the 9 DRG Categories, the prices in SVMC are lower than BMC, though the differences are not statistically significant. For instance, in the first column, SVMC charges 4.7% lower than BMC with a standard error of 9.12%. Our finding is consistent with the parties claim that SVMC and BMC charge lower prices than OPMC because, unlike the situation facing OPMC as sole hospital in the county, the other two operate closer to the urban center of Jacksonville where the market is relatively competitive with 6 nearby hospitals[19] in the local community competing for the MCO contract.

Baptist Medical Center–Beaches and Memorial Hospital Jacksonville also have lower price levels than OPMC. The former charges 12% to 26% less than OPMC and the latter 11% to 23% less depending the DRG categories. Price at St. Luke's Hospital is 21% to 30% higher than the benchmark OPMC. The main reason may be that St. Luke's is affiliated with the Mayo Clinic and treats patients with severe conditions. The pricing patterns for Shands Jacksonville Medical Center vary depending on DRG categories. For 6 out of the 9 sets of DRGs, including top-50 and top-10 DRGs with "highest discharge frequency" statewide; and the four DRG categories based on local market, Shands has a higher price level ranging from 3% to 17%. For top-50 and top-10 statewide "most widely treated" DRGs and the 10 DRGs based on Melnick and Keeler (2007), Shands charges 9% to 17% lower than OPMC. We thus did not find a consistent pricing pattern for Shands Jacksonville Medical Center.

[19] Specifically, Baptist Medical Center, St. Vincent's Medical Center, Baptist Medical Center—Beaches, Shands Jacksonville Medical Center, Memorial Hospital Jacksonville, and St. Luke's Hospital. In the SVMC application, the case mix adjusted net revenue per discharge for private pay patients by SVMC is much less than BMC ($5541.13 vs. $6769.69). The net revenue is based on inpatient data for 2004. The applicant did not provide details for the data and the methodology. No confidence intervals are provided. It also contradicts similar calculations by the agency. As a result, AHCA did not consider price differences a main factor in the decision making process.

Previous research, including Abraham et al. (2005), Dranove et al. (1993), Staten et al. (1988), Dranove and Ludwick (1999) and Melnick et al. (1992), find that competition among hospitals leads to lower prices. In this case study, we also find that being the only hospital in Clay County, OPMC is able to charge at least 10% more compared to SVMC and BMC in central Jacksonville, arguably a more competitive market than Clay County.

5. Welfare and Price Impacts of the New Hospital

Based on hospital capacity and occupancy rate data, AHCA ruled that the construction of a new hospital is justified for providing medical care for the fast growing population in Clay County, Florida.[20] The question is which one of the proposed hospitals provides the highest benefit to the community. Empirical demand models in general, and the WTP method, provide a new approach to quantify these welfare effects. Patient preferences are revealed in their choice behavior and can be measured by the Conditional Logit Model. The estimated parameters in the model can then be used to calculate the patients' expected maximum utility after a new hospital is introduced.[21] More specifically, we first estimate the following conditional logit model:

$$S_{ij}(G, X_i, \lambda_i) = \frac{a_{ij} \exp(\alpha R_j + H_j' \Gamma X_i + \tau_1 T_{ij} + \tau_2 T_{ij} X_i + \tau_3 T_{ij} R_j)}{\sum_{k=1}^{J} a_{ik} \exp(\alpha R_k + H_k' \Gamma X_i + \tau_1 T_{ij} + \tau_2 T_{ij} X_i + \tau_3 T_{ij} R_k)} \tag{2}$$

Where $a_{ij} = 0$ if hospital j is not available to individual i.

$H_j = [R_j, S_j]$, R_j is a vector of hospital j's characteristics, including its control types (for profit, not for profit, or government), teaching status, nursing intensity, capital intensity etc. S_j are services offered by hospital j. T_{ij} is the travel time from patient i's home to hospital j. $X_i = [Y_i, Z_i]$ include detailed demographic information, Y_i, and clinical information, Z_i. Assume the error term follows extreme value distribution, the expected maximum utility from adding a new hospital is:

[20] The population in Clay County is growing at a greater rate (2.6%) than other neighboring counties (1.89%) and is projected to continue through 2010. The U.S. Census Bureau identified Clay County as the 49th fastest growing U.S. Counties by percentage growth from July 1, 2003 to July 1, 2004. The two main hospitals, OPMC and SVMC, serving Clay County have an average of 72% occupancy rate in 2004 and over 90% during the peak admission seasons.

[21] For details, refer to Fournier and Gai (2007) and Capps et al. (2003)

$$U(G+1, Y_i, Z_i, \lambda_i) = E \max_{g \in (G+1)} [U(H_g, Y_i, Z_i, \lambda_i)] \tag{3}$$
$$= \sum_{i=1}^{N} \sum_{z} \ln[\sum_{g \in (G+1)} \exp(U(H_g, Y_i, Z_i, \lambda_i))] p(Z_i|y_i)$$

Where $G+1$ stands for existing facilities, G, plus the proposed new hospital. $p(Z_i|y_i)$ is the probability of individual i having disease Z_i conditional on her socioeconomic attributes. Attributes, H_g, for the new hospital can be found in the application material submitted to AHCA. Estimated parameters from equation 2 are used to measure the indirect utility from hospital j: $\hat{U}(H_g, Y_i, Z_i, \lambda_i) = \hat{\alpha} R_j + H_j' \hat{\Gamma} X_i + \hat{\tau}_1 T_{ij} + \hat{\tau}_2 T_{ij} X_i + \hat{\tau}_3 T_{ij} R_j$.

To estimate $\hat{U}(H_g, Y_i, Z_i, \lambda_i)$, we need to determine the service area by the new hospital. We use the joint 16 zip codes listed in table 5 as the service area of the new hospital, as these were the areas explicitly proposed in the CON applications. The last column is the primary service areas for OPMC in the application, consistent with the choice sets constructed from 2005 hospital inpatient discharge data. The proposed service areas of the three hospitals overlap, while BMC Clay proposes to serve a larger area. BMC Clay and SVMC Clay also share some of the zip codes currently served by OPMC. As a result we expect that a new hospital by either BMC or SVMC would attract patients away from the existing provider, OPMC, and thereby increase competition in the local market.

We use bootstrap methods to analyze the standard error of the aggregate utility for patients in proposed service areas after introducing new hospitals. The first column in table 6 is the aggregate patient utility from existing providers. Column 2 and 3 are the utility from adding the new hospital, BMC Clay, and the percentage increase from current utility level. Column 4 and 5 are the level and percentage change in utility from OPMC Clay. The last two columns are results for introducing SVMC Clay. The average utility (standard error) is 34.20% (5.30%), 12.84%(3.36%), and 24.66%(2.46%) higher than the current level after introducing BMC Clay, OPMC Clay and SVMC Clay respectively. The increase in utility is statistically significant for all three new hospitals, while the increase generated by BMC Clay and SVMC Clay is significantly larger than OPMC Clay. The utility increase between BMC Clay and SVMC Clay is not statistically different.

The results suggest that the new hospital proposed by either BMC or SVMC will benefit the local community more than the one proposed by OPMC. However, before we reach this conclusion, we need to examine the price effects of the new hospital. In theory, a new competitor will weaken the market power of the existing providers. In our case, BMC Clay and SVMC Clay will both increase competition in the market and lead to lower prices. On the other hand, OPMC Clay, a new hospital owned by the incumbent firm, will increase the bargaining power of the hospital and lead to higher prices. The magnitude of these price changes is an empirical question.

We have shown in a related paper Fournier and Gai (2007) that WTP has a positive and significant, but inelastic effect on prices. The overall elasticity (standard error) is estimated here to be 0.627 (0.032) for "most widely treated" DRGs, while for DRGs with "highest discharge frequency" it is 0.683 (0.011) and significant. We re-estimate equation 1 with the panel data from 2002 to 2005:

$$\ln(netp/los)_{ijd} = x'_{ijd}b + \alpha_d \ln(WTP_j) + \varepsilon_{ijd} \quad (4)$$

Variables are the same as in equation 1. Observations in the regression are commercial insurance, HMO and PPO patients discharged from the 7 hospitals in district 4 from 2002 to 2005. Corresponding WTPs for each hospital in each year are estimated. Using patient frequency weights by DRGs, wt_d, a weighted average of α_d, $\widetilde{\alpha} = \sum wt_d \alpha_d$ gives the measure of the overall elasticity of prices with respect to WTP. Nine elasticities are calculated for each of the 9 DRG categories defined in section 4. The highest elasticity (standard error) is 0.874 (0.101) for top-10 DRGs with "highest discharge frequency" statewide, while the lowest is 0.718 (0.169) for the top-50 "most widely treated" DRGs statewide. The elasticities are positive and significant in all 9 cases.

To predict the price changes following the entry of the new hospital, we measure the price index for hospital j, $P_j = \sum_d wt_d \exp(\ln(netp/los)_{d_j})$, evaluated at the patient-DRG mean characteristics for hospital j in 2005. Note that all three applicants operate existing hospitals. This co-ownership requires that we consider the enhanced bargaining position of the affiliated hospitals relative to the insurers when the new hospital enters. Assuming BMC is granted the CON certificate, we estimate the joint WTP for BMC and BMC Clay and the new WTPs for the other 6 hospitals. Whenever the new hospital enters, the additional value of each existing hospital will decrease while the joint value of BMC and BMC Clay will increase and will be larger than the sum of the two WTPs were the two not owned by the same system. These new WTPs together with the patient-DRG mean characteristics in 2005 are used to measure the new price index, $\overline{P}$ which is used to calculate price change in each hospital, $\frac{\overline{P_j}-P_j}{P_j}$. Denote w_j the frequency weight for hospital j based on patient volume for the 7 focal hospitals and wl_j the weight for hospital j based on patient distribution in the 16 zip codes (service areas of the new hospital), $\frac{\sum_j w_j*\overline{P_j}-\sum_j w_j*P_j}{\sum_j w_j*P_j}$ gives the overall price impacts of the new hospital on all patients in District 4, while $\frac{\sum_j wl_j*\overline{P_j}-\sum_j wl_j*P_j}{\sum_j wl_j*P_j}$ is the price change for patients in a smaller market, the service area of the new hospital. Both w_j and wl_j are predicted patient volume based on the conditional logit model.

Table 7 reports the results of the predicted price impacts under different scenarios for nine sets of DRGs. In scenario 1 in table 7, when the CON is awarded to BMC, for top-50 "most widely treated" DRGs locally, prices in Shands, St. Luke, SVMC and OPMC will decrease with the largest decrease (8.76%) induced upon OPMC. This result is expected because the new hospital BMC Clay is a direct competitor for OPMC in the same area. The increase of the joint bargaining power of BMC Clay and BMC leads to a small price increases of about 1.2%.

Weighted by predicted patient volume in District 4, the new hospital generates a very small price decrease of 0.72%. If we focus on patients in the service area of the new hospital (an area including 16 zip codes), price would decrease by 3.27%. In the second scenario, however, when OPMC Clay is allowed to build the new hospital, results are quite different. First, the model predicts that there will still be a small decrease in price in the other 6 hospitals. OPMC, on the other hand, is predicted to raise its price by 7.69% due to the increased market power brought by the new OPMC Clay. For a wide market including all patients in District 4, the overall price decreases about 0.7%. However, the impact for patients in proposed service areas is rather large with a price increase of 1.8%, which implies a price difference of about 5% between this scenario and scenario 1 or 3. This pattern is not sensitive to the alternative assumptions. For example, the final 3 columns show similar effects based on the original Keeler index components.[22]

Despite different weights and DRGs categories, we find that if OPMC were to be granted the CON, prices in OPMC would increase 7% to 11%. The overall price increase for patients in proposed service areas would be about 2%. On the other hand, BMC Clay (or SVMC Clay) would lead to a price decrease of about 8% to 10% for existing OPMC. Though the new hospital would increase the price in BMC (or SVMC) by about 1%, there would be a 3% decrease for paints living in the 16 zip codes.

[22]This pattern of results is further robust to the DRG samples used to construct regressions and index weights, e.g. substituting the top-10 statewide weights or using the "most widely treated" DRGs.

6. Limitations and Extensions of the WTP Method

Using parameters estimated from the Conditional Logit Model, we measure the change of total utility for patients residing in the proposed service areas. We find unambiguos welfare gains when the new hospital is chosen and that there would be a significant increase in patients' utility by 34.20%, 12.84%, and 24.66% after introducing BMC Clay, OPMC Clay or SVMC Clay respectively. Thus, model predicts that the increase generated by BMC Clay and SVMC Clay is significantly larger than OPMC Clay. The utility after introducing BMC Clay or SVMC Clay is not statistically different. Furthermore, if the new hospital is owned by either BMC or SVMC, the existing provider, OPMC, will be induced to lower its price by 7% to 11% and it will lead to a price decrease of about 3% for local residents. If the new hospital is OPMC Clay owned by the incumbent hospital, however, it will increase its bargaining power and increase the price at OPMC by about 8%, which in turn leads to a price increase of 2% for local residents. The results suggest that the new hospital proposed by either BMC or SVMC will benefit the local community more than the one proposed by OPMC. Of the three applicants, OPMC is the only existing provider in Clay County. As a result, we find that OPMC charges higher prices compared to the other two applicants who operate in a more competitive market.

We are unable to choose between BMC Clay and SVMC Clay because both proposed hospitals will increase patients' utility by similar magnitude and cause similar price decrease in the local community. Comparisons in two areas may distinguish the two proposals.

First is the efficiency of the proposed hospitals. According to the proposal submitted to AHCA, SVMC Clay will provide Obstetric care services while it is not included in the BMC Clay plan. The internal analysis of BMC suggests that for the obstetric program to operate at an efficient level, at least 1,000 annual deliveries are required. Given the population growth and current utilization rates, it is unlikely to meet this threshold. Substantial economies of scale are experienced by most of hospital services, including Obstetric care services. Higher occupancy levels enable an intensive use of facilities and staff to reduce the costs per case. It also helps improve the skill of physicians and thus improve the quality of care. If the population for a new obstetric program is below the optimal level, adding this program in Clay County will cause duplication of the service and the ability of existing providers to offer quality obstetric care could be diminished.

SVMC on the other hand states that the minimum cases required for an efficient obstetric program is 500. If this statement is correct, SVMC Clay would appear to be more appealing.

Recent studies by Abraham et al. (2005) and Zang (2006) may provide some useful information. The two studies adopted the Bresnahan and Reiss model (the BR model) to analyze the minimum population requirement for hospital entries and the impact of market structure on competition in local hospital markets. The intuition behind the BR model is that as the number of firms in a market increases, the competition will get tougher and a larger population is required to generate profits necessary to cover entry costs. The minimum market size necessary to support a certain number of firms can be solved by the zero-profit condition.

Both studies find that entry of a hospital will lead to a significant increase in competition, and most of the effects come from the entry of the second firm, which would require a large increase in population to support. Abraham et al. (2005) used data in 1990 and took the output of hospital production to be a single output product, a composite of the set of all hospital services. The minimum population for one hospital to make zero profit is 16,947 and to make the entry of a second hospital financially feasible, a population of 29,767 is required. According to the Population Estimates by the U.S. Census Bureau, the population in Clay County is 178,899 in June 2006. In the past five years the population in Clay County has increased by 27%. By 2010, the population is estimated to be 197,792. These figures provide support for a second hospital in the county.

For the purpose of comparing different proposals, Zang (2006) is more appropriate, where hospitals are treated as multi-product firms offering 46 hospital services. The projected population in 2010 in Clay County will meet or exceed the estimated threshold in Zang (2006) for adding the services in the CON applications with an exception of Obstetric services. A total population of 87,500 is needed to support the first Obstetric program while 456,000 is needed for two Obstetric programs. Even with rapid growth rates, the population in Clay County by 2030 is estimated to be 290,702 and it is much lower than the minimum requirement.

Hospitals may have other goals such as minimizing the patient travel distance, or offering a large scope of services. These objectives could change the optimal number of obstetric programs needed in the area. But these goals should be achieved under the "break even" financial constraint. The population required for a second obstetric program to cover the fixed costs is much larger than the projected future population in Clay County. Thus SVMC Clay may cause duplication of services and increase health care costs.

The second consideration might be the possibility of differences in the quality of care in BMC and SVMC. Although we can not predict the quality in the two proposed new hospitals, a comparison between existing providers provides information on the conduct of the hospitals in the past. Quality of care is a complicated issue and it is not addressed in the WTP method. We do find, however, that for the 15 risk-adjusted mortality indictors in the AHRQ Inpatient Quality Indicators, BMC has a lower rate than SVMC and OPMC.[23]

[23] The Inpatient Quality Indicators (IQIs) are a set of measures that provide a perspective on hospital quality of care using hospital administrative data. The software is developed by investigators at Stanford University and the University of California, under a contract with Agency for Healthcare Research and Quality (AHRQ). These indicators reflect quality of care inside hospitals and consist of 35 measures, including 15 mortality indicators for conditions or procedures for which mortality can vary from hospital to hospital.

7. Conclusion

The CON comparative review for hospital construction raises complicated issues of comparison among competing applications based on a set of criteria. Some comparisons can be done relatively easily, while others such as the welfare and price impacts of the new hospital can be difficult to carry out. In this study, we adopt the WTP method and use the CON application in Clay County, FL to compare the welfare and price impacts of the proposed hospitals.

Situations like the case studied here are inherent in the economic value of CON licenses and likely to come up often. For instance, in 2004, Central Florida Hospital(CFH), Oviedo HMA and Orlando Regional Health Care System (ORHS)each filed a CON application for a new acute care hospital in Ovideo, Florida. The proposed new hospitals from the three applicants were very similar in terms of locations, sizes, services and construction costs. Two factors that stood out were the close relationship between Oviedo HMA and ORHS, and the dominance of the ORHS in the local market. According to the agreement, the new hospital would be a joint venture between Oviedo HMA and ORHS, with ORHS contributing 20% of the project cost. The Ovideo market was being served mostly by Florida Hospital(61.7%) and ORHS(30.9%) while CFH was only serving 3.6% of the market. AHCA granted the CON to Oviedo HMA despite the conjecture that the Oviedo HMA/ORHS collaboration would have 54% of the market share and completely eliminate the ability for CFH to compete in the Oviedo market. Although the administrative judge on appeal noted that another hospital in the market could lower prices, AHCA's initial decisions were recommended due to the lack of convincing evidence on the magnitude of such effect.

We have shown here that empirical analysis based on widely available patient discharge and hospital financial data can be used in the CON comparative process. The results reveal the likely contribution of each proposal to the utility of local residents, as well as the impact on the price of hospital care to privately insured patients. Results clearly favor the proposal between OPMC Clay and SVMC Clay, or between OPMC Clay and BMC Clay. However, since the WTP method does not directly address the issue of efficiency or quality of care, additional analysis is needed to distinguish the proposals of BMC and SVMC.

Table 1. Total Number of Patients and Percentage Coverage, by hospital, in the CON application

ID	Hospital Name	City	County	Total N	N in Sample	Percent
100001	SHANDS JACKSONVILLE MEDICAL CENTER	JACKSONVILLE	DUVAL	25369	27742	91.45
100007	FLORIDA HOSPITAL	ORLANDO	ORANGE	52	52152	0.10
100017	HALIFAX MEDICAL CENTER	DAYTONA BEACH	VOLUSIA	3039	29790	10.20
100040	SAINT VINCENT'S MEDICAL CENTER	JACKSONVILLE	DUVAL	25216	28687	87.90
100045	FLORIDA HOSPITAL DELAND	DELAND	VOLUSIA	69	9381	0.74
100057	FLORIDA HOSPITAL WATERMAN	TAVARES	LAKE	54	11774	0.46
100062	MUNROE REGIONAL MEDICAL CENTER	OCALA	MARION	347	25084	1.38
100082	SHANDS AT AGH	GAINESVILLE	ALACHUA	1538	10560	14.56
100084	LEESBURG REGIONAL MEDICAL CENTER	LEESBURG	LAKE	1092	18488	5.91
100088	BAPTIST MEDICAL CENTER	JACKSONVILLE	DUVAL	28301	30921	91.53
100102	SHANDS AT LAKE SHORE	LAKE CITY	COLUMBIA	2626	6339	41.43
100103	SHANDS AT STARKE	STARKE	BRADFORD	600	891	67.34
100113	SHANDS HOSPITAL AT THE UNIV. OF FLORIDA	GAINESVILLE	ALACHUA	3098	29588	10.47
100117	BAPTIST MEDICAL CENTER - BEACHES	JACKSONVILLE BEACH	DUVAL	7287	8225	88.60
100118	FLORIDA HOSPITAL FLAGLER	PALM COAST	FLAGLER	3924	5409	72.55
100140	BAPTIST MEDICAL CENTER - NASSAU	FERNANDINA BEACH	NASSAU	2436	2959	82.33
100151	SAINT LUKE'S HOSPITAL	JACKSONVILLE	DUVAL	12097	17736	68.21
100156	LAKE CITY MEDICAL CENTER	LAKE CITY	COLUMBIA	1264	3737	33.82
100169	FLORIDA HOSPITAL - ORMOND MEMORIAL	ORMOND BEACH	VOLUSIA	5101	14198	35.93
100179	MEMORIAL HOSPITAL JACKSONVILLE	JACKSONVILLE	DUVAL	20268	21609	93.79
100204	NORTH FLORIDA REGIONAL MEDICAL CENTER	GAINESVILLE	ALACHUA	2580	21409	12.05
100212	OCALA REGIONAL MEDICAL CENTER	OCALA	MARION	139	12018	1.16
100219	FLAGLER HOSPITAL	SAINT AUGUSTINE	ST. JOHNS	11632	14104	82.47
100226	ORANGE PARK MEDICAL CENTER	ORANGE PARK	CLAY	13384	14879	89.95
100232	PUTNAM COMMUNITY MEDICAL CENTER	PALATKA	PUTNAM	5459	7193	75.89
100248	LARGO MEDICAL CENTER	LARGO	PINELLAS	84	14203	0.59

Table 2. Hospital Control Type and Services Offered in the Sample

ID	Hospital Name	Control	teaching	mri	cardio	nerv	resp	labor	psych	transplant
100001	SHANDS JACKSONVILLE MEDICAL CENTER	NFP	1	1	1	1	1	1	1	1
100007	FLORIDA HOSPITAL	NFP	0	1	1	1	1	1	1	0
100017	HALIFAX MEDICAL CENTER	Gov	0	1	1	1	1	1	1	0
100040	SAINT VINCENT'S MEDICAL CENTER	NFP	0	1	1	1	1	1	0	0
100045	FLORIDA HOSPITAL DELAND	NFP	0	1	1	0	1	1	1	0
100057	FLORIDA HOSPITAL WATERMAN	NFP	0	1	1	1	1	1	0	0
100062	MUNROE REGIONAL MEDICAL CENTER	NFP	0	0	1	1	1	1	0	0
100082	SHANDS AT AGH	NFP	1	1	1	1	1	1	1	1
100084	LEESBURG REGIONAL MEDICAL CENTER	NFP	0	1	1	0	1	1	0	0
100088	BAPTIST MEDICAL CENTER	NFP	0	1	1	1	1	1	1	0
100102	SHANDS AT LAKE SHORE	NFP	0	1	0	0	1	1	0	0
100103	SHANDS AT STARKE	NFP	0	1	0	0	1	0	0	0
100113	SHANDS HOSPITAL AT THE UNIV. OF FLORIDA	NFP	1	1	1	1	1	1	1	1
100117	BAPTIST MEDICAL CENTER - BEACHES	NFP	0	1	0	0	1	1	0	0
100118	FLORIDA HOSPITAL FLAGLER	NFP	0	1	1	0	1	0	0	0
100140	BAPTIST MEDICAL CENTER - NASSAU	NFP	0	1	0	0	1	1	0	0
100151	SAINT LUKE'S HOSPITAL	NFP	0	1	1	1	1	1	0	1
100156	LAKE CITY MEDICAL CENTER	FP	0	1	1	0	1	0	0	0
100169	FLORIDA HOSPITAL - ORMOND MEMORIAL	NFP	0	1	1	1	1	1	0	0
100179	MEMORIAL HOSPITAL JACKSONVILLE	FP	0	1	1	0	1	1	0	0
100204	NORTH FLORIDA REGIONAL MEDICAL CENTER	FP	0	0	1	1	1	1	0	0
100212	OCALA REGIONAL MEDICAL CENTER	FP	0	1	1	0	1	1	0	0
100219	FLAGLER HOSPITAL	NFP	0	1	1	0	1	1	1	0
100226	ORANGE PARK MEDICAL CENTER	FP	0	1	1	1	1	1	1	0
100232	PUTNAM COMMUNITY MEDICAL CENTER	FP	0	1	1	0	1	1	0	0
100248	LARGO MEDICAL CENTER	FP	0	1	1	1	1	0	0	0
109873	Proposed Baptist Medical Center Clay	NFP	0	1	1	0	1	0	1	0
109874	Proposed Orange Park South Clay Medical Center	FP	0	1	1	0	1	1	0	0
109875	Propsed St. Vincent's Clay County	NFP	0	1	1	0	1	1	0	0

Note: Control indicates Not-for-Profit (NFP), Government (Gov) or for-profit (FP) ownership. The columns indicate whether the hospital is a teaching hosptial and whether it offers services or specializes in magnetic resonance imaging (mri), cardiac care (cardio), diseases of nervous system (nerv), respiratory (resp) , labor and delivery (labor), psychiatric care (psych) and organ transplant services (transplant).

Table 3. Patient Sample Statistics in the CON application in 2005

Variable	Mean	Std. Dev.	Min	Max	Variable	Mean	Std. Dev.	Min	Max
age	56.821	24.917	0	108	urinary	0.047	0.211	0	1
lstay	4.866	7.099	0	779	endor	0.032	0.176	0	1
male	0.417	0.493	0	1	liver	0.028	0.166	0	1
white	0.781	0.414	0	1	genital	0.035	0.184	0	1
elderly	0.545	0.498	0	1	integ	0.022	0.147	0	1
child	0.090	0.286	0	1	infection	0.031	0.173	0	1
admission	1.845	0.991	1	5	injury	0.012	0.109	0	1
status	0.098	0.592	0	5	blood	0.013	0.113	0	1
fp	0.238	0.426	0	1	ent	0.009	0.092	0	1
teaching	0.112	0.315	0	1	alcohol	0.003	0.058	0	1
time	18.214	14.905	0	156	myelop	0.008	0.087	0	1
income	20.888	7.092	0	74.609	healthf	0.003	0.058	0	1
xchrlson	2.790	2.184	0	15	hiv	0.002	0.044	0	1
ndx	5.644	3.045	0	9	trans	0.001	0.026	0	1
npx	0.964	1.729	0	9	image	0.083	0.276	0	1
cardio	0.228	0.419	0	1	other	0.003	0.058	0	1
resp	0.110	0.313	0	1	medicare	0.522	0.500	0	1
labor	0.135	0.341	0	1	medcarhm	0.038	0.191	0	1
digest	0.095	0.293	0	1	commins	0.036	0.187	0	1
muscl	0.089	0.285	0	1	commhmo	0.196	0.397	0	1
nerv	0.069	0.254	0	1	commppo	0.208	0.406	0	1
psych	0.025	0.157	0	1					

Table 4. Price Indexes Based on Different DRG Categories

Variable	Widely DRGs Statewide		DRGs of Highest Frequency Statewide		Widely Treated DRGs Locally		DRGs of Highest Frequency Locally		Keeler 10 DRGs
	Top 50	Top 10	Top 50	Top 10	Top 50	Top 10	Top 50	Top 10	
constant	6.912††	6.675††	7.88††	7.643††	6.595††	7.387††	7.875††	7.579††	6.223††
	(0.18)	(0.131)	(0.118)	(0.097)	(0.117)	(0.076)	(0.113)	(0.082)	(0.11)
Shands	-0.117	-0.174††	0.05	0.089††	0.034	0.17††	0.072	0.133††	-0.088
	(0.085)	(0.058)	(0.048)	(0.031)	(0.05)	(0.033)	(0.046)	(0.028)	(0.055)
St Vincent	-0.363††	-0.338††	-0.241††	-0.154††	-0.26††	-0.24††	-0.229††	-0.149††	-0.334††
	(0.066)	(0.042)	(0.04)	(0.031)	(0.037)	(0.024)	(0.038)	(0.027)	(0.048)
Baptist Downtown	-0.316††	-0.333††	-0.224††	-0.171††	-0.232††	-0.272††	-0.195††	-0.13††	-0.287††
	(0.063)	(0.037)	(0.033)	(0.017)	(0.036)	(0.024)	(0.031)	(0.014)	(0.047)
Baptist Beaches	-0.252††	-0.247††	-0.187††	-0.125††	-0.254††	-0.264††	-0.185††	-0.115††	-0.28††
	(0.085)	(0.047)	(0.059)	(0.048)	(0.048)	(0.033)	(0.056)	(0.043)	(0.06)
St Luke	0.27††	0.238††	0.278††	0.288††	0.206††	0.266††	0.274††	0.303††	0.209††
	(0.081)	(0.058)	(0.048)	(0.035)	(0.044)	(0.031)	(0.045)	(0.031)	(0.059)
Memorial	-0.191††	-0.175††	-0.147††	-0.116††	-0.149††	-0.189††	-0.143††	-0.113††	-0.228††
	(0.071)	(0.047)	(0.043)	(0.032)	(0.04)	(0.026)	(0.041)	(0.028)	(0.054)
Yr2003	-0.03	-0.026	-0.051‡	-0.052††	-0.044$\dagger$	-0.037‡	-0.053‡	-0.051††	-0.028
	(0.044)	(0.026)	(0.022)	(0.012)	(0.026)	(0.018)	(0.021)	(0.011)	(0.033)
Yr2004	0.043	0.024	0.015	0.006	0.018	0.024	0.012	0.006	0.044
	(0.044)	(0.027)	(0.022)	(0.012)	(0.025)	(0.018)	(0.021)	(0.011)	(0.033)
Yr2005	0.05	0.024	0.025	0.011	0.03	0.04‡	0.021	0.009	0.067‡
	(0.045)	(0.027)	(0.023)	(0.013)	(0.025)	(0.018)	(0.021)	(0.011)	(0.034)

†† p-value .01 or less; ‡ p-value .05 or less and † p-value .1 or less
Parameter standard errors are given in parenthesis.

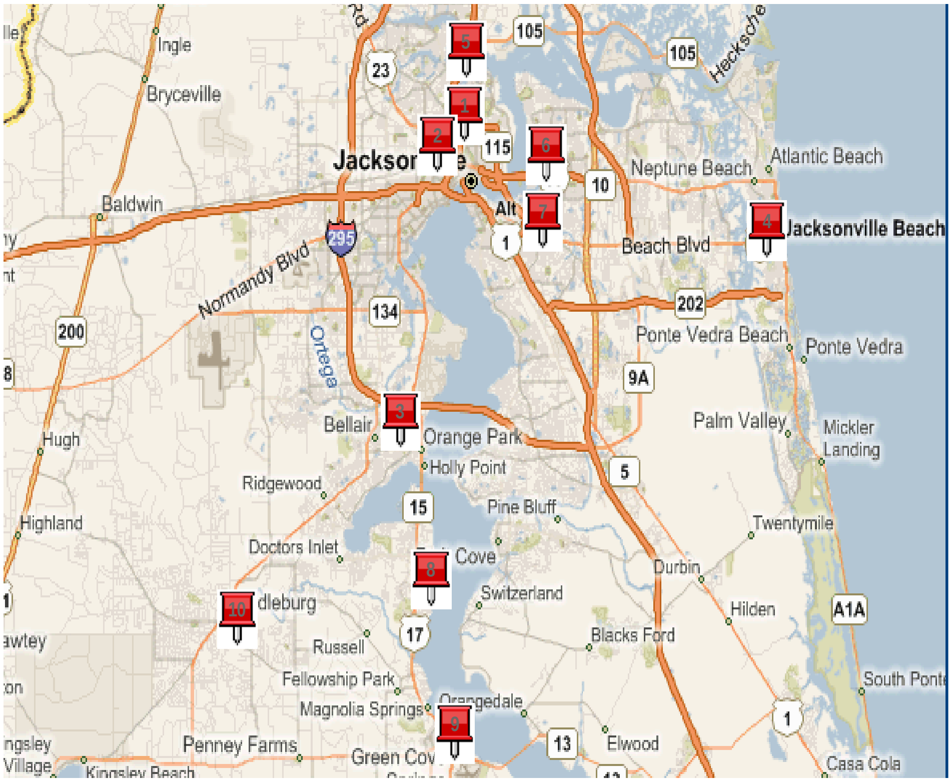

FIGURE 2. Locations of the 7 focal hospitals and 3 proposed new hospitals in the CON case.

1. Baptist Medical Center (BMC)
2. St. Vincent's Medical Center (SVMC)
3. Orange Park Medical Center (OPMC)
4. Baptist Medical Center – Beaches
5. Shands Jacksonville Medical Center (Shands)
6. Memorial Hospital Jacksonville
7. St. Luke's Hospital
8. Proposed Baptist Medical Center of Clay (BMC Clay)
9. Proposed Orange Park South Clay Medical Center (OPMC Clay)
10. Proposed St. Vincent's Clay County (SVMC Clay)

Table 5. Proposed Service Areas and OPMC's Primary Service Area

CON 9872 BMC Clay	CON 9873 OPMC Clay	CON 9874 SVMC Clay	Existing Facility OPMC
32003	32003	32003	32003
32006	32092	32656	32244
32030	32656	32043	32210
32043	32043	32065	32043
32050	32091	32068	32065
32065	32065	32073	32068
32067	32259		32073
32068	32068		
32073	32177		
32079			

The joint 16 zip codes are: 32003 32006 32030 32043 32050 32065 32067 32068 32073 32079 32092 32091 32259 32177 32244 32210.

Source: CON#9872, 9873, 9874

Addresses of Proposed Hospitals:
BMC Clay: 2233 Village Square Pkwy Orange Park, FL 32003
SVMC Clay: 1850 Blanding Blvd Middleburg, FL 32068-3838, US
OPMC Clay: 801 Oak St Green Cove Spgs, FL 32043, US

Table 6. Utility for Patients in Proposed Service Areas After Introducing New Hospitals

Bootstrap	Existinig Facility	Adding BMC Clay		Adding OPMC Clay		Adding SVMC Clay	
		Utility	% Increase	Utility	% Increase	Utility	% Increase
1	-32004.12	-24755.21	29.28	-26719.22	16.51	-23585.18	26.31
2	-30937.78	-22720.73	36.17	-28737.75	7.11	-22865.71	26.09
3	-30790.81	-23774.44	29.51	-27278.46	11.41	-23876.40	22.46
4	-32804.31	-24869.09	31.91	-28657.63	12.64	-24507.80	25.29
5	-32119.15	-23797.96	34.97	-27330.10	14.91	-24912.68	22.44
6	-32246.08	-23279.97	38.51	-28210.63	12.51	-24230.19	24.86
7	-32360.40	-23472.81	37.86	-27287.03	15.68	-22503.81	30.46
8	-31968.47	-22180.19	44.13	-28647.10	10.39	-24482.62	23.42
9	-30969.92	-24329.19	27.3	-28109.16	9.24	-23749.94	23.31
10	-32265.14	-22175.93	45.5	-28445.92	11.84	-24388.35	24.41
–	–	–	–	–	–	–	–
100	-32244.68	-24669.63	30.71	-27255.80	15.47	-24023.94	25.49
Mean	-31737.11	-23675.26	34.2	-27645.96	12.84	-23903.17	24.66
Std. Dev.	712.38	792.62	5.3	777.22	3.36	744.21	2.46

TABLE 7. Predicted Price Change After Introducing A New Hospital, Part 4

	Hospital	DRGs with Highest Frequency Locally						Keeler 10 DRGs		
		Top 50			Top 10			Top 50		
Scenario 1:	BMC Clay	Price Change	District Four	Service Area	Price Change	District Four	Service Area	Price Change	District Four	Service Area
	Shands	-0.75	-0.049	-0.034	-0.941	-0.061	-0.043	-0.692	-0.045	-0.032
	St Luke	-1.357	-0.142	-0.081	-1.766	-0.185	-0.106	-1.299	-0.136	-0.078
	Memorial	0.128	0.017	0.007	0.161	0.021	0.009	0.118	0.016	0.007
	St Vincent	-1.338	-0.256	-0.298	-1.677	-0.321	-0.373	-1.234	-0.236	-0.275
	Baptist Downtown	1.255	0.448	0.314	1.577	0.563	0.395	1.155	0.413	0.289
	Baptist Beaches	-0.116	-0.008	0	-0.141	-0.009	0	-0.124	-0.008	0
	Orange Park	-8.759	-0.726	-3.177	-11.059	-0.916	-4.011	-8.242	-0.683	-2.989
	Weighted Price Change		-0.715	-3.27		-0.908	-4.13		-0.68	-3.078
Scenario 2:	OPMC Clay		Top 50			Top 10				
	Shands	-0.929	-0.06	-0.043	-1.165	-0.076	-0.053	-0.857	-0.057	-0.045
	St Luke	-1.91	-0.2	-0.114	-2.483	-0.26	-0.149	-1.829	-0.195	-0.123
	Memorial	-1.016	-0.134	-0.057	-1.275	-0.168	-0.072	-0.937	-0.127	-0.063
	St Vincent	-1.47	-0.281	-0.327	-1.843	-0.353	-0.41	-1.356	-0.265	-0.298
	Baptist Downtown	-1.914	-0.683	-0.479	-2.397	-0.856	-0.6	-1.765	-0.513	-0.27
	Baptist Beaches	-0.145	-0.01	0	-0.176	-0.012	0	-0.155	-0.01	0
	Orange Park	7.686	0.637	2.788	9.929	0.823	3.601	7.195	0.831	3.146
	Weighted Price Change		-0.732	1.767		-0.901	2.317		-0.336	2.346
Scenario 3:	SVMC Clay		Top 50			Top 10				
	Shands	-0.918	-0.06	-0.042	-1.152	-0.075	-0.053	-0.846	-0.054	-0.037
	St Luke	-0.876	-0.092	-0.052	-1.14	-0.119	-0.068	-0.838	-0.084	-0.044
	Memorial	-0.215	-0.028	-0.012	-0.27	-0.036	-0.015	-0.198	-0.026	-0.01
	St Vincent	0.905	0.173	0.201	1.137	0.218	0.253	0.833	0.235	0.302
	Baptist Downtown	-0.176	-0.063	-0.044	-0.221	-0.079	-0.055	-0.162	-0.045	-0.017
	Baptist Beaches	-0.157	-0.011	0	-0.19	-0.013	0	-0.168	-0.011	0
	Orange Park	-8.212	-0.68	-2.979	-10.376	-0.86	-3.763	-7.726	-0.621	-2.972
	Weighted Price Change		-0.76	-2.928		-0.963	-3.702		-0.607	-2.778

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