A Structural Approach to Market Definition With an Application to the Hospital Industry*

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Abstract

Market definition is common in merger analysis, and often the decisive factor in antitrust cases. This has been particularly relevant in the hospital industry, where many merger challenges have been denied due to disagreements over geographic market definition. We compare geographic markets produced using frequently employed ad hoc methodologies to structural methods that directly apply the "SSNIP test" to California hospitals. Our results suggest that markets produced using previous methods overstate hospital demand elasticities by a factor of 2.4 to 3.4 and were likely a contributing factor to the permissive legal environment for hospital mergers.

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Introduction

The assessment of market power is key in antitrust cases. The goal is to assess competitive effects (Federal Trade Commission and U.S. Department of Justice, 2010). In the past this was done in a fairly rigid way, starting with market definition, leading to measurement of market shares and construction of concentration indices. This approach has received a great deal of criticism (e.g., Kaplow, 2010; Farrell and Shapiro, 2010a). The 2010 Horizontal Merger Guidelines (Federal Trade Commission and U.S. Department of Justice, 2010) explicitly introduced greater flexibility into this process, making clear that a variety of methods may be applied (including market definition, 2010 Guidelines, Section 4), as appropriate to the specifics of the case (Shapiro, 2010a; Farrell and Shapiro, 2010b).

While the Guidelines suggest greater flexibility, the Antitrust Division of the Department of Justice and the Federal Trade Commission have both recently emphasized an ongoing role for market definition (Shapiro, 2010b; Fry et al., 2011, also see Werden, 2012). In addition, courts have continued to insist on the inclusion of market definition as part of the evidence base (see, for example, FTC v. CCC Holdings, Inc., 605 F. Supp. 2d 26, 37, 39-40 (D.D.C. 2009), City of New York v. Group Health Incorporated, No. 10-2286-cv (2d Cir. Aug. 18, 2011); United States of America Federal Trade Commission Office of Administrative Law Judges, Docket No. 9346, In The Matter Of Promedica Health System, Inc., December 12, 2011), also Schmalensee, 2010; Kaplow, 2010), in part because of the role of precedent in case law (e.g., United States v. E.I. du Pont de Nemours and 11 Co., 353 U.S. 586, 593 (1957), "Determination of the relevant market is a necessary predicate to a finding of a violation of the Clayton Act because the threatened monopoly must be one which will substantially lessen competition within the area of effective competition." (internal quotation marks omitted).

In practice market power is frequently evaluated via market definition and the measurement of market shares. As a consequence, market definition often determines the results of antitrust cases (Kaplow, 2010; Farrell and Shapiro, 2010a, Baker, 2007; Areeda, Hovenkamp, and Solow, 2007; Jacobson et al., 2007; Pitofsky, 1990; Eastman Kodak Co. v. Image Technical Servs., Inc., 504 U.S. 451, 469 n.15, 1992) and is the focus of intense battles by the opposing parties. Plaintiffs claim narrower markets and defendants broader markets (e.g., FTC v. Staples, Inc., 970 F. Supp. 1066 (D.D.C. 1997); FTC v. Whole Foods Mkt. Inc.,548 F.3d 1028 (D.C. Cir. 2008), United States v. Oracle, Inc., 331 F. Supp. 2d 1098 (N.D. Cal. 2004).). It is no exaggeration to state that antitrust merger cases are usually won or lost based on the court's acceptance of one side's market definition.

Conceptually, there exists an approximate consensus about how market definition should be done in principle (Baker, 2007), however, in practice, there is wide variation in how market definition is implemented in antitrust analysis. Some ad hoc methods have been widely used in practice for defining markets. However, a number of analysts have recently pointed out that these methods suffer from serious flaws (Baker, 2007; Capps et al., 2002; Danger and Frech, 2001; Frech et al., 2004; Katz and Shapiro, 2003; Langenfeld and Li, 2001; Varkevisser et al., 2008; Werden, 1981, 1990). To our knowledge these methods have not previously been compared to empirical antitrust markets that are consistent with economic theory.

It is clear that an antitrust market should be the set of products and locations that exercise a significant competitive constraint on each other (Motta, 2004). The U.S. antitrust authorities introduced the "hypothetical monopolist" or "SSNIP" test as a method for delineating markets (Federal Trade Commission and U.S. Department of Justice, 1982), and this approach has been adopted by competition authorities worldwide. The Small but Significant and Non-transitory Increase in Price (SSNIP) test begins by defining a narrow market and asking whether a hypothetical monopolist in the defined market could profitably implement a SSNIP (usually a 5 percent price increase for 1 year). If sufficient numbers of consumers are likely to switch to alternative products so that the price increase is unprofitable, then the firm or cartel lacks the power to raise price. The relevant market therefore needs to be expanded. The next closest substitute is added and the process is repeated until the point is reached where a hypothetical cartel or monopolist could profitably impose a 5% price increase. The set of products/locations so defined constitutes the relevant market.

While the conceptual exercise prescribed by the SSNIP is straightforward, implementation in practice is not. This is due in part to data limitations, and in part to analysts' failure to utilize econometric analysis. If one has reliable estimates of demand in hand, the SSNIP test can be implemented in a clear-cut way that is consistent with the conceptual exercise. In the past, data limitations precluded demand estimation. In addition, modern econometric methods were not brought to antitrust until approximately 20 years ago (Scheffman and Spiller, 1987). As a consequence, informal methods of market definition were developed that did not require either extensive data or econometric methods (Elzinga and Hogarty, 1973, 1978; Harris and Simons, 1989). These simple quantitative approaches to market definition have been widely used in antitrust analysis in part due to historical precedent, yet they have been criticized for their static nature, simplifying assumptions and internal inconsistencies, all of which have the potential to affect the conclusions drawn from these methods.

The use of such ad hoc market definition methods has been particularly influential in antitrust decisions in the hospital industry, where 1,425 mergers and acquisitions were successfully consummated between 1994 and 2009 (Kaiser Family Foundation, 2005; Irving Levin Associates, 2007-2010). These mergers have resulted in increases in the price of inpatient care (Keeler et al., 1999; Vita and Sacher, 2001; Capps et al., 2003; Gaynor and Vogt, 2003; Dafny, 2009), no measurable increase in the quality of care (Hamilton and Ho, 2000) and estimated losses of $42 billion in consumer welfare (Town et al., 2005). While the hospital industry has seen more merger litigation in recent years than any other industry (American Bar Association, 2003), the courts denied all but one government request to block hospital mergers since 1994, due largely to the inability of the antitrust authorities to convincingly define a geographic market that supports their case. In the eight cases brought to the courts since 1994, the primary reason given for denying the government's request in six of these cases centered on market delineation.

In this paper we analyze differences in the scope of geographic markets defined by ad hoc methods used in actual merger cases versus those defined using structural models derived from economic theory, using the hospital industry as an illustration. We seek to better understand the extent to which these commonly employed methods of market definition define markets that are consistent with the criteria for merger analysis described in the merger guidelines.

We proceed by describing the ad hoc approaches to market definition versus structural methods for market definition. One of the structural approaches is based on the familiar differentiated Bertrand oligopoly model, and uses the methods developed by Berry, Levinsohn and Pakes (2004) and adapted for the hospital industry by Gaynor and Vogt (2003). This structural model allows for the exact implementation of the thought experiment prescribed by the merger guidelines' SSNIP test. The use of such models has been promoted in the past decade as a theoretically superior approach to merger analysis in differentiated product industries, (e.g., Nevo, 2000; Motta, 2004; Baker, 2007; Geroski and Griffith, 2004; Van Reenen, 2004; Ivaldi and Lőrincz, 2009) however, such an approach has not been commonly employed in antitrust analysis, and thus little is known about the differences in markets produced by these methods relative to the methods used in actual cases.[1]

Using the structural approach, we define geographic markets in the hospital industry and compare the resulting markets to those produced by the techniques that have been used by the courts in actual hospital merger cases. We then proceed to empirically analyze the similarities in the extent of market power determined by the differentiated Bertrand model as compared to that of an important alternative structural model of hospital competition developed by Capps et al. (2003). This model (which we refer to as the "option demand" model) explicitly allows for an important feature of hospital markets: negotiations between insurers and hospitals. However, the option demand model does not account for the joint pricing decisions of the individual hospitals in multihospital systems (hospital systems are multiplant firms and are a prominent feature of hospital markets -- nearly 60% of all hospitals are in systems), so its pricing predictions for individual hospitals in systems can't be used to define markets using the SSNIP test. We do, however, compare the results of merger simulations for single plant firms using the two models, as well as compute the average, system-wide price increases implied by the models for a multi-system merger.

Our results suggest that the market definition techniques used in courts' decisions involving hospital mergers have defined overly expansive (geographic) markets. Our analysis of California hospitals using 1995 data suggests that markets implied by previously employed quantitative market definition methods are, in the majority of cases,

[1] This analysis can provide direct evidence on competitive effects without relying on market definition, so it can be a useful component of the enforcement agencies' set of tools. We are grateful to an anonymous referee for emphasizing this point.

substantially larger than those that would be implied by a method rooted in the principles set forth in the merger guidelines. Furthermore, we find that both structural methods are consistent in their findings that hospital markets are largely local in nature, and differ from those produced using the methods that have historically been accepted as valid by the courts. While these results are specific to the hospital industry, they suggest the existence of this phenomenon more generally.

The paper is organized as follows. Part 1 provides background on the merger guidelines and their application in the hospital industry. Part 2 discusses quantitative approaches to market definition and outlines our use of a structural model to define geographic markets, while Part 3 describes our data. Part 4 describes our implementation of these methods and presents our results. Part 5 concludes.

1. The Merger Guidelines and Market Definition

1.1. The Merger Guidelines

The merger guidelines are a collaborative effort by the FTC and DOJ outlining the enforcement policy of the agencies concerning horizontal acquisitions and mergers subject to section 7 of the Clayton Act, section 1 of the Sherman Act, or section 5 of the FTC Act. They are considered to be the foremost articulation of the government's policy regarding enforcement standards for horizontal mergers (Werden, 1997). Their purpose is to convey the analytical framework by which the government is to go about determining the extent to which a merger is likely to lessen competition.

Though the first guidelines were released in 1968 and modified as recently as 2010, the thrust of the criteria for market definition was pioneered largely in the 1982 version, in which the guidelines focused on the central enforcement-related question of whether a merger would result in a price increase through the use of the SSNIP criterion. In the SSNIP criterion, an antitrust market is defined as a group of products and a geographic area in which a hypothetical profit-maximizing firm, not subject to price regulation, that was the only present and future seller of those products in that area would impose a "small but significant and non-transitory increase in price" (SSNIP) above all prevailing or likely future levels holding constant the terms of sale for all products produced elsewhere. As a general matter, it defined a price increase as significant if it was at least 5% and lasted for one year. The general idea in this process is to find the smallest group of products or firms for which there are no close substitutes, thus allowing such a hypothetical monopolist to exert market power.

The development of this concept was notable in that the economic reasoning was comprehensible to both attorneys and economists, and the methodology was operable. Though there are still differences on the implementation aspect of market definition analysis, the basis for these disagreements is typically methodological rather than the fundamental theoretical question of what defines a market (Scheffman et al., 2002). To this day the SSNIP criterion continues to be the standard by which courts define antitrust markets.

The antitrust enforcement agencies and courts "…normally consider measures of market shares and market concentration as part of their evaluation of competitive effects.'' (Federal Trade Commission and U.S. Department of Justice, 2010). The determination of market boundaries from market definition directly influences these measures since it determines which products or firms are in the market.[2] The inclusion of many products can understate market concentration, while failure to include relevant products may overstate concentration. Likewise, the delineation of geographic markets can be fundamental to the determination of the degree of market power. The inclusion of an inappropriately large number of firms could overstate the degree of competition, while failure to incorporate all firms involved may understate the prevailing competitive environment.

Once the market boundaries have been set, the merger guidelines specify levels and changes in the Herfindahl-Hirschmann Index (HHI) which serve as a guide as to when mergers are likely to be anti-competitive.[3] According to the 2010 guidelines, markets with a post-merger HHI below 1,500 are said to be unconcentrated and are thus unlikely to have adverse competitive effects. Markets with post-merger HHIs between 1,500 and 2,500 are regarded as moderately concentrated and are likely to warrant

[2] The current (2010) guidelines offer more flexibility than in the past, in that "The Agencies' analysis need not start with market definition….although evaluation of competitive alternatives available to customers is always necessary at some point in the analysis." (FTC/DOJ, 2010, p. 7).
[3] Because the thresholds set by the guidelines are intended to be a reference point, the FTC has been flexible in their enforcement of mergers conforming to these exact HHI thresholds. See Merger Challenges Data, Fiscal Years 1999–2003, at http://www.ftc.gov/os/2003/12/mdp.pdf.

scrutiny only if a merger will result in an increase in the HHI of more than 100. Mergers resulting in a post-merger HHI of above 2,500 are regarded as resulting in markets that are highly concentrated and thus mergers producing an increase in HHI of between 100 and 200 are presumed to raise significant competitive concerns, with increases of 200 points or more deemed likely to enhance market power.

1.2 Application of the Merger Guidelines to Hospital Care

In the case of hospital care, the relevant product market has not been an issue of contention in merger cases. The generally accepted product market definition has been to "cluster" products, leading to a typical product market definition of "general acute care hospital services" (American Bar Association, 2003, p. 30; Frech et al., 2004). In only one of the last eight cases brought by the government has failure to convincingly define a product market been a deciding factor in a hospital merger case (United States of America v. Long Island Jewish Medical Center and North Shore Health System, Inc., 983 F. Supp. 121 (1997)).

The inability to convincingly define geographic markets for hospital care was, however, the primary determining factor in six of the government's eight unsuccessful merger challenges between 1994 and 2005. Table 1 presents a list of the most recent cases challenged by the government, as well as the size of the geographic markets and level of concentration in each market.

2. Quantitative Approaches to Geographic Market Definition

As discussed above, the failure to correctly define a market may potentially have serious consequences in antitrust cases. However, because the merger guidelines have traditionally prescribed their market definition methodology through a thought experiment rather than a well defined method, there is no uniform approach for defining these markets. As a result, numerous quantitative approaches have been suggested and applied across many industries including beverages, software, hospitals and supermarkets. These include approaches based on product shipments, methodologies incorporating econometric methods and merger simulation, and analysis of consummated mergers.

Given our application to the hospital industry and the importance of geographic market definition in hospital antitrust disputes, our analysis focuses on the most widely used methods of geographic market delineation in this industry. It should be understood, however, that the general methodological issues are essentially the same regardless of industry or whether the focus is on product or geographic markets. In this section we carefully outline the principles upon which four methods of market definition are based. The first two methods that we describe, Elzinga-Hogarty (EH) and Critical Loss Analysis (CLA), rely in practice on inferring the extent of the market using shipment (discharge) data and have been used for defining markets in merger cases involving industries such as beer (United States v. Pabst Brewing Co., (1966)), photographic film (United States v. Eastman Kodak Co. (1995)) and software (United States v. Oracle Corp., (2004)), and are, to the best of our knowledge, the only quantitative approaches employed in hospital merger cases. Additionally, as Table 2 details, these methods have been utilized in the vast majority of hospital merger cases. We then contrast these with two more recent models of hospital competition based on formal economic modeling, whose constructs allow for the direct determination of the price effects of hospital mergers, as opposed to the more ad hoc approaches embodied in the less formal shipments-based methods.

2.1 Elzinga-Hogarty

As Table 2 indicates, the Elzinga-Hogarty method, (Elzinga and Hogarty, 1973, 1978) has been utilized extensively for defining markets in hospital merger cases (it was used by at least one side in 7 cases). The concept behind EH is straightforward. If an area imports little of its health care, it can be deemed a market from the demand perspective, as few individuals see the need to leave the area to be treated, while that if an area exports little of its health care, it can be deemed a market from the supply perspective. Using this conceptual framework, all that is required for producing a market using this method are shipments information consisting of patient origin and destination.

2.1.1 The Elzinga-Hogarty Test

The two measures specified in the original EH article as determining the extent of the market are LIFO (little in from outside) and LOFI (little out from inside). These respectively establish the geographic extent of demand and supply. Within a specified geographic area, one needs only to compute the extent to which an area imports a good (equivalent to a patient leaving an area for their hospital care) as well as the extent to which an area exports a good (equivalent to a patient from outside the area receiving treatment at a hospital within an area) to define the geographic extent of a market using these measures. Specifically, the import ratio is:

$$\text{import ratio}=\frac{\text{patient outflows from area of interest into any other area}}{\text{total discharges from area of interest}}$$

and the export ratio is:

$$\text{export ratio}=\frac{\text{patient inflows from other areas into this area}}{\text{total discharges from hospitals in this area}}$$

LIFO, defined as 1-(import ratio), and LOFI, defined as 1-(export ratio), must be simultaneously above a given threshold for an area to be deemed a geographic market. Thus, the larger the value of LIFO, the lower the proportion of imports into an area, and the larger the value of LOFI, the lower the proportion of exports out of an area. The specific thresholds for both measures recommended in the original EH article are 0.75 for a "weak market" and 0.90 for a "strong market."

While the computation of LIFO and LOFI in a *given* area is a straightforward task, an area in which both the LIFO and LOFI criteria are simultaneously satisfied need not be unique. For example (using zip codes as the "building blocks" with which to construct a geographic market, as is common in practice) suppose that for a given zip code, LIFO and/or LOFI does not meet the 0.75 threshold. This implies that this zip code in isolation does not constitute a geographic market according to the EH criteria, and thus to create a geographic market, additional zip codes need to be included. The choice of which zip code(s) should be incrementally added to the initial zip code can potentially affect the size of a market and the number of competitors. For example, adding zip codes based on a fixed radius from an initial geographic point can produce a different market than if one were to iteratively add zip codes based on the zip code that contributes the most to either the LIFO or LOFI statistic (Frech et al., 2004).

2.1.2 Limitations of Elzinga-Hogarty

While EH has frequently been acknowledged by the courts as an acceptable method by which to define geographic markets, there is nothing in economic analysis to justify its use; consequently, particular attention has been devoted to its limitations for defining hospital markets.[4] Patient flow methods may lead to overly expansive delineation of market boundaries when product attributes are heterogeneous in the quality or type of service offered (Werden, 1990). For example, patients from suburban or rural areas will often flow into an urban area to obtain more specialized care that is only available there. This could lead one to erroneously conclude, based on EH analysis, that the relevant market includes both urban hospitals offering specialized services, and distant rural hospitals which offer only general services. Furthermore markets delineated using only patient flow data implicitly assume that travel by some patients is indicative of the willingness of other patients to travel in a similar fashion in the event of a price increase, an assumption that may understate market concentration (Brief for Health Care and Indus. Org. Economists, 2010; Capps et al., 2001). However, as Werden (1981) notes, the EH test may instead delineate overly small markets. For example, when firms that are close substitutes for each other but have no cross shipments between the regions in which they are located (due to consumers optimizing based on transportation costs), EH would erroneously conclude that each firm and its corresponding region constitute a market, despite the competitive constraints present due to their high cross price elasticities.

2.2 Critical Loss Analysis

[4] In the most recent hospital merger case (In the Matter of Evanston Northwestern Healthcare Corporation, Docket No. 9315, FTC August 2007) Kenneth Elzinga himself testified that the method is not appropriate for hospital market definition.

Critical Loss Analysis, first developed by Harris and Simons (1989), has been widely employed in merger analysis since its introduction (Epstein and Rubinfeld, 2004). It seeks to directly answer the question posed by the merger guidelines regarding the smallest set of products or firms that would have to be included in the market to make a hypothetical price increase of 5% profitable. CLA has played an important role in determining geographic markets in industries such as chewing tobacco (FTC v. Swedish Match, 131 F. Supp. 2d 151 (D.D.C. 2000)) and supermarkets (FTC v. Whole Foods Mkt., Inc., 502 F. Supp. 2d 1 (D.D.C. 2007)), and in hospital cases such as the Dubuque, Poplar Bluff and Sutter cases detailed in Table 2. In addition, in the Poplar Bluff case mentioned above, the circuit court gave substantial weight to the defendant's CLA in its reversal of the district court's initial ruling (Langenfeld and Li, 2001).

2.2.1 The CLA Test

The CLA test proceeds in three steps. For a given set of firms, the first step is to determine, for a given price increase, the percentage reduction in demand that would render such a price increase unprofitable. Given a constant variable unit cost, c, a pre-merger price of a product, p, and a pre-merger total quantity produced of q, the benefit of a price increase to a hypothetical monopolist from a price increase would be $\Delta p[q+\Delta q]$ and the cost of such a price increase would be $-(p-c)\Delta q$, where Δp is a positive number and Δq is negative. Given this, the critical loss is the percentage reduction in quantity such that the benefit of the price increase equates to the cost of the price increase, or that $\Delta p[q+\Delta q]=-(p-c)\Delta q$. Defining $X=\Delta q/q$ (the "critical loss" or percentage reduction in quantity) and $Y=\Delta p/p$ (percentage increase in price), X can be written as a function of the proposed price increase and the gross margin of the firm, and is given by Harris and Simons (1989) as:

$$X=\left[\frac{Y}{Y+CM}\right]*100 \qquad (1)$$

where, Y is typically defined as 5% in the case of the SSNIP test, and CM is the contribution margin defined as $(p-c)/p$.[5] According to the equation given in (1), a firm with a high contribution margin would suffer a greater loss in profits due to the loss of relatively few consumers relative to a firm with a lower contribution margin. For example, if the contribution margin of a firm is 0.55, the critical loss from a 5% price increase is 8.3%. The second step involves calculating the actual percentage of sales that a firm would lose were they to increase their price by a given percentage. This is called the "estimated loss" and in hospital merger cases, the determination of the estimated loss has typically proceeded by examining zip codes in which a significant percentage (e.g. 20% or more) of patients already use other hospitals. It is then argued that given a price increase, a significant number of patients in these zip codes (termed "contestable zip codes") would switch to an alternative hospital and make such an increase unprofitable. The third step entails comparing the Critical Loss with the estimated loss. If the estimated loss is greater than the Critical Loss, this area being analyzed does not constitute a market as defined by the SSNIP test, because the hospital or hospitals in question would lose too many patients to other substitute hospitals. In such a scenario, the geographic market would have to be expanded to include some or all of the substitute hospitals in order to comprise an antitrust market (American Bar Association, 2003).

2.2.2 Limitations of Critical Loss

While the standard critical loss calculation in (1) is correct, the assumptions employed by analysts who make use of critical loss in merger cases are often internally inconsistent, and may thus lead to erroneous conclusions regarding the extent of antitrust markets. The first concerns the manner in which analysts classify accounting cost data used for the determination of the contribution margin. As indicated in (1), high contribution margins imply a small critical loss; consequently the classification of costs as fixed rather than variable increases the contribution margin and can thus lead to the definition of large CLA markets. Second, as O'Brien and Wickelgren (2004) indicate, economic theory asserts that high margins are associated with more inelastic demand.

[5] See Harris and Simons (1989) p. 212-215 for a more extensive derivation of these formulas.

Thus, the presence of a large contribution margin implies a low elasticity of demand and consequently, a small actual loss (Katz and Shapiro, 2003; Danger and Frech, 2001). However, as noted above, in a number of merger cases, analysts have claimed sizeable contribution margins for merging hospitals, while also arguing that significant numbers of patients would likely switch to alternative hospitals in the event of a price increase (implying relatively elastic demand), thereby rendering such a price increase as unprofitable. This type of misuse of critical loss in antitrust has gained a sufficient measure of legitimacy such that "it is now common for people to assume that high pre-merger margins imply broader markets and/or a smaller likelihood of anticompetitive effects." (O'Brien and Wickelgren, 2004, p. 184).

Furthermore, O'Brien and Wickelgren (2004) highlight the fact that standard critical loss analysis ignores the importance of the degree of substitutability (e.g. cross elasticities of demand) among products produced by firms contemplating a price increase. Assuming that firms are profit maximizing, the absence of cross-price elasticities between the locations of merging firms would provide no incentive for the firm to raise price in the event of a merger. Alternatively, the presence of large cross-price elasticities between firm locations provides an incentive for a firm to increase price, due to the ability of the firm to capture lost sales at its other location. Thus, the failure of critical loss to account for cross elasticities in its derivation may lead to unreliable conclusions about the extent of market power.[6]

Third, as Frech et al. (2004) note, the contestable zip code method rests on an assumption that is closely related to that employed in Elzinga-Hogarty analysis; specifically, both methods are based on the logical leap that current patient flows indicate a willingness of consumers to switch to alternative hospitals in the event of a small price increase. Simpson (2001) argues that in areas deemed contestable (presumably indicating a high elasticity of demand), price increases at nearby hospitals in actuality induce very small numbers of patients to switch, thus indicating that demand is in fact less elastic in these contestable zip codes than has been claimed in hospital merger cases.

2.3 Market Delineation using Structural Methods

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[6] We thank an anonymous referee for pointing out this important limitation of critical loss analysis.

In what follows, we outline two recently developed structural economic models of hospital competition that explicitly model both the individual decisions of consumers as well as the conduct of firms (Gaynor and Vogt, 2003; Capps, Dranove, and Satterthwaite, 2003). These models have generated considerable interest from antitrust practitioners, and variations of these models have been shown to accurately predict the resultant price increases from actual hospital mergers (Fournier and Gai, 2007; Akosa Antwi et al., 2009). While these models differ in their setup, both enable an approach to merger analysis that explicitly accounts for price changes and are thus based more closely on the method set forth by the antitrust authorities in the merger guidelines.

2.3.1 Differentiated Bertrand (DB) Oligopoly Model

Gaynor and Vogt's (2003) adaptation for the hospital industry of the methods set forth in Berry, Levinsohn and Pakes's (2004) model of differentiated product oligopoly is particularly well suited to delineating antitrust markets using the SSNIP criteria in that it is a fully specified model of price and quantity determination that allows for the calculation of own-price and cross-price elasticities for each hospital in the data. This model directly estimates demand and supply relation parameters and builds on the work of Baker and Bresnahan (1985), Scheffman and Spiller (1987), and Froeb and Werden (2000). In addition, it allows for the determination of an initial equilibrium price and quantity for the market, thus allowing for direct implementation of the thought experiment characterized by the merger guidelines. A number of papers, including work by Hausman et al. (1994), Werden and Froeb (1994), Nevo (2000), Epstein and Rubinfeld (2001), and Dube (2005) have used similar methods to analyze the price effects of mergers and the introduction of new products (see Werden and Froeb, 2008 for a detailed survey on merger simulation). Our approach is very close to that of Nevo (2000). He uses the Berry, Levinsohn, and Pakes (1995) random coefficients model to simulate mergers in the ready-to-eat breakfast cereal industry, and finds that the simulated price changes are close to the actual changes.[7]

We employ the familiar discrete choice structural model of differentiated product oligopoly with Bertrand conduct (Berry, Levinsohn and Pakes, 1995; Berry, Levinsohn and Pakes, 2004). In our application there are micro data on individuals. This allows demographic characteristics at the level of individual consumers to explain hospital choice. While this section presents the basic constructs of the model, for a full exposition, including parameter estimates, see Gaynor and Vogt (2003).

With a choice set of j (j=1,…..J) hospitals, the utility of consumer i(=1,….,N) is assumed to be of the form:

$$U_{ij} = -\alpha_p p_j - p_j X_{ij}^{p}\alpha + X_{ij}\beta + X_j\gamma + \xi_j + \epsilon_{ij} \quad (2)$$

where p_j is the hospital price, α_p is the marginal utility of income, X are observable consumer characteristics, observable hospital characteristics and their interactions, X^p are consumer and hospital characteristics interacted with price and ξ_j are unobservable hospital characteristics. Consumers choose the hospital j that gives them the highest utility. Assuming that ϵ_{ij} is an i.i.d. extreme value random variable, hospital choice can be treated as a multinomial logit.

Because equation (2) contains an unobservable term (ξ_j) that is correlated with price, a set of hospital fixed effects are used to absorb this source of endogeneity, as in Berry (1994) and Berry, Levinsohn and Pakes (2004). Since the use of this fixed effect renders identification of α_p infeasible, an additional regression of these hospital fixed effects on hospital price and other observable hospital characteristics is used to recover this parameter. Because price is also endogenous in this additional regression, exogenous wages and the predicted semi-elasticity (using only geographic distribution and exogenous consumer characteristics) are used as instruments for price, thus enabling recovery of α_p, the marginal utility of income.

In this model, firms are assumed to maximize profits à la Bertrand. Multi-plant firms (called multihospital systems) are also common in this industry, necessitating a

[7] In recent papers Peters (2006) finds that merger simulation both over and underpredicted post-merger price changes in the airline industry. Weinberg (2011) finds that merger simulation underpredicts price changes for feminine hygiene products.

model which accounts for substitution among plants and the coordination of pricing (this is the same as a multiproduct firm). Let θ represent a $J \times J$ matrix with $\theta_{jk} = 1$ if hospitals j and k have the same owner and $\theta_{jk} = 0$ otherwise. The familiar Bertrand pricing equation takes the form:

$$p = MC - \left[\Theta \otimes \left[\frac{\partial Q}{\partial p}\right]\right]^{-1} Q \tag{3}$$

where $[\partial Q/\partial p]$ is the $J \times J$ demand derivative matrix and ⊗ denotes an element-by-element Hadamard matrix multiplication operator.

Since there are detailed consumer level micro data, consumer heterogeneity is treated as observed, as opposed to unobserved (via varying distances from consumers to hospitals). The model thus does not suffer from the well known problem of restrictive substitution patterns of the logit (Train, 2003). Using the estimates obtained from this model, own-price and cross-price elasticities can be calculated for each hospital in the dataset using the formulas:

$$\frac{\partial Q_j}{\partial p_j} = \sum_{i=1}^{N} q_i P_{i\rightarrow j}\left(1 - P_{i\rightarrow j}\right)(-\alpha - X_{ij}^{p}\alpha_p) \tag{4}$$

$$\frac{\partial Q_j}{\partial p_k} = \sum_{i=1}^{N} q_i P_{i\rightarrow j} P_{i\rightarrow k}(\alpha + X_{ij}^{p}\alpha_p) \tag{5}$$

where (4) corresponds to the calculation of the own-price, and (5) to the cross-price elasticity.

We present a summary of the key model characteristics in Table 3.[8] Hospitals face a downward sloping demand curve, with average own-price elasticity of -4.57 and an average price of $4,681 for a unit of care. Additionally, as the average cross-price elasticities in the bottom of Table 3 show, hospitals physically close to one another have higher cross-price elasticities than do hospitals far apart. For example, the average cross-price elasticity between a given hospital and its most proximate competitor (measured by distance) is calculated as 0.60, while the cross-price elasticity with the fifth-closest competitor is one-third of this magnitude. This implies that markets for hospital care are largely local, and will clearly be key in market definition.

2.3.2 The Option Demand (OD) Model

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[8] All coefficient estimates are available in Gaynor and Vogt, (2003).

The option demand model of Capps et al. (2003) has been particularly influential for health care antitrust analysis in recent years, and has been applied to proposed consolidations in New York State by Dranove and Sfekas (2009). This model adopts a distinctly different approach to the modeling of hospital markets in that it more explicitly recognizes the intermediary role played by insurers when patients select hospitals. More specifically, as in Town and Vistnes (2001), it considers the market for hospitals as one in which insurers, acting as intermediaries, negotiate with hospitals for contracts to provide care to their beneficiaries, and consumers then choose their insurer based on the network of providers included in a given insurance plan. In this model, the ex-post decision of a consumer to receive treatment at a hospital is independent of the price charged by that hospital, however, the ex-ante decision of a consumer to join an insurance plan is determined by both the price of an insurance plan, as well as the network of providers included in each plan, giving more desired hospitals the ability to bargain with insurance companies due consumers' high willingness to pay (WTP) for the inclusion of these hospitals in an insurance network. The supply side is therefore a bargaining model, as opposed to the posted price framework of the differentiated Bertrand model.

In the OD approach, the indirect utility that individual *i* obtains from receiving care at hospital *j* is defined as:

$$U_{ij} = U(Z_j, X_{ij}) + \epsilon_{ij} \qquad (6)$$

where Z_j is a vector of hospital characteristics, and X_{ij} are patient characteristics that vary at both the patient-hospital level (e.g. distance from patient to hospital) and patient level (e.g. socioeconomic and diagnosis characteristics). Individuals choose the hospital which provides them the greatest utility.

Assuming ϵ_{ij} is distributed i.i.d. extreme value generates the multinomial logit, Capps et al. (2003) show that hospital *j*'s contribution to individual *i*'s expected utility is:

$$\Delta V_j^{IU}(G, Z_j, X_{ij}) = ln\left[\frac{1}{1-s_{ij}(G,Z_j,X_{ij})}\right] \qquad (7)$$

where *G* is the network of hospitals from which the patient chooses. Summing over all consumers, the willingness to pay (WTP) for hospital j is thus:

$$\overline{\Delta W_J^{EA}}(G) = N \int_X \; ln\left[\frac{1}{1-s_{ij}(G,Z_j,X_{ij})}\right] f(X_i)dX_i \tag{8}$$

where *N* represents the total number of ill patients.

After the willingness to pay measure is calculated for all hospitals, Capps et al. (2003) assume that each hospital is able to capture the willingness of consumers to pay for their inclusion in a network through negotiation with employers. Consequently, a hospital's profitability is directly related to consumers' willingness to pay for a given hospital's inclusion in an insurer network in that hospitals that deliver greater incremental value to employers can extract more profits from these negotiations in the form of higher prices. This is captured in the OD model by regressing hospital profits on the WTP measure (without a constant) and recovering the coefficient from this regression, $\hat{a}$. This generates the predicted impact of WTP on hospital profits. Using the average revenue and average cost per discharge at a hospital, they then calculate a measure of profits per discharge at each hospital.

The degree of market power possessed by hospitals (and consequently the ability to raise price in the event of a merger) entails calculating the difference in WTP for a merged entity versus the WTP for each entity independently. The WTP for merged hospitals *j* and *k* is:

$$\overline{\Delta W_{J+k}^{EA}}(G) = N \int_X \; ln\left[\frac{1}{1-s_{ij}(G,Z_j,X_{ij})-s_{ik}(G,Z_k,X_{ik})}\right] f(X_i)dX_i \tag{9}$$

and the increase in WTP as a result of a merger is thus:

$$\overline{\Delta W_{J+k}^{EA}}(G) - \overline{\Delta W_J^{EA}}(G) - \overline{\Delta W_k^{EA}}(G) \tag{10}$$

The second step in using WTP to simulate merger effects involves inferring the increase in profits resulting from a merger of two firms. Capps et al. (2003) do this by calculating the increase in profits to the entity (*j*+*k*), $\Delta\hat{\pi}_{j+k}$, as:

$$\Delta\hat{\pi}_{j+k} = \hat{a}\left[\overline{\Delta W_{J+k}^{EA}}(G) - \overline{\Delta W_J^{EA}}(G) - \overline{\Delta W_k^{EA}}(G)\right] \tag{11}$$

Profits are then calculated for the merged entity as $\pi_j + \pi_k + \Delta\hat{\pi}_{j+k}$. Price increases are inferred by the price changes implied by the changes in profits, assuming quantity does not change.

2.3.3 Structural Methods: Comparison and Limitations

As can be seen above, the DB and OD models are similar in their treatment and estimation of consumer demand for hospital care. In particular, in both models, consumer demand parameters are estimated using microdata on individuals with a multinomial logit specification. Consequently, the degree of geographic and service overlap in each hospital's market serves as the primary driver of the size of merger-induced price effects in both models. The models differ, however in their treatment of price in a consumer's demand function. The DB model explicitly treats price as a component of consumer preferences, whereas in the OD model, prices do not enter directly into the consumer's choice framework. While consumers are likely to exhibit minimal price sensitivity when choosing between in-network hospitals, the inclusion of price in a consumer's utility function can be thought of as a reduced form choice function incorporating the objectives of consumers and insurers.[9]

The models also differ in their treatment of supply. The most prominent difference is the modeling of pricing. The DB model is a posted price model. Firms post prices and consumers decide where to buy. As noted previously, this model has been widely applied to examine mergers for many other industries (e.g., Nevo, 2000). The OD model is a Nash bargaining model where hospitals are assumed to capture a fixed proportion of profits based on the value that they add to a hospital network and translate this into their pricing decision.

The two approaches have their advantages and disadvantages. As mentioned previously, the use of the DB framework enables the direct application of the model to

[9] Gaynor and Vogt prove that, under fairly general conditions, insurers, in effect, act on behalf of consumers. In this case the demand function they estimate recovers consumer preferences. Consumers may not pay differential prices at the point of choosing a hospital, but they do pay higher premiums if hospital prices are higher. Insurers' objectives are not affected by hospital characteristics, but they must attract consumers who do care about these factors, http://www.andrew.cmu.edu/user/mgaynor/Assets/NFP-FP_Supplementary.pdf.

market definition using the SSNIP criteria, and to the identification of unilateral pricing effects. As noted in the previous section, price determination in the OD model is not modeled in a manner that allows for the allocation of merger induced price increases across multiple hospitals when each hospital operates under joint ownership, thereby limiting the ability of this model to directly implement the SSNIP test. The OD model, on the other hand, captures the institutional realities of the hospital industry directly by employing a bargaining framework.

The two models coincide under certain conditions. As noted by Grennan (2012), the differentiated Bertrand price equilibrium is a special case of the Nash bargaining equilibrium where the hospital possesses all the bargaining power and there is no price discrimination. If both hospitals and insurers have some bargaining power, imposing a Bertrand equilibrium will lead to misspecification if the true model is the bargaining model. Of course, all models are simplifications and thus are necessarily misspecified, so it is unclear how important this misspecification is for merger analysis or market definition. Given that bargaining models can be complicated and also subject to misspecification (the OD model makes some strong assumptions), one way to think about the posted price model is that it is a reduced-form way of capturing a complicated underlying bargaining relationship. As will be seen later, the two models' predictions are nearly identical in our application.

The two models differ in some other details. The DB model allows hospital quantity to change in the event that a hospital merger increases price, whereas in the OD model, merger-induced changes in market power translate only into profit increases, with an assumption that quantity is maintained at its current level. The models also differ in the ways they capture price and economic cost. In the DB model, price is captured via a method (briefly outlined in section 3.2) that creates a single hospital price for a unit of hospital care using an output index that is normalized for each patient using diagnosis, demographic and hospital characteristics, while marginal costs are estimated via the Bertrand pricing equation. In the OD model, price and marginal cost are measured using accounting data for average revenue per admission and average cost per admission respectively.

Both models are subject to limitations imposed by the use of the logit demand framework. As Crooke et al. (1999) note, the use of this functional form can lead to predicted price increases that are likely to be smaller than those that model demand using AIDS and log-linear functional forms, though larger than those that make use of linear demand. Separately, these models don't explicitly account for some potentially important competitive factors that can affect their usefulness. The models do not explicitly account for the potential for post-merger entry or product repositioning. In addition, each model employs a stylized form of firm conduct, which may impose limitations if neither of these models conforms to the nature of real-world competition in the hospital industry. Ultimately, while there are limitations to these models (as there all to all models), recent work by Fournier and Gai (2007) and Akosa Antwi et al. (2009) find that these models are reasonable predictors of the actual price increases that occur for actual hospital mergers.

3. Data

We use 1995 data from California's Office of Statewide Health Planning and Development (OSHPD) which maintains a variety of datasets on various aspects of health care in the state. Below we briefly describe each of the particular datasets we draw upon and the criteria for selecting subsets of the data.

3.1 Discharge data

Each non-Federal hospital in California is required to submit discharge data to OSHPD. Each patient discharge during a calendar year generates a separate record. Among the items collected by OSHPD for each discharge are patient demographics (e.g. race, age, sex), diagnosis (DRG and ICD9-CM codes), treatment (multiple ICD9 procedure codes), an identifier for the hospital at which the patient sought care, the patient's zip code of residence, and charges. Although the charges that appear on a patient's discharge record are an imperfect proxy for the exact transaction price paid to the hospital and thus cannot be used solely as a measure of transaction price, given the way they are calculated, they are related to the amount of care a patient consumes and coupled with the financial data, provide an indication of the price paid for a hospital visit.

In addition, a field in these data describes in general terms the patient's health insurance information (e.g. Medicare, Medicaid, Blue Cross, HMO, PPO, other private insurance, self-pay and "other").

3.2 Annual and Quarterly Financial data

Annual financial disclosures are submitted each fiscal year and every time a hospital changes ownership. From these data, we use information on location of the hospital, ownership of the hospital, type of care provided by the hospital, whether the hospital is a teaching hospital or not, and wages. Quarterly financial disclosures are submitted by calendar quarters, so that they are synchronized both with the discharge data and with one another. Most notably, these quarterly findings include elements that allow the mapping of the list "gross charges" for each hospital to a measure that more closely proxies for the "net charges" paid by insurers net of contractual discounts given to insurers. This allows us to deflate (at a hospital level) the measure of charges included in the discharge data and allows for a more accurate measure of the transaction price paid for each patient stay.

Using this measure, a price is calculated for each hospital for use in the DB model using a regression based approach detailed in Gaynor and Vogt (2003). Specifically, a hospital-level measure of the ratio of net-to-gross charges is constructed using information available in the financial data, and we assume that the quantity of care consumed by person i, $q_i = \exp(X_i\beta + \nu_i)$, where X_i is a vector containing consumer characteristics related to the amount of quantity of care consumed. Thus a regression of $ln(p_j q_i)$ on a complete set of hospital dummy variables and consumer characteristics gives a set of hospital fixed effects that we use to proxy for the price for a standardized unit of care at each hospital.

3.3 Selections

For 1995, there are a total of 3.6 million patient discharges. For our analysis we use only those discharges whose payment comes from private sources. These are discharges in the HMO, PPO, other private, self-pay, and Blue Cross/Blue Shield categories. This amounts to 1.47 million discharges. Our motivation in making these choices is that for patients in these categories, some entity is making explicit choices among hospitals, based, at least in part, on price. In the case of the various insurance categories, insurers have discretion both over which hospitals to include in their networks of approved providers and via any channeling of patients to less expensive hospitals. We also eliminate patients with a DRG frequency of less than 1,000, patients with missing values for any of the variables used in any of our analyses, patients with charges less than $500 or greater than $500,000 and consumers with lengths of stay of zero or greater than 30. After all the exclusions, there are 913,547 remaining observations.

Of the 593 total hospitals in the financial data, we exclude hospitals such as psychiatric hospitals, children's hospitals, rehabilitation hospitals, and other specialty institutions, as well as hospitals associated with staff model HMOs. In addition we exclude hospitals with either missing or useless quarterly financial data (some hospitals had larger deductions from revenue than they had gross revenue, for example). We also exclude hospitals with fewer than 100 discharges for the year. Finally, we drop hospitals whose closest competitor (in terms of distance) is in another state. This is because our data precludes us from observing hospitals in neighboring states which could presumably be reasonable substitutes for those hospitals located on a state border. This leaves us with an analysis sample of 913,547 discharges and 368 hospitals.

4. Geographic Markets and HHI Calculations

In the following section, we compare markets delineated for all hospitals in California using the three different methodologies described above, Elzinga-Hogarty, Critical Loss, and the SSNIP market definition using the Differentiated Bertrand model. Below we describe the specifics of our implementation of each of the methods, then present the geographic markets defined using each method, as well as the associated concentration measures.

We then focus on a specific area (San Diego) as a way of illustrating the differences between markets defined using these three methodologies, and compare the results of merger simulations for San Diego using the Differentiated Bertrand and Option Demand models.

4.1 Implementation

4.1.1 Defining Markets Using Elzinga-Hogarty

There is no universally accepted method for constructing an Elzinga-Hogarty market. Frech et al. (2004) test a number of approaches, while demonstrating the effects that varying the algorithm used to add zip codes can potentially have on the size of geographic markets. Their analysis indicates that realistic geographic markets that are compact and contiguous can be delineated using an algorithmic method of expansion termed "contiguous search" in which an area is expanded, one zip code at a time, by iteratively adding a zip code contiguous to an area based on its incremental contribution to LIFO or LOFI. Consequently, for our analysis, we have developed a method that closely approximates the algorithm developed by Frech et al. (2004). Our method proceeds, as follows: 1) Choose as a starting zip code the zip code of the hospital for which a market is to be defined. 2) Calculate LIFO and LOFI for this zip code. 3) If either LIFO or LOFI is less than the weak market threshold of 0.75, one chooses the zip code that contributes most to the minimum of LIFO and LOFI, from the universe of zip codes contiguous to the zip code of interest, as follows. For each additional zip code, z_j, that is contiguous to the combination of zip codes already included in the service area from previous iterations, z_{-j}, zip code z_i is added, one at a time if it satisfies (for each iteration)[10]:

$$z_i = min\{\max[LIFO(z_{-j}, z_j)], \max\,[LOFI(z_{-j}, z_j)]\}\ \forall\ z_j$$

We continue to add zip codes using this algorithm until both the LIFO and LOFI are simultaneously greater than 0.75.

4.1.2 Defining Markets Using Critical Loss

[10] Because of data limitations, we use a fixed radius between zip code centroids to create the universe of zip codes by which to expand the market, rather than shared zip code borders.

Our analysis of CLA closely follows the contestable zip code method used in hospital antitrust cases. The contestable zip code approach is based on the assumption that the demonstrated willingness of consumers within a zip code to travel to hospitals other than those being considered in a merger case indicates that other consumers living in these zip codes would be similarly willing to travel to alternative hospitals in response to a price increase. Given that our goal is to approximate CLA markets as determined by previous cases, we base our assumptions on previous judicial decisions in which critical loss analysis was utilized. Though the estimated loss number is not clearly defined and could vary by case, we base our estimated loss numbers on the determination in the Sutter case (see Table 1) that suggested that the number of patients traveling into the proposed market that would have to switch is between one-third and two-thirds (Langenfeld and Li, 2001).

Given that the court ruled in favor of the defendant, we interpret this figure to be indicative of the court's conclusion of the likely substitution patterns of hospital patients.[11] In actual cases, a hospital's contribution margin has been assumed to range from 41.4% in State of California v. Sutter Health System to 65.9% in FTC v. Tenet (Langenfeld and Li, 2001). In our simulation of CLA, we apply a contribution margin of 55%, which leads to a Critical Loss of approximately 8.3% for a 5% increase in price. We define zip codes as contestable if 25% or more patients travel to hospitals other than those being defined in a hypothetical merger, an admittedly conservative assumption, given the use of a 20% contestable zip code threshold in the Poplar Bluff case (Scheffman, 2002). Finally, we assume that of the patients that currently receive care at one of the merging hospitals, 30% of these patients from zip codes deemed contestable (i.e. zip codes that have at least 25% outflows under the pre-merger terms of sale) would substitute to another hospital as a result of a 5% increase in price. Thus, our exact algorithm for implementing critical loss proceeds as follows:

1) Start with a hospital and the hospital closest to this hospital.

[11] We do acknowledge, however that the number of patients that were determined to travel into the market accounted for only 15% of the total discharges in question. The set of contestable zip codes often does constitute a larger subset of discharges than was determined "out of the market" in the Sutter case.

2) Find the universe of Diagnosis Related Groups (DRG) served by the hospitals chosen.[12]

3) Find the contestable zip codes given this universe of DRGs, given our 25% threshold.

4) Calculate the actual loss by assuming that 30% of the patients currently attending the hospitals of interest in the contestable zip codes acquire their care elsewhere.

5) Compare the loss calculated in (4) to the critical loss figure of 8.3% of original demand. If actual loss is greater than critical loss, we add the next closest hospital and repeat steps 1-4. If not, the set of hospitals is determined to be a market.

4.1.3 Geographic Market Definition Using the Differentiated Bertrand Model

A distinct advantage of the use of the Differentiated Bertrand model to define SSNIP markets is that it can explicitly account for the response of consumers to price changes using available data, rather than relying on imperfect proxies, such as patient flows. The DB model in particular is well suited to implementing the SSNIP test for geographic markets, as the price paid by a consumer directly affects hospital choice in this setup, thereby enabling the direct application of the thought experiment prescribed by the merger guidelines. In order to define geographic markets that conform to the Merger Guidelines using this model, we define the SSNIP test for a given hospital as the smallest set of hospitals (inclusive of the hospitals for which we are attempting to define a SSNIP market) for which a given price increase would be profitable, holding constant price at all other hospitals. Intuitively, the SSNIP criterion states that for a given hospital, j, a SSNIP market is the smallest set of hospitals for which an increase in price at this set of hospitals (including hospital j) would increase the collective profits in the systems of which these hospitals are members. This approach allows for the definition of geographic markets that take into account system membership, making it consistent with the current (2010) revision of the merger guidelines in its explicit treatment of firms that own multiple plants in the same geographic area.

[12] The inclusion of this step was due to our desire to make the algorithm correspond as closely as possible to methods used in antitrust cases. The inclusion of all DRGs in our algorithm produces critical loss markets of very similar size.

To illustrate the criterion, consider 4 hospitals, A, B, C and D, and let A and B be members of the same hospital system. Suppose hospitals A and C act as a "hypothetical monopolist" and engage in a coordinated price increase of 5% (holding the terms of sale constant at all other locations), resulting in a decrease in demand at both hospitals and a decrease in profits at the combined hospital entity of A and C. Suppose, however, that B is a sufficiently adequate substitute for care at these hospitals so that the increase in profits as a result of the increase in demand for hospital B's services is greater than the decrease in profits at the combined hospital entity of A and C. Hospitals A and C would be a market under the SSNIP criterion, as the collective profits in the systems of which these hospitals are members has increased. Likewise, if hospital D is a close substitute for the care rendered at A and C while hospital B is not, hospital B would see little or no increase in demand or profits and thus hospitals A and C would not be considered a market according to the SSNIP criterion.

In the event that a price increase at a given location results in a reduction of sales sufficiently large enough such that a hypothetical monopolist would not find it profitable to impose an increase in price, the merger guidelines suggest adding the location from which production is the next-best substitute for production at the merging firm's location. Because spatial differentiation is an important attribute of hospital care, when a SSNIP is not profitable, we include additional hospitals in order of their geographic proximity to the location of the merging hospital(s) in question. While this market expansion criteria is likely to lead to markets that are larger than if we were to expand based purely on "next best" substitution, this algorithm ensures comparisons of the various market definition methods are uniform, since neither EH nor CLA allow for the expansion of markets based on diversion ratios or cross price elasticities, but do allow for expansion based on geographic distance. Our algorithm for implementing SSNIP markets using the DB model (SSNIP Market Definition) is as follows:

1. Begin with a hospital for which one would like to define a geographic market.
2. Find the hospital geographically closest to the hospital chosen in step 1.

3. Raise the price of only these hospitals by a given percentage (we use 5%) and allow demand to change as a result of the price increase.[13]

4. If the total difference in profits for the hospital system (given diversion to other hospitals in the same system) is positive, this constitutes a market by the SSNIP test. If it does not, we add the next hospital that is geographically closest to the hospital in step 1.

We repeat this process until the increase in price for the chosen hospitals results in a positive difference in profits.

4.1.4 Defining Markets using the Option Demand Model

The structure of the Option Demand model precludes the direct definition of geographic markets. This is because the model does not account for hospital systems in its constructs, implicitly assuming that all hospitals in a particular market operate as independent business entities, each with a separate $\overline{\Delta W_j^{EA}}(G)$ (from equation 8). Consequently, a SSNIP market definition algorithm cannot be directly applied using this model. However, we can determine the model's likely conclusions about the size of SSNIP markets by comparing the extent to which the OD model produces price increases similar in magnitude to those of the DB model via merger simulation. While this does not allow for the direct delineation of geographic markets, it provides insight into whether these models differ in their assessment of the likelihood of a price increase in the event of a merger. We address this issue in detail in section 4.4 below.

4.2 Statewide Analysis

[13] Since we use current prices, we note the possibility of a "cellophane fallacy effect" for hospitals that already exercise considerable market power. As Werden (2000) says, "When a firm has already raised price substantially above competitive levels, it makes no sense to determine whether that firm is a monopoly by asking if it could increase its profits through further price increases." If there is a cellophane effect it will have the impact of making markets defined using prevailing prices too big. We retain the use of current prices in order to facilitate comparison with the other methods and for consistency with the Merger Guidelines (Federal Trade Commission and U.S. Department of Justice, (2010), Section 4.1.2, p. 10). In addition, this leads to conservative comparisons between SSNIP and EH and CLA markets. We are grateful to an anonymous referee for drawing our attention to this point.

Table 4 reveals substantial differences in the markets defined by the methodologies in both the number of hospitals in each market, as well as the degree of concentration as defined by the HHI. SSNIP market definition using the DB model (termed "SSNIP Mkt. Def." in the tables) determines that the median hospital in California operates in a market of 3 hospitals with an HHI of 3,814.[14] This is well above the threshold determined by the merger guidelines as being highly concentrated. In contrast, CLA market definition generates the result that the median hospital operates in a market with 16 hospitals and an HHI of 1,194.[15] EH defines markets similar to CLA, with the median hospital operating in a market with 12 other hospitals and an HHI of 1,499. Thus under the merger guidelines, both the CLA and EH methods would find that the median hospital exists in a market that is unconcentrated.

Many health economics studies use political boundaries to define markets, such as Metropolitan Statistical Areas (MSA), or Health Service Areas (HSA), which are defined based on commuting patterns and patient flows respectively (U.S. Census Bureau, 2007, page 895; Makuc, 1991). Therefore we also examine the implications of using these boundaries to define geographic markets. This produces the lowest concentration measures of all market definition approaches. Using MSAs to define geographic markets implies that the median hospital operates in a market with 18 hospitals and an HHI of 1,191, while defining geographic markets using HSAs infers that the median hospital operates in a market with 15 other hospitals and an HHI of 1,191.

A more detailed breakdown of the hospitals by geographic area reveals a substantial amount about the competitive environment for hospitals based upon their location. Dividing the hospitals in the sample into hospital "density quartiles" based on the number of hospitals within a 25-mile radius exposes the wide variation in the methodologies' market definition for urban and rural areas. Quartile 1 includes hospitals

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[14] We use available beds in our calculation of HHI by market. The correlation between beds, total discharges and total patient days and other standard measures of hospital output is above .9 for all measures.

[15] As a robustness check, we implemented the Critical Loss algorithm using conservative assumptions. Specifically, we assume a contribution margin of 40% (the lowest assumed in a case to our knowledge is 41.4%) and assume that a zip code is contestable only if at least 30% of patients in a given zip code seek care at a hospital other than the merging hospitals. Using these assumptions, we find that the median size of a hospital market is 5, with an HHI of 2811. Even these conservative assumptions imply (using the method outlined in the creation of Table 7) that elasticities are overstated by a factor of 1.7 compared to the Differentiated Bertrand Oligopoly model.

with 0-5 other hospitals within a 25-mile radius, quartile 2 includes hospitals with 6-18 other hospitals within a 25-mile radius, quartile 3 includes hospitals with 19-70 other hospitals within a 25-mile radius, while quartile 4 includes hospitals with 71-110 other hospitals within a 25-mile radius. Figure 1 maps these hospital density quartiles while Table 5 shows the characteristics of hospitals within these quartiles.

As can be seen in Figure 1, the wide variability in the number of other hospitals within a 25-mile radius is due to the difference in hospital density in urban and rural areas. In particular, quartile 4 consists entirely of hospitals in Los Angeles County and Orange County, while quartile 3 consists of hospitals from the Los Angeles (44.3%), San Francisco-San Jose (37.5%) and San Diego (18.2%) metro areas. Quartile 1 consists of mostly Northern California hospitals, hospitals in coastal towns and on the far outskirts of metro areas, while quartile 2 comprises a mix of hospitals on the periphery of the 5 major metro areas in California, as well as the hospitals located in the central part of the state between San Francisco and Los Angeles.

As would be expected, the size of the geographic markets using all three of the methodologies indicates that markets are more concentrated in areas where there are fewer nearby hospitals and less concentrated in areas where there are more hospitals close by. The magnitude of the concentration difference, however, varies substantially depending on the density quartile. In particular, in quartile 1, all methodologies indicate that the mean level of market concentration is somewhat high, although the structural model produces markets where the mean level of market concentration (HHI of 4694) is higher than that implied by both EH and CLA (3471 and 3161 respectively). However, in this quartile, EH and CLA agree with SSNIP market definition on the size of the market in 22 and 10 of the 93 cases respectively (not shown), and produce smaller markets in some cases. This stands in contrast to quartile 3 and 4 in which neither shipments-based methodology produces markets of comparable size to markets defined using the structural model.

As is evident from Table 5, all three of the methodologies produce markets that include more hospitals in areas with greater hospital density. However, though the change in the level of concentration by market is directionally equivalent, the magnitudes of the concentration levels differ substantially. This suggests that although the shipments-based methods are consistent in their determination that antitrust markets encompass a larger number of hospitals in areas with greater hospital density (i.e. urban areas), the difference in market sizes determined by these methods are substantially larger than those implied by the DB model, and these differences are greater as the number of surrounding hospitals increases.

In Los Angeles, for example, in density quartile 4, EH must include an average of 50 hospitals (and over 100 zip codes) in order to produce a market, whereas CLA must include an average of 65 hospitals in order for the loss from contestable zip codes to be sufficiently small so as to produce a market. In contrast, SSNIP market definition using the DB model finds that the average hospital in this quartile operates in a market with just 5 other hospitals. In quartile 1 on the other hand, EH specifies a market with an average of 7.19 hospitals and CLA determines that an average market in this quartile includes 5.8 hospitals. Market definition using the DB model determines that in this quartile, the average hospital market consists of just 2.78 hospitals

The bottom panel of Table 5 also reveals a great deal about the market concentration according to the prescribed thresholds set by the merger guidelines. Across quartiles, both CLA and EH indicate that markets become less concentrated as we move from quartile 1 to quartile 4. The percentage of hospitals operating in markets with HHIs of less than 1,500 for CLA increases from 8.6% in quartile 1 to 100% in quartile 4. Likewise, for EH, the percentage of hospitals in markets with HHIs of less than 1,500 increases from 16.1% in quartile 1 to 100% in quartile 4. SSNIP market definition using the DB model finds only five markets with HHIs of less than 1,500 in any concentration quartile.

The number of markets considered highly concentrated (HHI greater than 2,500) also show significant changes across concentration quartiles. The percentage of hospitals operating in markets with HHIs of greater than 2,500 according to CLA decreases from 68.8% in quartile 1 to 0% in quartile 4. Similarly, the EH method determines that 51.6% of hospitals operate in markets with an HHI of greater than 2,500 in quartile 1, while in quartile 4 no hospitals operate in a market with an HHI of such magnitude. SSNIP market definition conversely shows all but three hospitals operating in a market with an

HHI of greater than 2,500 in quartiles 1 and 2, and just 12.5% and 48.4% of hospitals in quartiles 3 and 4 operating below the 2,500 threshold respectively.

4.3 Elasticities

The DB model allows for the calculation of the elasticity of demand for each hospital. As shown in Table 3, the average own-price elasticity of demand for a hospital in the sample is calculated as -4.57. Table 6 indicates that this elasticity varies by density quartile, as the average elasticity of demand for hospitals increases (in absolute value) from 3.55 in quartile 1 to 5.48 in quartile 4. This suggests that hospitals in areas with more nearby competitors do in fact face stiffer competition than those with a lower number of nearby hospitals. While this increase in own-price elasticity using the DB model is notable in and of itself, as Table 5 indicates, both the EH and CLA methodologies produce significantly larger markets in all density quartiles, thus implying a much flatter demand curve for each hospital and consequently a larger elasticity than estimated by the structural model.

Because the estimated consumer utility in equation (2) depends on price, all firm-level elasticities are a function of the price parameter contained in the specified utility function, α_p. Thus, the larger elasticities produced by the two comparison methodologies are equivalent to consumers exhibiting more price sensitive behavior, or equivalently, that the value of α_p in the utility function is of larger (absolute) magnitude than is estimated in the structural model. Therefore, if we solve for the value of α_p that produces markets of equivalent size to EH and CLA, we can determine the elasticities that would be required in order to produce markets of equivalent size to those implied by our comparison methods for a 5% price increase.

In the top portion of Table 7, we include a summary by hospital density quartile of the average own-price elasticity in a hospital market determined by the Elzinga-Hogarty and Critical Loss methodologies according to the elasticity estimates of the Differentiated Bertrand model. For example, for the 93 hospital markets calculated using CLA in density quartile 1, the average own-price elasticity as calculated using the estimated price parameter in the DB model is -3.60. In the lower panel, we present the elasticities that would be required for the DB model to define markets consistent with

CLA or EH (computed by empirically solving for the value of α_p for each market). Thus the value of -10.10 in the lower panel indicates that for the same 93 hospital markets calculated using CLA in density quartile 1, the value of the price parameter in the DB model that would make consumers sufficiently price sensitive to produce an equivalent market to that determined by CLA leads to an implied average own-price elasticity in these 93 markets of -10.10.

Similarly, for the 93 hospital markets calculated using EH in density quartile 1, the average own price elasticity as calculated using the estimated price parameter in the DB model is -3.89. The value of -12.55 in the lower panel implies that for the same 93 hospital markets calculated using EH in density quartile 1, the value of the price parameter in the DB model that would make consumers sufficiently price sensitive to produce an equivalent market to that determined by EH implies that the average own-price elasticity in these 93 markets is -12.55.

The differences in these implied elasticities demonstrate that both CLA and EH implicitly substantially overstate the price sensitivity of consumers with regards to hospital care. Looking across all quartiles, Table 7 shows that CLA overstates the magnitude of elasticities of a hospital in the median hospital market by a factor ranging from 2.4 in quartile 1 to 3.4 in quartile 4, while EH overstates these elasticities by a factor ranging from 2.3 in quartile 3 to 2.7 in quartile 1.

These elasticity differences also suggest that the implied markups for hospital care using these informal methods are smaller than the markups that are assumed when analyzing actual hospital merger cases. The commonly used Lerner Index, $\frac{p-mc}{p} = \frac{1}{\epsilon}$, relates elasticity to margins, implying that the determination of high margins indicates a low elasticity of demand. In the calculation of Critical Loss, the contribution margin defined in the previous section is equivalent to the left-hand side of a Lerner Index (assuming constant returns to scale). Thus from our elasticity estimates in Table 7, we can infer that the percentage markup over marginal cost implied by the CLA market size is substantially lower than the 55% that was actually used in our definition of the CLA markets, which is within the range used by analysts in antitrust suits. As Table 7 indicates, even in the lowest hospital concentration quartile, the implied markup for a hospital in the median hospital market using the CLA methodology is 12%, while in quartile 4, the implied markup in the market for the median hospitals is 5.4%. Although EH in its implementation does not explicitly postulate about the implied markup, it suffers from similar shortcomings in that it suggests markups ranging from 7.4%-9.9% for a hospital in the median hospital market, well below those implied by the elasticity estimates in the DB model. Both of these findings suggest that the market definition techniques used in previously decided merger cases are inappropriate for hospital market definition; that is, using shipments based techniques will by and large produce overestimates of the price elasticity of demand faced by hospitals, thus resulting in substantially larger markets than intended in the merger guidelines.

4.4 An Analysis of San Diego

To further demonstrate market definition under the SSNIP criteria, we examine markets defined in a localized area of the state. Specifically, we perform market definition in the San Diego area. Our selection of San Diego is strategic in that it is an area with few geographic barriers and it contains a reasonable number of hospitals so as to allow for methodological illustration while still being computationally feasible. It also allows for a comparison of the DB and OD models, as the original study conducted by Capps et al. (2003) was estimated using data on San Diego.

A summary of the San Diego area hospitals is presented in Table 8, while a map of the hospitals in the area is presented in Figure 2. San Diego contains hospitals that fall into hospital density quartiles 2 and 3. The dominant systems in the area in our 1995 data are the Scripps and Sharp systems, with each controlling 6 and 5 of the 23 hospitals respectively. While 19 of the 23 hospitals were members of a multi-hospital system, 4 of these hospitals, Alvarado, Harbor View, Mission Bay and Paradise Valley were owned by corporations that controlled no other hospitals in the San Diego area. The other two multi-hospital systems, University of California (UC) and Palomar Pomerado, each controlled only two hospitals.

Table 9 presents the results of market definition for the San Diego area for each of our three market definition methodologies. As shown in Table 8, San Diego County had a moderate degree of concentration in 1995, with a system-based HHI of 1,949. With the exception of Fallbrook Hospital, all methods produce a market which is a subset of the hospitals in this county. CLA in column one defines markets as consisting of 13-38 hospitals, each of which comprise substantial subsections of the San Diego area, and in the case of Fallbrook Hospital, portions of the Los Angeles Area. Similarly, EH market definition in column two determines that markets are anywhere from 14-19 hospitals in size. The DB model in column three, however, shows that SSNIP markets consist instead of small sets of no more than 4 hospitals, with a median market size of two hospitals. This difference in methodology evidently affects the degree of concentration implied in the San Diego area. Both of the comparison methods produce markets with the majority of HHIs falling in the 2,000-3,000 range, while no SSNIP market produced by the DB model has a HHI lower than 3,000 and 18 of the 23 hospitals operate in a market with an HHI of more than 5,000.

Figure 3 illustrates the differences in markets produced by the three methodologies, using as an example the definition of a market for Scripps Memorial Hospital - Chula Vista (Scripps Chula Vista), a 159-bed hospital located in the southern portion of the San Diego metropolitan area. SSNIP market definition indicates that, Scripps Chula Vista and Community Hospital of Chula Vista, a 306-bed hospital located in the same area represent a geographic market, with a HHI of 5,500. Using EH, a geographic market would include these two hospitals, as well as 16 other facilities in the San Diego area, producing a market with an HHI of 2,228. The market produced using CLA shows a similar pattern, as a critical loss market would include a total of 17 hospitals in the San Diego metropolitan area, implying that Scripps Chula Vista operates in a market with an HHI of 2,692.

4.5 Comparison with the Option Demand Model

As we describe in Section 2, while the OD model represents a promising method of analyzing mergers, its constructs are not conducive to the construction of geographic SSNIP markets equivalent to those delineated using the DB model. In particular, since the OD model does not allow for market definition for a single hospital where a large hospital firm (system) controls multiple plants (hospitals), our comparison of these methods necessitates the simulation only of mergers between individual hospitals, as well as individual hospital systems, thereby enabling direct comparisons of merger effects for each model. Thus, we use our data to estimate the OD model, employing the same variables in our utility function as were used by Capps et al. (2003) with minor exceptions.[16] We note that our use of the OD method necessitates a different sample of consumers than was used in the work of Capps et al. (2003), since the original estimation sample used by Capps et. al. (2003) included not only private pay patients but also Medicare patients. Thus, in order to ensure the most direct comparison of the two structural methods, we include only indemnity and HMO/PPO consumers in our estimation in our estimation sample for both models. Coefficients from our estimation of the OD model are included in Appendix A1.

Table 10 includes the results of merger simulations using the DB and OD models for 27 hypothetical mergers of independent hospitals located in the San Diego area.[17] As Table 10 demonstrates, the two models show merger effects on price that are virtually zero for the independent San Diego hospitals. For the mergers in Table 10, for only one merger, that of Tri-City Hospital and Fallbrook Hospital, do the methods differ on whether a merger would produce a price increase of 5%. They are otherwise in agreement.

Though the calculation of WTP from equation (8) does not allow for isolation of unilateral merger effects, given the prominence of hospital systems in San Diego we compare the average effects of a merger of entire hospital systems in Table 11 by separately calculating the WTP for each hospital within a system, and given these estimates, we then infer the measure for an entire hospital system. As we indicate previously, though this method cannot identify a price increase at any individual hospital that is a system member, the average price effect of the merger of two entire systems can then be approximated using the difference in the aggregate WTP for both systems versus the WTP for each system separately.

[16] Instead of the “equipment intensity” variable, we use a “tech index” variable which is the sum over dummy variables for the presence of 28 technologies reported in the annual hospital financial data (such as presence of an MRI, open heart surgical suite, etc.). Also, instead of travel time, we use distance.

[17] We classify a hospital as independent for purposes of this analysis if the hospital had was not a member of a hospital system *or* if the hospital was owned by a corporation that controlled only one hospital in the San Diego area.

In three of the five system mergers presented in Table 11, both models agree on which system mergers would result in an average increase in price of 5%.[18] For the two mergers presented in Table 11 in which the two methods do not agree, both of these mergers involve the University of California, San Diego, a hospital which generates the largest WTP measure of all hospitals in our data. As Capps et al. (2003) indicate in their paper, this could be due to UCSD's status as the only university hospital in the market. This fact, coupled with UCSD's service area overlap with Scripp's Mercy Hospital (0.4 miles from UCSD) and Sharp Memorial Hospital (3.2 miles from UCSD) in downtown San Diego most likely accounts for the substantial increase in WTP (and thus price) induced by a merger of UCSD with both Sharp and Scripps. In the structural Bertrand model, however, UCSD Medical Center charges the highest price for a unit for hospital care in the San Diego ($5,827) area while also exhibiting the highest own-price elasticity (-5.99) of San Diego area hospitals (with the exception of Villa View Hospital). This pattern is suggestive of the UCSD Medical Center exerting market power in its pricing of hospital services. Consequently, while a merger of UCSD with hospital systems in the area does produce an increase in price using the DB model, this increase is most likely not as large as would be the case if UCSD were not already exerting market power. To the degree that consumers and health insurers substitute to other health care providers as a result of the prevailing high price at UCSD Medical Center, the observed elasticity may account for the lower price increase implied by the merger of these systems in the DB model.

Overall, the results of the comparisons between these two methods reveal a notable degree of similarity for hospital merger effects in the San Diego area. Though the models differ in their assumptions about firm conduct, given that both models identify demand-side merger effects via the intersection of patient market shares, such a result is not surprising. Furthermore, these results are suggestive that for these models, the assumptions on firm conduct are likely less of a factor in their determination of the likely price increases due to merger than is the specification of demand, though the differences

[18] The correlation between the merger simulations and WTP model is 0.82. Furthermore, though the merger simulations allow for identification of hospital-specific merger effects, in order to facilitate a direct comparison of the two methodologies, we weight the price increases produced by the DB model's merger simulations by the demand at each hospital (pre-merger).

indicate that these assumptions could in some cases potentially impact the conclusions of these models as to the likelihood of a SSNIP.

5. Conclusion

Market definition has played a pivotal role in antitrust decisions. While recent developments have provided more flexibility in antitrust analysis, market definition is likely to retain an important role. Many merger cases, including the vast majority of hospital merger cases, have utilized ad hoc methods of market definition that rely heavily upon shipments data, with no explicit economic model used to justify such methods. Our use of a fully specified structural model of hospital competition compares commonly employed geographic market definition approaches used in actual hospital merger cases to geographic markets rooted in the principles set forth by the merger guidelines. This method explicitly models consumer and producer behavior, and also accounts for firms operating at multiple locations, as required by the 2010 merger guidelines.

We find that the use of approaches frequently utilized in previous cases largely overstates the size of geographic markets for hospitals, particularly in areas with greater hospital density. In addition, these informal approaches imply elasticities ranging from 2.4-3.4 times as large as those calculated from a structural model of hospital competition. Furthermore, our analysis of the San Diego area shows that different structural methods generate results that are largely consistent with each other and inconsistent with ad hoc methods.

The results have important implications for merger analysis in both the hospital industry and other industries involving differentiated products. They illustrate the importance of economic modeling for defining markets, and indicate that reliance on imprecise methods of market definition has the potential to mislead the courts as to the appropriate extent of geographic markets. The markets presented here are most consistent with those identified in merger cases by plaintiffs rather than by defendants, in contrast to the court's frequent rejection of markets alleged by the antitrust authorities. Thus the use of such an approach should be emphasized when assessing the extent of market power in this and other differentiated product industries.

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Table 1: Case Summary 1994-2005

Year	Case	Winner	Primary Reason for Decision	Market Size	Government's Alleged Pre-Merger Market Concentration
2005	**Evanston Northwestern Health Care**	FTC	Merger substantially lessened competition	**Government:** 3 hospitals **Defendant:** 9 hospitals	10,000
1999	**Sutter** (California ex rel. Lockyer v. Sutter Health Sys.)	Hospitals	Insufficient evidence of a relevant geographic market	**Government:** 10 hospitals **Defendant:** 29 hospitals	
1999	**Poplar Bluff** (Circuit) (FTC v. Tenet Healthcare)	Hospitals	FTC failed to identify a relevant geographic market	**Government:** 7 hospitals **Defendant:** 22 hospitals	2,800-4,300
1998	**Poplar Bluff** (District) (FTC v. Tenet Healthcare)	FTC	FTC's prliminary injunction request was granted but later reversed (see above)	See above	See above
1997	**Long Island** (U.S. v. Long Island Jewish Med. Ctr.)	Hospitals	DOJ failed to identify relevant product and geographic market	**Government:** 5-mile radius **Defendant:** Nassau, Queens, Western Suffolk and Manhattan	(no pre-merger info but allegations that the merging hospitals would have 100% of the market post-merger)
1996	**Grand Rapids** (FTC v. Butterworth Health Corp)	Hospitals	Not-for-profit merger	**Government:** 9 hospitals **Defendant:** 9 hospitals	Approx. 1,600-1,700
1995	**Dubuque** (United States v. Mercy Health Servs.)	Hospitals	DOJ failed to identify relevant geographic market	**Government:** 3 hospitals **Defendant:** 19 hospitals	
1995	**Joplin** (FTC v. Freeman Hosp.)	Hospitals	FTC failed to identify a relevant geographic market	**Government:** 5 hospitals **Defendant:** 17 hospitals	1,402
1994	**Ukiah** (Adventist Health Sys./West)	Hospitals	FTC failed to identify a relevant geographic market	**Government:** 5 hospitals **Defendant:** 16 hospitals	4,600 (3,196 on appeal)

Table 2: Geographic Market Definition Methodologies in Merger Cases (1994-2005)

Year	Case	Winner	Primary Method Used for Geographic Market definition
2005	**Evanston Northwestern Health Care**	FTC	Government: Managed care testimony, post-merger price increases Defendant: Patient flow analysis (similar to Elzinga-Hogarty), travel time, physician admitting practices
1999	**Sutter** (California ex rel. Lockyer v. Sutter	Hospitals	Government: Elzinga-Hogarty and Critical Loss Defendant: Critical Loss (and "direct competitor test")
1999	**Poplar Bluff** (Circuit) (FTC v. Tenet Healthcare)	Hospitals	Government: Elzinga-Hogarty Defendant: Critical Loss
1998	**Poplar Bluff** (District) (FTC v. Tenet Healthcare)	FTC	See above
1997	**Long Island** (U.S. v. Long Island Jewish Med. Ctr.)	Hospitals	Government: Testimony of managed care witnesses Defendant: Patient Origin data
1996	**Grand Rapids** (FTC v. Butterworth Health Corp)	Hospitals	Government: Elzinga-Hogarty Defendant: Elzinga-Hogarty
1995	**Dubuque** (United States v. Mercy Health Servs.)	Hospitals	Government: Elzinga-Hogarty Defendant: Critical Loss
1995	**Joplin** (FTC v. Freeman Hosp.)	Hospitals	Government: Elzinga-Hogarty Defendant: Elzinga-Hogarty
1994	**Ukiah** (Adventist Health Sys./West)	Hospitals	Government: Elzinga-Hogarty Defendant: Elzinga-Hogarty

Table 3 Summary Data for the Differentiated Bertrand Model

Consumer characteristics (N=913,547)	**Mean**
Quantity	1.24
HMO	0.50
PPO	0.31
Unscheduled	0.53
Distance to chosen hospital	11.60
Hospital Characteristics (N=368)	
Price	4681
% For Profit	28%
% Not-For-Profit	52%
% Teaching	21%
Tech Index	15.10
% System Members	50%
Beds	192
Demand	3070
Own-Price Elasticity	-4.57
Cross-Price Elasticity w/rspt to closest hospital	0.60
Cross-Price Elasticity w/rspt to 2nd closest hospital	0.40
Cross-Price Elasticity w/rspt to 3rd closest hospital	0.30
Cross-Price Elasticity w/rspt to 4th closest hospital	0.21
Cross-Price Elasticity w/rspt to 5th closest hospital	0.19

Table 4

(N=368)	Method of Market Definition				
	Critical Loss	**Elzinga-Hogarty**	**SSNIP Mkt. Def.**	**HSA**	**MSA/PMSA***
Number of Hospitals in a Market					
Mean	26.75	22.43	3.78	54.38	41.83
std. dev	25.63	20.54	2.06	56.18	40.62
Median	16	13	3	16	18
Max	89	78	14	130	100
Min	2	1	2	1	2
Hospital HHIs (beds)					
Mean	1505	1460	3874	1031	1005
std. dev	1511	1392	1418	1377	1070
Median	875	1026	3683	832	714
Max	6914	10000	8911	10000	5947
Min	183	211	1054	118	158
Hospital System HHIs (beds)					
Mean	1891	1899	3989	1386	1398
std. dev	1716	1577	1442	1500	1260
Median	1194	1499	3814	1191	1191
Max	10000	10000	8911	10000	10000
Min	356	439	1244	327	366

* The number of MSAs in California is 24. The number of hospitals in the sample that are located in a MSA is 312.

Table 5 Market size by quartile of the number of hospitals within a 25-mile radius	(N=93) Quartile 1 (0-5 hospitals within 25 miles)			(N=96) Quartile 2 (6-18 hospitals within 25 miles)			(N=88) Quartile 3 (19-70 hospitals within 25 miles)			(N=91) Quartile 4 (71-110 hospitals within 25 miles)		
	Critical Loss	**Elzinga-Hogarty**	**SSNIP Mkt. Def.**	**Critical Loss**	**Elzinga-Hogarty**	**SSNIP Mkt. Def.**	**Critical Loss**	**Elzinga-Hogarty**	**SSNIP Mkt. Def.**	**Critical Loss**	**Elzinga-Hogarty**	**SSNIP Mkt. Def.**
Number of Hospitals in a Market												
Mean	5.80	7.19	2.78	10.79	9.51	2.80	26.27	23.73	3.64	65.47	50.37	5.96
std. dev	5.51	4.69	1.24	9.19	5.55	1.17	11.77	15.30	1.30	13.50	15.18	2.42
Median	4	6	2	8	8	2	24	18	4	67	50	5
Max	46	22	10	48	26	7	76	73	7	89	78	14
Min	2	1	2	2	1	2	11	7	2	28	9	2
Unique Markets	68	57	73	65	49	73	68	43	72	86	30	79
Difference in Market Size from SSNIP Market Def.												
Mean	3.01	4.41	-	7.99	6.71	-	22.64	20.09	-	59.52	44.42	-
std. dev	4.98	4.94	-	9.17	5.60	-	11.58	15.15	-	12.96	15.17	-
Median	1	3	-	5	5	-	20	16	-	62	44	-
Max	36	20	-	45	23	-	72	68	-	85	73	-
Min	-3	-3	-	-2	-1	-	8	3	-	22	2	-
Hospital System HHIs (beds)												
Mean	3471	3161	4694	2460	2510	4823	1065	1250	3820	474	592	2552
std. dev	1719	1920	1053	1636	1270	1198	750	683	1441	61	205	675
Median	3448	2611	5047	2243	2290	5045	770	1134	3372	468	545	2538
Max	10000	10000	7381	10000	10000	8911	2769	2960	8362	695	1367	5006
Min	524	745	1452	392	721	2450	356	439	1814	380	442	1244
Hospitals Operating within Guideline Thresholds												
Premerger HHI <1500	8	15	1	24	18	0	72	61	0	91	91	4
1500 ≤ Premerger HHI ≤ 2500	21	30	1	39	40	1	6	24	11	0	0	40
2500<Premerger HHI	64	48	91	33	38	95	10	3	77	0	0	47
Number of Hospitals within 25 miles												
Mean		2.40			10.71			36.15			93.10	
std. dev.		1.61			3.54			16.60			9.93	

Table 6

Own Elasticity by Hospital Concentration Quartile

	Own Price Elasticity			
	Quartile 1	**Quartile 2**	**Quartile 3**	**Quartile 4**
Mean	-3.55	-4.24	-5.05	-5.48
std. dev	1.51	1.78	1.55	1.66
Median	-3.27	-3.88	-4.90	-5.27
Max	-1.01	-1.75	-1.67	-2.15
Min	-8.87	-11.55	-11.33	-10.36

Table 7 Elasticity by Hospital Density Quartile

	Quartile 1	Quartile 2	Quartile 3	Quartile 4
Average Estimated Differentiated Bertrand Elasticity in Critical Loss Market				
Mean	-3.60	-4.39	-5.20	-5.48
std. dev	0.72	0.89	0.54	0.12
Median	-3.51	-4.29	-5.39	-5.47
Max	-2.17	-2.74	-4.10	-5.09
Min	-6.35	-8.55	-5.84	-5.84
Average Estimated Differentiated Bertrand Elasticity in Elzinga-Hogarty Market				
Mean	-3.89	-4.26	-5.28	-5.41
std. dev	0.91	0.69	0.65	0.14
Median	-3.72	-4.20	-5.39	-5.43
Max	-1.01	-3.22	-4.14	-4.92
Min	-6.81	-5.99	-6.25	-5.63

	Quartile 1	Quartile 2	Quartile 3	Quartile 4
Average Implied Differentiated Bertrand Elasticity in a Critical Loss Market				
Mean	-10.10	-13.84	-17.27	-18.65
std. dev	7.02	6.86	6.31	3.58
Median	-8.57	-12.54	-15.36	-18.53
Max	-2.27	-2.74	-7.76	-10.51
Min	-30.35	-48.13	-36.54	-29.02
Average Implied Differentiated Bertrand Elasticity in an Elzinga-Hogarty Market				
Mean	-12.55	-13.32	-14.57	-13.10
std. dev	9.41	6.80	8.04	2.37
Median	-10.15	-10.97	-12.16	-13.60
Max	-1.01	-3.23	-6.80	-5.96
Min	-37.40	-34.81	-32.85	-15.47

Table 8 San Diego Hospitals

Hospital	Ownership	Teach	Control	Tech Index	Beds	Price	Demand	Own Price Elasticity	# Hosps. Within 25 Miles
ALVARADO HOSPITAL MEDICAL CENTER	Tenet	N	FP	14	240	3979	2213	-4.48	20
SCRIPPS MEMORIAL HOSPITAL - CHULA VISTA	Scripps	N	NFP	8	159	3931	1335	-4.23	17
HARBOR VIEW HEALTH PARTNERS	Ornda	N	FP	14	156	3025	1479	-3.50	19
THE CORONADO HOSPITAL	Sharp	N	NFP	19	204	4007	562	-4.63	19
SHARP CABRILLO HOSPITAL	Sharp	N	NFP	17	227	2535	920	-2.96	19
SHARP MEMORIAL HOSPITAL	Sharp	Y	NFP	22	642	4238	15749	-3.92	20
SCRIPPS HOSPITAL EAST COUNTY	Scripps	N	NFP	14	162	3440	485	-3.93	19
FALLBROOK HOSPITAL DISTRICT		N	Munic	9	149	4133	665	-3.92	7
GROSSMONT HOSPITAL CORPORATION	Sharp	Y	NFP	24	422	3425	9392	-3.29	20
MERCY HOSPITAL	Scripps	Y	NFP	16	416	4282	8242	-4.30	19
MISSION BAY MEMORIAL HOSPITAL	Columbia	N	FP	18	128	2219	613	-2.66	20
PALOMAR POMERADO HEALTH SYSTEM (Escondido)	Palomar	N	Munic	21	389	3874	5247	-3.30	12
PARADISE VALLEY HOSPITAL	Adventist	N	NFP	15	228	3035	703	-3.55	18
SCRIPPS HEALTH - LA JOLLA	Scripps	N	NFP	27	454	4211	10376	-3.98	21
TRI-CITY HOSPITAL DISTRICT		N	Munic	24	333	2865	5242	-2.10	7
UCSD MEDICAL CENTER	UC	Y	NFP	23	359	5827	4193	-5.99	19
VILLA VIEW COMMUNITY HOSPITAL		N	NFP	11	102	5368	26	-6.18	19
COMMUNITY HOSPITAL OF CHULA VISTA	Sharp	N	NFP	15	306	4383	2557	-4.15	17
PALOMAR POMERADO HEALTH SYSTEM (Poway)	Palomar	N	Munic	20	250	4572	2819	-4.70	19
GREEN HOSPITAL OF SCRIPPS CLINIC	Scripps	Y	NFP	24	173	2357	5202	-2.62	21
SCRIPPS MEMORIAL HOSPITAL - ENCINITAS	Scripps	N	NFP	16	145	4560	2219	-4.74	18
SAN DIEGO HOSPICE CORPORATION		N	NFP	0	24	3741	55	-4.33	19
UCSD LA JOLLA, THORNTON HOSPITAL	UC	N	NFP	13	62	4523	1265	-5.02	21

Table 9
Market Definition for San Diego

	Critical Loss Market		Elzinga-Hogarty		SSNIP Mkt. Def.	
	No. of Hospitals	**HHI**	**No. of Hospitals**	**HHI**	**No. of Hospitals**	**HHI**
ALVARADO HOSPITAL MEDICAL CENTER	16	2769	14	2960	3	4216
SCRIPPS MEMORIAL HOSPITAL - CHULA VISTA	17	2692	18	2228	2	5500
HARBOR VIEW HEALTH PARTNERS	16	2696	18	2228	4	3584
THE CORONADO HOSPITAL	16	2696	18	2228	2	5089
SHARP CABRILLO HOSPITAL	17	2692	19	2454	2	5254
SHARP MEMORIAL HOSPITAL	18	2709	19	2454	2	5400
SCRIPPS HOSPITAL EAST COUNTY	17	2500	15	2861	2	5991
FALLBROOK HOSPITAL DISTRICT	38	775	14	2242	3	4306
GROSSMONT HOSPITAL CORPORATION	16	2769	14	2960	2	5378
MERCY HOSPITAL	17	2692	18	2228	2	5027
MISSION BAY MEMORIAL HOSPITAL	17	2239	19	2454	4	6914
PALOMAR POMERADO HEALTH SYSTEM (Escondido)	13	2083	14	2200	3	5496
PARADISE VALLEY HOSPITAL	17	2692	18	2228	2	5159
SCRIPPS HEALTH - LA JOLLA	16	2464	19	2454	3	8362
TRI-CITY HOSPITAL DISTRICT	19	1873	14	2033	2	5773
UCSD MEDICAL CENTER	17	2692	18	2228	2	5027
VILLA VIEW COMMUNITY HOSPITAL	16	2769	18	2228	4	3029
COMMUNITY HOSPITAL OF CHULA VISTA	17	2692	18	2228	2	5500
PALOMAR POMERADO HEALTH SYSTEM (Poway)	14	2302	18	2228	3	5143
GREEN HOSPITAL OF SCRIPPS CLINIC	16	2464	19	2454	3	8362
SCRIPPS MEMORIAL HOSPITAL - ENCINITAS	15	1825	16	2064	3	5003
SAN DIEGO HOSPICE CORPORATION	16	2696	18	2228	3	4739
UCSD LA JOLLA, THORNTON HOSPITAL	16	2464	19	2454	2	7886

Table 10: Price Increases for Mergers of Independent San Diego Hospitals

Merger (distance between hospitals in parenthesis)	**Price increase**	**Merger** (distance between hospitals in parenthesis)	**Price increase**
Mission bay & Alvarado (9.36 miles)		**Alvarado & Fallbrook** (43.09 miles)	
Differentiated Bertrand Model	**0.28%**	**Differentiated Bertrand Model**	**0.02%**
Option Demand Model	**0.41%**	**Option Demand Model**	**0.03%**
Mission bay & Paradise Valley (11.14 miles)		**Alvarado & Tri-City** (31.36 miles)	
Differentiated Bertrand Model	**0.14%**	**Differentiated Bertrand Model**	**0.14%**
Option Demand Model	**1.06%**	**Option Demand Model**	**0.22%**
Mission bay & Harborview (6.27 miles)		**Alvarado & Villa View** (2.32 miles)	
Differentiated Bertrand Model	**0.39%**	**Differentiated Bertrand Model**	**0.04%**
Option Demand Model	**0.83%**	**Option Demand Model**	**0.34%**
Alvarado & Paradise Valley (6.4 miles)		**Alvarado & San Diego Hospice** (6.62 miles)	
Differentiated Bertrand Model	**0.43%**	**Differentiated Bertrand Model**	**0.05%**
Option Demand Model	**0.48%**	**Option Demand Model**	**0.12%**
Alvarado & Harborview (7.22 miles)		**Paradise Valley & Fallbrook** (48.82 miles)	
Differentiated Bertrand Model	**0.61%**	**Differentiated Bertrand Model**	**0.00%**
Option Demand Model	**0.23%**	**Option Demand Model**	**0.03%**
Paradise Valley & Harborview (5.36 miles)		**Paradise Valley & Tri-City** (36.51 miles)	
Differentiated Bertrand Model	**0.46%**	**Differentiated Bertrand Model**	**0.03%**
Option Demand Model	**0.67%**	**Option Demand Model**	**0.15%**
Mission Bay and Fallbrook (39.84 miles)		**Paradise Valley & Villa View** (4.23 miles)	
Differentiated Bertrand Model	**0.00%**	**Differentiated Bertrand Model**	**0.00%**
Option Demand Model	**0.24%**	**Option Demand Model**	**1.62%**
Mission Bay and Tri-City (26.68 miles)		**Paradise Valley & San Diego Hospice** (6.01 miles)	
Differentiated Bertrand Model	**0.11%**	**Differentiated Bertrand Model**	**0.04%**
Option Demand Model	**0.75%**	**Option Demand Model**	**0.55%**
Mission Bay and Villa View (8.9 miles)		**Harborview and Fallbrook** (45.58 miles)	
Differentiated Bertrand Model	**0.00%**	**Differentiated Bertrand Model**	**0.01%**
Option Demand Model	**1.91%**	**Option Demand Model**	**0.03%**
Mission Bay and San Diego Hospice (5.24 miles)		**Harborview and Tri-City** (32.70 miles)	
Differentiated Bertrand Model	**0.01%**	**Differentiated Bertrand Model**	**0.08%**
Option Demand Model	**1.46%**	**Option Demand Model**	**0.14%**
Fallbrook & Tri-City (13.85 miles)		**Harborview and Villa View** (5.32 miles)	
Differentiated Bertrand Model	**1.57%**	**Differentiated Bertrand Model**	**0.01%**
Option Demand Model	**5.30%**	**Option Demand Model**	**0.74%**
Fallbrook & Villa View (44.85 miles)		**Harborview and San Diego Hospice** (1.25 miles)	
Differentiated Bertrand Model	**0.00%**	**Differentiated Bertrand Model**	**0.05%**
Option Demand Model	**0.10%**	**Option Demand Model**	**0.30%**
Villa View & Tri-City (32.71 miles)		**Tri-City & San Diego Hospice** (31.5 miles)	
Differentiated Bertrand Model	**0.00%**	**Differentiated Bertrand Model**	**0.00%**
Option Demand Model	**0.11%**	**Option Demand Model**	**0.05%**
Villa View & San Diego Hospice (5.02 miles)			
Differentiated Bertrand Model	**0.00%**		
Option Demand Model	**2.28%**		

Table 11: Price Increases for Mergers of San Diego Hospital Systems

System Merger	Price increase
Scripps and Sharp	
Differentiated Bertrand Model	16.11%
Option Demand Model	17.48%
Scripps and UCSD	
Differentiated Bertrand Model	3.48%
Option Demand Model	8.37%
Sharp and UCSD	
Differentiated Bertrand Model	3.70%
Option Demand Model	13.31%
Palomar Pomerado and Scripps	
Differentiated Bertrand Model	5.40%
Option Demand Model	8.46%
Palomar Pomerado and Tri-City	
Differentiated Bertrand Model	6.18%
Option Demand Model	9.43%

Table A.1 Option Demand Model Demand Parameter Estimates

Conditional (fixed-effects) logistic regression
Number of obs = 1381200
LR chi2(68) = 126728.31
Prob > chi2 = 0.0000
Log likelihood = -119532.84 Pseudo R2 =0.3464

	Coef.	std. error	z	P>|z|	[95% Conf. Interval]	
fp	-0.546	0.109	-5.030	0.000	-0.759	-0.334
teach	0.984	0.069	14.210	0.000	0.848	1.119
transplant	0.372	0.015	25.150	0.000	0.343	0.401
nurs_int	-0.187	0.011	-16.620	0.000	-0.209	-0.165
tech_ind	0.104	0.006	18.710	0.000	0.093	0.115
distance	-0.275	0.004	-64.550	0.000	-0.283	-0.266
distXfp	0.013	0.001	13.270	0.000	0.011	0.014
distXteach	0.010	0.001	18.460	0.000	0.009	0.011
distXnurs	0.001	0.000	3.710	0.000	0.000	0.001
distXtech	0.001	0.000	10.330	0.000	0.001	0.001
distXmale	0.008	0.002	5.120	0.000	0.005	0.011
distXelderly	-0.043	0.002	-23.810	0.000	-0.046	-0.039
distXwhite	0.029	0.003	8.490	0.000	0.022	0.036
distXincome	0.000	0.000	-3.060	0.002	0.000	0.000
distXlengstay	0.000	0.000	3.260	0.001	0.000	0.000
distXpctravl	0.264	0.008	34.240	0.000	0.249	0.279
distXotherproc	0.005	0.001	7.750	0.000	0.004	0.007
distXotherdiag	-0.008	0.001	-13.900	0.000	-0.009	-0.007
maleXfp	-0.159	0.046	-3.490	0.000	-0.248	-0.070
maleXteach	-0.163	0.028	-5.880	0.000	-0.217	-0.109
maleXnursint	0.035	0.005	7.510	0.000	0.026	0.044
maleXtech	-0.002	0.002	-0.920	0.357	-0.007	0.002
eldXfp	-0.021	0.051	-0.420	0.677	-0.121	0.079
eldXteach	-0.696	0.031	-22.300	0.000	-0.757	-0.635
eldXnurs_int	0.083	0.005	15.590	0.000	0.073	0.093
eldXtech	-0.041	0.003	-15.120	0.000	-0.046	-0.035
whiteXfp	0.066	0.084	0.790	0.431	-0.099	0.231
whiteXteach	0.670	0.059	11.320	0.000	0.554	0.786
whiteXnursint	-0.105	0.009	-11.440	0.000	-0.124	-0.087
whiteXtech	-0.007	0.005	-1.470	0.142	-0.016	0.002
incomXfp	0.000	0.000	-6.050	0.000	0.000	0.000
incomXteach	0.000	0.000	-16.680	0.000	0.000	0.000
incomXnursint	0.000	0.000	7.410	0.000	0.000	0.000
incomXtech	0.000	0.000	14.350	0.000	0.000	0.000
lengsXfp	-0.059	0.004	-13.590	0.000	-0.067	-0.050
lengsXteach	-0.019	0.002	-9.150	0.000	-0.024	-0.015
lengsXnursint	-0.003	0.000	-10.030	0.000	-0.003	-0.002
lengsXtech	0.000	0.000	-1.110	0.267	0.000	0.000
pctraXfp	0.659	0.203	3.250	0.001	0.261	1.057
pctraXteach	-0.452	0.129	-3.500	0.000	-0.704	-0.199
pctraXnursint	0.476	0.024	19.800	0.000	0.429	0.523
pctraXtech	0.046	0.011	3.990	0.000	0.023	0.068
other_prXfp	-0.030	0.018	-1.610	0.107	-0.066	0.006
other_prXteach	-0.017	0.012	-1.400	0.160	-0.040	0.007

other_prXnursint	0.018	0.002	9.070	0.000	0.014	0.022
other_prtech	-0.003	0.001	-2.720	0.006	-0.005	-0.001
other_diXfp	0.292	0.019	15.580	0.000	0.255	0.328
other_diteach	-0.105	0.011	-9.950	0.000	-0.126	-0.084
other_diXnursint	0.020	0.002	11.040	0.000	0.016	0.023
other_diXtech	-0.007	0.001	-7.690	0.000	-0.009	-0.005
match_nerv	0.510	0.085	5.970	0.000	0.343	0.677
match_resp	0.221	0.144	1.540	0.124	-0.061	0.503
match_card	0.702	0.030	23.070	0.000	0.642	0.761
match_obst	2.157	0.061	35.420	0.000	2.037	2.276
match_imag	1.273	0.289	4.400	0.000	0.705	1.840
distXdiag_endo	-0.019	0.009	-2.000	0.045	-0.037	0.000
distXdiag_otol	-0.011	0.009	-1.280	0.202	-0.028	0.006
distXdiag_resp	0.053	0.006	9.610	0.000	0.042	0.064
distXdiag_card	0.045	0.003	15.140	0.000	0.039	0.051
distXdiag_lymp	0.028	0.009	3.280	0.001	0.011	0.045
distXdiag_diges	0.000	0.003	0.120	0.908	-0.006	0.007
distXdiag_urin	0.005	0.005	1.120	0.263	-0.004	0.015
distXdiag_geni	0.002	0.002	0.850	0.394	-0.003	0.007
distXdiag_obst	0.049	0.002	19.860	0.000	0.044	0.054
distXdiag_musc	0.016	0.003	5.860	0.000	0.010	0.021
distXdiag_inte	0.006	0.005	1.260	0.207	-0.003	0.015
distXdiag_imag	0.050	0.006	8.440	0.000	0.038	0.061
distXdiag_nerv	0.029	0.004	6.370	0.000	0.020	0.037

Note: This corresponds to specification (4) in Capps et al. (2003)

Figure 1

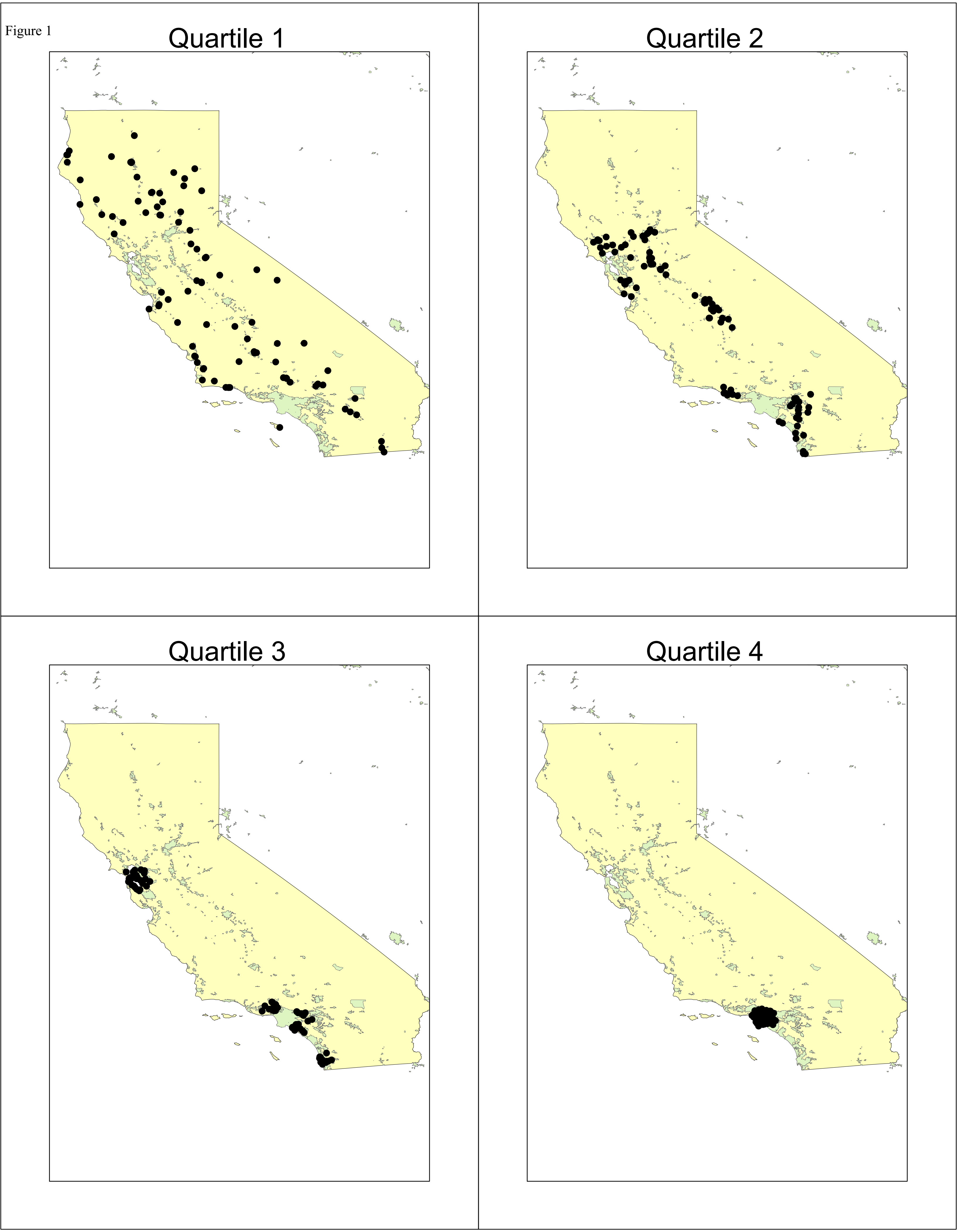


Figure 2

San Diego Metro Hospitals (N=23)

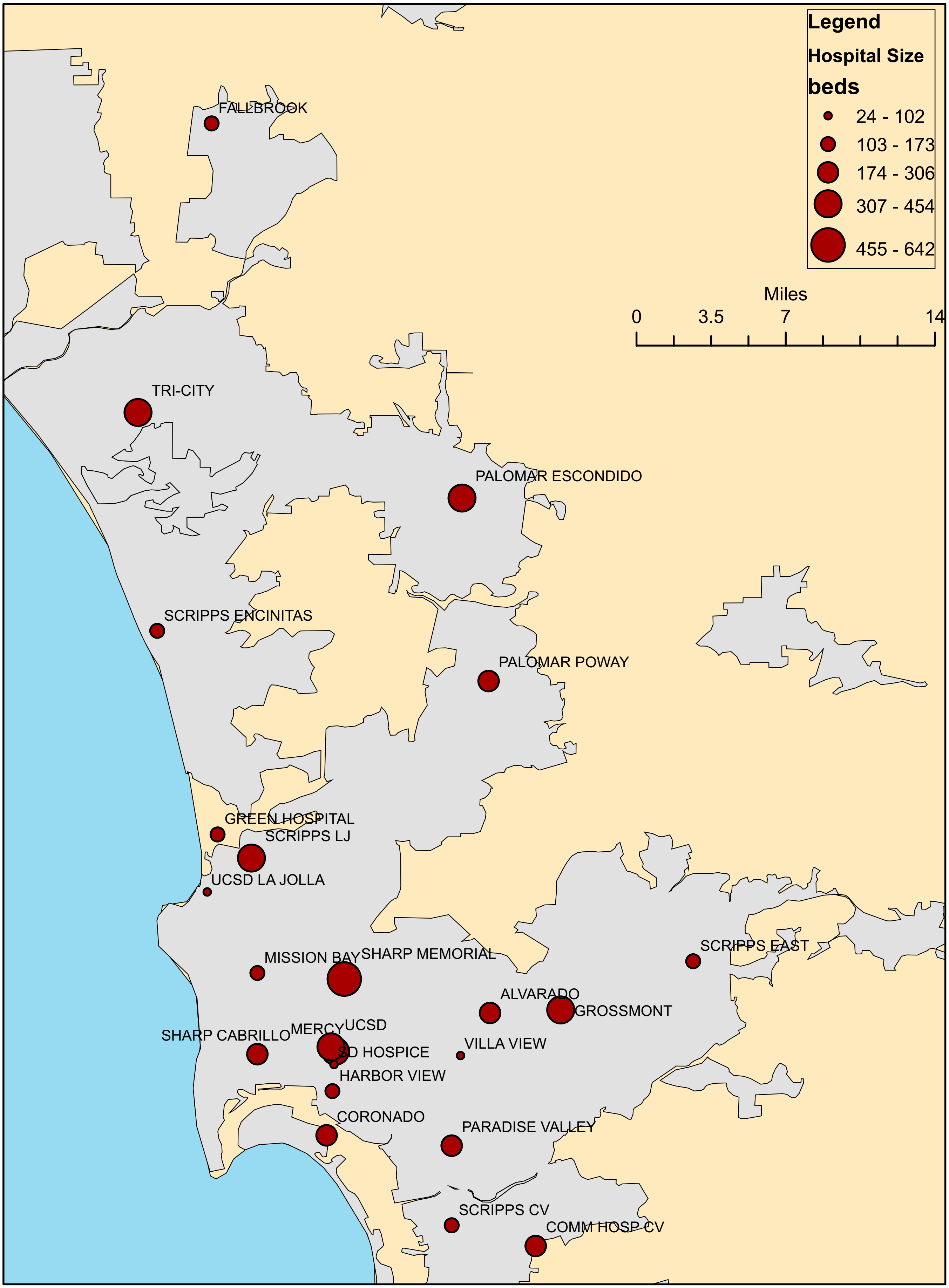
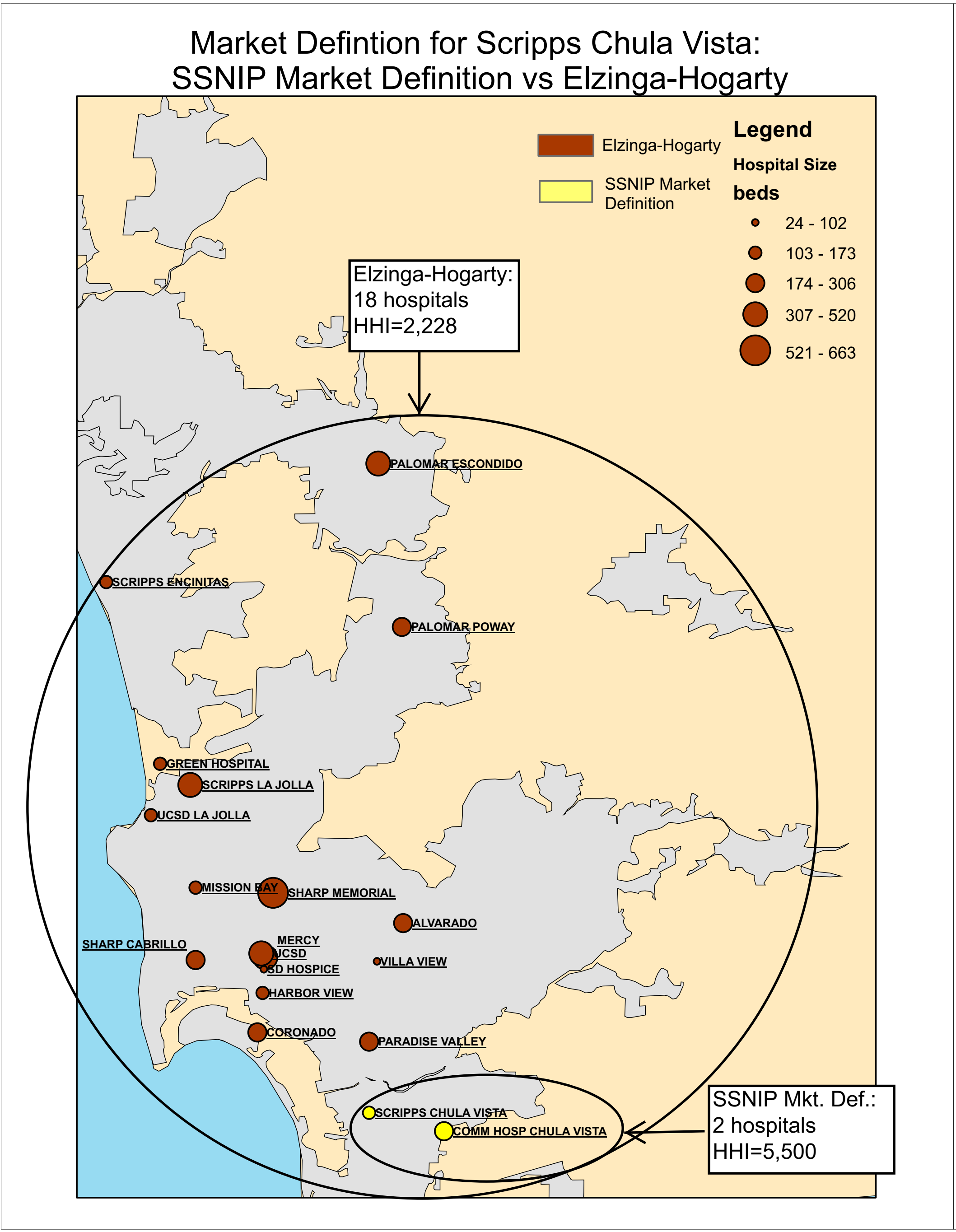
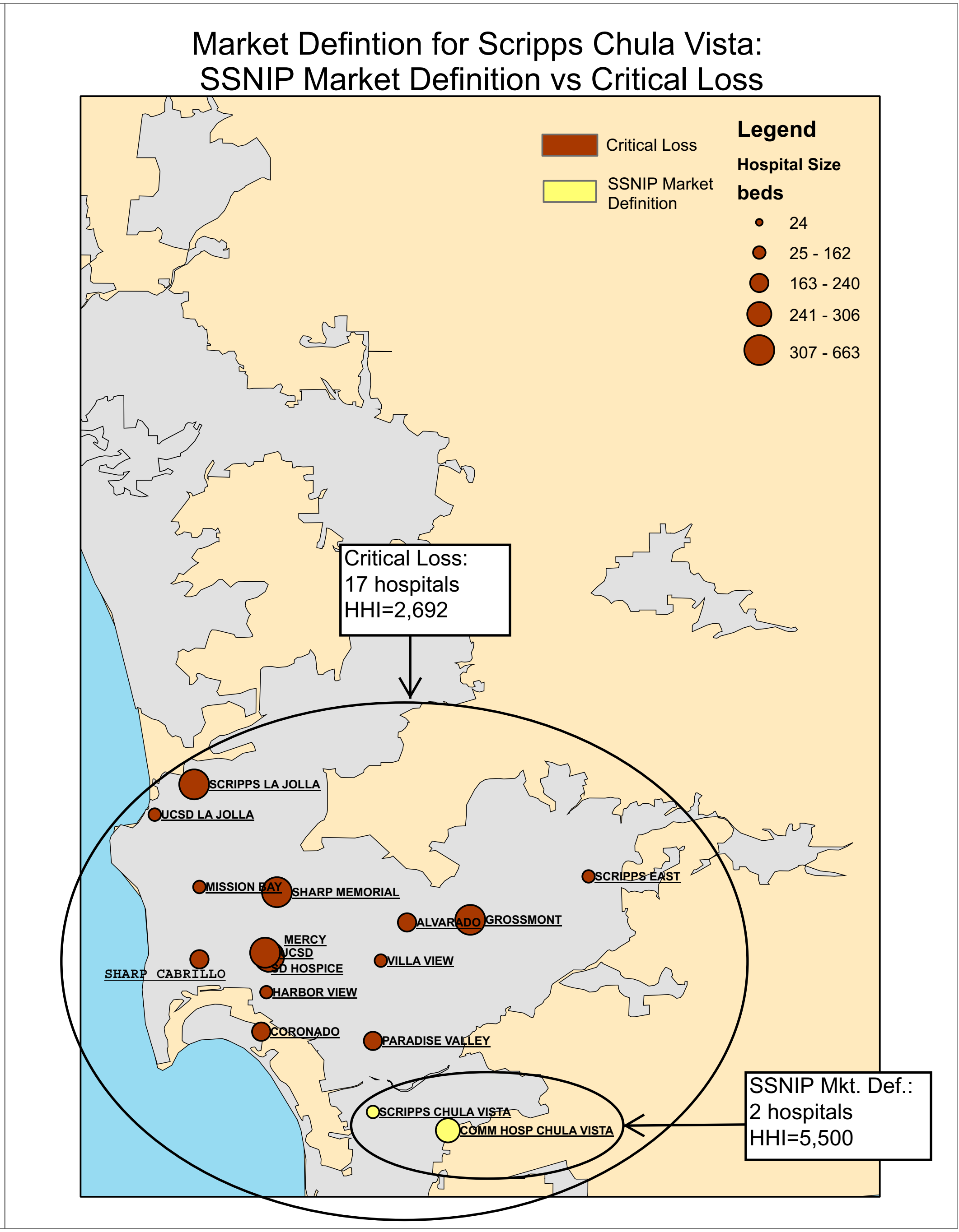


Figure 3



Market Defintion for Scripps Chula Vista:
SSNIP Market Definition vs Elzinga-Hogarty
Elzinga-Hogarty
SSNIP Market Definition
Legend
Hospital Size
beds
24 - 102
103 - 173
174 - 306
307 - 520
521 - 663
Elzinga-Hogarty:
18 hospitals
HHI=2,228
PALOMAR ESCONDIDO
SCRIPPS ENCINITAS
PALOMAR POWAY
GREEN HOSPITAL
SCRIPPS LA JOLLA
UCSD LA JOLLA
MISSION BAY
SHARP MEMORIAL
ALVARADO
SHARP CABRILLO
MERCY
UCSD
SD HOSPICE
VILLA VIEW
HARBOR VIEW
CORONADO
PARADISE VALLEY
SCRIPPS CHULA VISTA
COMM HOSP CHULA VISTA
SSNIP Mkt. Def.:
2 hospitals
HHI=5,500



Market Defintion for Scripps Chula Vista:
SSNIP Market Definition vs Critical Loss
Critical Loss
SSNIP Market Definition
Legend
Hospital Size
beds
24
25 - 162
163 - 240
241 - 306
307 - 663
Critical Loss:
17 hospitals
HHI=2,692
SCRIPPS LA JOLLA
UCSD LA JOLLA
SCRIPPS EAST
MISSION BAY
SHARP MEMORIAL
ALVARADO
GROSSMONT
MERCY
UCSD
SD HOSPICE
VILLA VIEW
SHARP CABRILLO
HARBOR VIEW
CORONADO
PARADISE VALLEY
SCRIPPS CHULA VISTA
COMM HOSP CHULA VISTA
SSNIP Mkt. Def.:
2 hospitals
HHI=5,500