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An Empirical Analysis of the Impact of Certificate of Need Law on Utilization of Inpatient Services

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Abstract

We investigate the impact of Certificate of Need (CON) Law and its stringency on Inpatient service utilization measured by hospital occupancy. We show that on average the CON legislation reduces utilization in Inpatient units. Besides, we do not find sufficient statistical evidence to reject the exogenous assumption of CON and its features. Furthermore, we confirm the qualitative nature of these key findings by an analysis featuring Inpatient length of stay (LOS). Other findings include the following: Inpatient utilization is positively related to proportion of females in a state and the proportion of Asian-Americans; a statistically significant positive relationship exists between GDP and utilization and a negative one is noted between utilization and proportion of population on Medicare; a statistically significant positive relationship is noted between population availing ED services in a state and Inpatient utilization;

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as the number of democratic senators in a state increases, it has a negative impact on utilization of Inpatient services.

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JEL classification: I11, I18

I. Introduction

The U.S. spends more on healthcare than any other country in the world. To put it in perspective, as per a study by the Centers of Diseases Control and Prevention, it accounts for more than 17% of Gross Domestic Product (GDP) (NCHS, 2012). All other economic sectors lag behind healthcare when it comes to spending. Nearly one-third of this is attributed to Inpatient hospital services and related utilization. Specifically, between 1997 and 2011, aggregate inflation adjusted hospital costs grew by 3.6 percent annually (Weis, Barrett and Steiner, 2014). It would be somewhat consoling if quality of healthcare outcomes is comparable with the utilization rates but that is not the case either. United States lags behind all other industrialized nations in this regard (OECD, 2009).

Healthcare regulation is usually a strategy that the governments employ to make sure the utilization and related costs do not get out of hand. As can be expected United States is no stranger to this. A number of laws have been implemented over the years with varied goals in mind. The 1946 federal Hill-Burton program for instance was aimed at funding new hospital construction in areas that most needed it. It was designed to provide funds for new hospital construction in such areas. However, a state would only receive these funds if they adopted a health plan that would evaluate the proposed projects (Lave and Lave, 1974). Another significant milestone in this regard was the Certificate of Need Law. The National Health Planning and Resource Development Act (NHPA) passed this law in 1974 to curtail unnecessary spending.

The primary goal with this law was to ensure availability of healthcare services while controlling for unnecessary capacity, expensive duplication of services and improving quality of care and competition (Conover and Sloan, 1998). Some states have repealed this law but then thirty six of them still pursue the law in various fashions and it continues to have an impact on their healthcare industry. While one would presume that these repeal and continuance decisions were backed by concrete evidence, analysis of extant literature portrays a different story altogether. Among other issues, one finds that a comprehensive analysis of the impact of CON Law is notably lacking.[2] Given the absence of a complete investigation of this profound issue, literature unsurprisingly includes studies that find the law to be favorable to the healthcare industry and then those that believe it has negatively impacted the healthcare industry without a clear frontrunner. We provide a few examples for both sides of the aisle on relevant healthcare issues such as entry to market, competition, cost of care and quality of care.

The Department of Justice & Federal Trade Commission (2004) and Zeta (2008) point out that CON Law leads to higher prices as it protects incumbents by acting as a barrier to entry. Adding support to this argument, Greenberg (1998) points out that CON Law makes it difficult for hospitals to enter the healthcare market or for an existing hospital to justify expenditures with regard to a medical procedure or service that is already available at other hospitals. Vaughan-Sarrazin et al. (2002) find a negative impact of the law on health outcomes. In their study featuring Coronary Artery Bypass Graft surgery (CABG) patients, they find the mortality rates of the CABG patients to be 22% higher in states with CON compared to those that don't. The proponents of the law argue that that the law is able to deter excessive investments in expensive technologies. Their argument is rooted in the ability of hospitals to compete on the basis of non-

[2] Hellinger (2009) and Smith and Forgione (2009) provide a detailed overview of CON Law and changes the law has gone through over the years since its enactment.

price attributes and this allowing them to easily pass on the cost of their investment to the consumers (or the insurers). Ferrier et al. (2010) similarly find CON Law to have a positive impact on healthcare costs. Specifically, they are able to show that states with CON Law are able to accomplish a more efficient allocation of resources and outputs than those without the law. Additionally, they note that the duration of the law in a state has a positive statistical significance. Paul et al. (2014) find that CON Law has a statistically significant negative impact on Emergency Department (ED) average Length of Stay (LOS) and therefore positively impacts health care quality in ED.

The primary motivation of this study is an empirical analysis of the impact of CON Law on Inpatient utilization. An additional aspect that makes this analysis interesting and worthwhile is the negative correlation noted between quality of Inpatient care and utilization in extant literature (Scholle et al. 2005). The same directional nature is observed to hold between average length of Inpatient stay and quality of care delivery (Coffman and Rundall, 2005; White and Glazier, 2011). We would like to study given this contrast, how does CON Law impact utilization measured by hospital occupancy and to check the robustness of these findings via an analysis focusing on a different measure of utilization, average LOS. Additional motivation is provided by findings in extant literature featuring EDs that demonstrate a positive impact of CON Law on quality of care (Paul et al., 2014).

Given that two states could vary with regard to the stringency with which they enforce the law, we control not only whether a state has CON law or not, but also we factor in the thresholds on expenditures that states with CON have put into place. Any expenditure request beyond these thresholds would have to go through a formal review. Therefore, a hospital or healthcare provider would have to obtain approvals from the government if they were

considering significant additions to their capacity or entering a new service market. To clarify, a higher threshold represents less stringent law as in such a scenario only a handful projects would have to go through a formal review. In this study, we devote our attention to stringency as it applies to thresholds on service expenditures[3]. We also account for both the supply and demand side of the Inpatient market in addition to the features of the law. These variables include but are not limited to health care supply, economic indicators, demographic characteristics, health status, health insurance coverage of local population, and state political environment/policy based variables. Finally, given the possibility of unobserved state heterogeneity, we extend our analysis by treating CON Indicator and its stringency as endogenous, and then test for their endogeneity.

II. Data and Summary Statistics

In this study, we investigate the impact of CON Law on Inpatient utilization or occupancy of hospital inpatient resources in the United States using hospital level data. We measure utilization as follows for each hospital: $(Utilization = \left[\frac{\text{Annual Inpatient Days}}{\text{Number of Beds} * 365}\right])$ following extant literature (Examples include Sampson et al., 2006; Connecticut Department of Public Health, 2013 among others).

Our outcome measure is built using Inpatient Days data of hospitals in each state for the years 2000, 2002, 2004, 2006 and 2009. Our key variables of interest are CON Law and its

[3] CON Law is usually associated with three thresholds: one to curb capital spending (for example, hospital expands its capacity using a loan and has to pay interest), one for equipment purchases and the third featuring service related expenditures. The one associated with equipment by definition is not relevant to Inpatient care but rather to emergency departments. Therefore, we did not include this measure in this research. In light of concerns regarding the consistency of threshold associated with capital spending over the time period in this study, we did not incorporate it either. Our communication with the American Health Planning Association from whom this data was obtained did not help resolve these inconsistency concerns.

stringency. We use a binary variable to describe whether a state has a CON Law or not. The stringency of CON Law is measured by an index based on the CON threshold for service related expenditures in the state, beyond which hospitals need to get permission from the state government if they plan to acquire new service. This threshold varies across states, whereas a small value of this threshold indicates a relatively stringent CON Law, while a large value of this threshold indicates a relatively lenient version of the law. It is important to include a measure on this feature of CON Law not only to differentiate between states with CON Law but also to differentiate between states with and without CON Law. This is mainly because there exist some states with CON Law that have a high threshold on new service related spending, which means very few service acquisitions are subject to review. These states are therefore not very different from states without CON Law where no spending is subject to review. The index of the threshold on service spending is defined as follows:

$$\left(Stringency\ Index_{State\_i} = \left[\frac{\max_{j\in I}\ CON\ Threshold_{State_j} - CON\ Threshold_{State_i}}{\max_{j\in I}\ CON\ Threshold_{State_j}}\right]\right).$$

We construct the measure of CON Stringency in this way, such that the meaning of increase in this index is similar to that in CON Indicator, where 0 implies a lenient environment and 1 implies a stringent one. Intuitively, Inpatient care utilization could be affected by both the demand and supply side of the Inpatient care market. On the supply side, we take into account important hospital characteristics, such as number of full time physicians; number of full time nurses; whether the hospital is a member of Council of Teaching Hospitals and Health Systems (COTH) of the Association of American Medical Colleges; whether the hospital has residency training approval by Accreditation Council for Graduate Medical Education and whether the hospital has accreditation by Joint Commission on Accreditation of Health Care Organizations (JCAHO) and state characteristics such as number of teaching hospitals. Increase in number of

teaching hospitals can negatively impact their turnaround rate (because of the greater role of resident physicians) and therefore market share of these hospitals. On the demand side, we construct measures to capture the health need of the population in a given market (state). First, we control for the demographic characteristics of the state population using measures on distributions of different age, gender and ethnicity groups. An increase in population in a state increases the demand for health care and thereby can influence utilization. Further, it is well known that females have more health care needs when compared to men, and hence an increase in their proportion might increase demand for Inpatient care and utilization (NCHS, 2012). An increase in the proportion of the elderly similarly might increase the demand for Inpatient care and related utilization. Health outcomes and socio-economic standing have been found to significantly vary by race (Census Bureau, 2013; NCHS, 2012) and therefore any substantial changes in the racial mix of the population can influence the demand for Inpatient care and related utilization. Similarly, we consider population that avail Emergency Department (ED) services). The emergency department related inputs are incorporated accounting for the fact that a major proportion of Inpatient volume comes from the ED and therefore the ED volume have a significant impact on Inpatient volume and therefore Inpatient utilization (Paul and Lin, 2012).

Second, we include the proportion of population covered by different types of health insurance, which could be a natural measure of individuals' accessibility to health care. For instance, if the number of individuals with employer-provided insurance increases, it can potentially lead to a reduction in demand for Inpatient care as these individuals are generally younger and healthier. The opposite might hold true for those on Medicaid. We also consider the number of illegal immigrants (in millions) to capture the population who lack health insurance coverage and hence are likely to be one of the most vulnerable groups.

Third, we try to measure the health status of a state population using the prevalence of obesity, percent of population that smoke daily, percent of population that drink heavily and child death rate (CDC, 2014a; CDC, 2014b; CDC, 2014c; CDC, 2014d). For instance, infant mortality rate is a good indicator of health status as it has been found to be directly related to health of expecting women which in turn is influenced by their life style and behavioral choices (CDC, 2014d). Another motivation for considering them in our study is the positive relationship noted between smoking, heavy drinking, obesity and the health care costs (NCHS, 2012).

There is no doubt that the political and economic environment of a state could affect the Inpatient care market as well. For instance, in a richer state, Inpatient care providers would have a stronger incentive to increase utilization of Inpatient services even if there is no real demand to justify it. We use median household income[4] to capture the economic effects.

Also, political environment of a state could very likely influence the policies implemented in the Inpatient care market which could have an impact on available services and related utilization. We construct several measures on the political environment of a state: 1) Party affiliation of the state governor and senators; 2) Voting records of the two senators from a state: both the number of affirmative votes and deviation of their votes. We include these variables in our study for the following reasons: First, voting record of senators is an indicator of the political climate in that state since rational senators would not vote in a manner that jeopardizes their chance of winning future elections. A higher number of affirmative votes along with a low deviation in the voting record of the senators is an indication of agreement between the senators and is possibly a result of a cooperative political climate in a state, either because one party is overwhelmingly dominant or because both parties enjoy a working relationship. Legislative changes can be made relatively easily in such a state. In such an environment,

[4] All variables in money terms used in our analysis have been adjusted for inflation in 1998 dollars for consistency.

powerful (influential) groups with special interests can get laws passed or modified in their favor and such changes might significantly impact utilization.

To the best of our knowledge, there is no single data set that includes all of the variables we need for our analysis. Therefore, we collect information on these variables from a variety of sources (Appendix Table A.1). We end up with a sample of 22639 observations at the hospital level, which covers the period of years: 2000, 2002, 2004, 2006 and 2009. Note that variables such as population demographics,, number of illegal immigrants, and those capturing political and economic environment, insurance type, are collected at the state level as they cannot be measured at the hospital level or they are not available. Table 1 provides the summary statistics of our sample with a comparison between hospitals in states with and without CON Law. A detailed description of the variables can be found in Appendix Table A.2.

----------Table 1 about here----------

From Table 1 above, compared to hospitals in states without CON Law, those with CON Law on average have larger populations, larger black population, lower proportion of people covered by privately purchased health insurance, and smaller population of illegal immigrants. A higher proportion of hospitals in states with CON are members of council of teaching, have approval for resident training, have Joint Commission of Healthcare Organizations Accreditation (JCAHO) and are not for profit. Similarly, they have an increased number of full time physicians and nurses. The governors are more likely to be Democratic, and their senators seem to be more cooperative as well[5]. Hospitals in states with CON are also associated with 1) higher GINI indexes, which indicates a higher dispersion in income; 2) lower tech index, which indicates a slower speed to implement newer technology.

[5] These differences have been tested to be statistically significant at the 5% level.

III. Econometric Specifications

In this empirical study, we would like to explore the relationship between CON Law and hospital occupancy, a measure of utilization of hospital resources. While the effect of CON Law on healthcare costs has been extensively investigated, to the best of our knowledge, there is no prior literature that studies the effects of CON Law from a utilization standpoint. Our analysis starts with a binary control of CON Law as mostly used in previous studies, then we extend it with measures on the stringency of the law, and finally test the endogeneity of CON Law measure(s). In all our models, we also control for other important variables as described previously that measure both the demand and supply side of Inpatient care market, and economic and political environment of a state.

The estimated model we start with is specified below:

$$HospOcc_{it} = \alpha_0 + \alpha_1 CON_{it} + \alpha_2 X_{it} + \varepsilon_{it}\,, \qquad (1)$$

where $HospOcc_{it}$ measures the utilization of Inpatient care based on the number of beds available in a given hospital *i* in time period *t*, CON is a dummy variable that indicates if a state has the CON Law or not, *X* includes all the other covariates, such as hospital resources and characteristics, population characteristics in the state where the hospital is located, and macro political and economic environment of the state, and ε represents the error term[6].

In order to tackle the existence of unobserved hospital heterogeneity, we extend our study by taking advantage the panel setting of our data. Our model of interest is presented below:

$$HospOcc_{it} = \alpha_0 + \alpha_1 CON_{it} + \alpha_2 X_{it} + \tau_i + \varepsilon_{it}\,, \qquad (2)$$

[6] There could be some concerns about the existence of autocorrelation in the error term. We test on it and cannot find sufficient statistical evidence to support the existence of autocorrelation with a p-value of 0.1094.

where τ_i represents time invariant unobserved hospital heterogeneity. If we assume there is no correlation between τ_i and the observables, we can use the Random Effect (RE) model to estimate the CON Law effects. We further relax the assumption by allowing the existence of arbitrary relationship between τ_i and the observables, where we use the Fixed Effect (FE) model to uncover the story. We use a Breusch-Pagan Test to check the existence of this unobserved heterogeneity of hospital and then use a Hausman type of test to compare our estimation results from our RE and FE models.

It is worth noticing that CON Indicator, our key variable of interest, is time invariant in the periods considered in this study. Therefore, we are not able to estimate the effect of CON in the FE model. In order to obtain some estimates of this key variable of interest that is time invariant, and at the same time allowing for some relationship between the observed and the unobserved heterogeneity, we apply a Hausman Taylor (HT) type of model to obtain Generalized IV (GIV) estimates. In this model, we allow correlation to exist between time varying observables and unobserved heterogeneity, with an assumption that CON (indicator) is exogenous (uncorrelated with the unobserved heterogeneity) first[7]. We then use a Hausman type of test to compare the result of the HT model with that of the FE model to test the robustness of our results towards model specification.

Since the decision to retain the law in a state depends on state-specific characteristics, some of which are unobserved (state's attitude towards rate of Inpatient care utilization for instance), we cannot rule out the possibility that the CON Indicator is correlated with the error term in equation (1) and (2) without testing for it. In other words, there is a possibility that the CON Indicator may be an endogenous variable. If this is true then we may end up with biased estimates of CON Law effects if we fail to tackle this issue appropriately. Therefore, we first use

[7] We treat CON indicator as an endogenous variable next and test for this endogeneity.

a two-stage least squares (2SLS) model[8] to estimate the effects of the CON Law treating CON Law indicator as endogenous. We then use the Durbin-Wu test to investigate whether we have strong empirical evidence to believe that the CON Indicator should indeed be treated as an endogenous variable. The 2SLS estimation is done using the following specifications:

Stage one: $CON_{it} = \theta_0 + \theta_1 IV_{it} + \theta_2 X_{it} + \vartheta_{it}$ (3)

Stage two: $HospOcc_{it} = \gamma_0 + \gamma_1 \widehat{CON_{it}} + \gamma_2 X_{it} + \mu_{it}$ (4)

In the first stage, we estimate the likelihood of a state having CON Law as a function of Instrumental Variables (IVs) and other covariates. And in the second stage, we estimate the Inpatient utilization as a function of the estimated likelihood of having CON Law from the first stage and other covariates. Theoretically, we need to include at least one IV for each endogenous variable in order to identify the model. In this specification, we use the index of science and technology and the GINI in a state as our IVs.

The following explains our motivation behind choice of these IVs i.e. why we posit that they are likely to influence whether a state has CON Law but not likely influence the Inpatient utilization is as follows: 1) The index of science and technology in a state is likely to be associated with the attitude of the state administration regarding how quickly new technologies can be adopted. A technologically advanced state will usually have a large technology sector that provides both jobs and taxes. Everything else remaining constant, such a state is less likely to have the law since it can hurt business interests in the state. On the other hand, states worried that such technology and innovation related investments do not justify the resulting benefits are more likely to have and continue to retain the law. These concerns that the effort to innovate

[8] We also used a discrete model in the first step and use the predicted probability of having CON from this stage as the IV in a 2SLS as a robustness check, and the findings of our main equation were consistent with those obtained from the 2SLS modeling specification. The results are available upon request. We report the results of 2SLS to make an easy comparison to the results of models where we control both CON Law indicator and law stringency.

often overtakes the effort to economize find adequate support in extant literature (Bodenheimer, 2005). This might also lead to a scenario wherein such states are technologically less innovative than those without CON Law. 2) The GINI index is a measure of income dispersion in the state population. When GINI index of a state increases, the income inequality rises (World Bank, 2013). In this case, it is possible that a large fraction of the population may be unable to pay for healthcare, particularly for inpatient services. Hospitals in states that have a higher proportion of low income patient base get subsidies towards the cost of care. For instance, as per the Inpatient Prospective Payment System (IPPS), the base payment rate (determined by the diagnosis-related group of a patient) to hospitals is adjusted by an add-on payment known as the disproportionate share hospital (DSH) adjustment (CMS, 2014). DSH basically provides for a percentage increase in Medicare payment for hospitals that serve a disproportionate share of low-income patients. Additionally, it includes a provision to increase this IPPS payment for expensive patient cases. Therefore, the governments of such states would have valid concerns that hospitals could easily pass on the cost of unnecessary treatment to them. This would in turn provide the state an incentive to curb excessive expansion of hospital by retaining and therefore supporting CON Law that helps curb such unnecessary expansion. This indicates that GINI index is less likely to influence the utilization but rather is more likely to impact whether a state has CON Law or not. We also use statistical tests to investigate the validity of these two IVs. Finally, we use a Durbin-Wu (Hausman type) test to determine if there is empirical evidence to suggest that the CON Indicator is indeed an endogenous variable.

We also test on the endogeneity of CON Indicator in the panel setting first in a RE specification and then in a HT Type of model (since our key variable is time invariant).

Stage one: $CON_{it} = \theta_0 + \theta_1 IV_{it} + \theta_2 X_{it} + \phi_i + \vartheta_{it}$ (5)

Stage two: $HospOcc_{it} = \gamma_0 + \gamma_1 \widehat{CON_{it}} + \gamma_2 X_{it} + \omega_i + \mu_{it}$ (6)

In the RE model where we treat the CON Indicator as the only endogenous variable, we actually estimate a Generalized 2SLS (G2SLS) model: first, we regress the CON Indicator on exogenous variables X_{it} and IVs; second, we regress HospOcc on the estimated CON from stage1 and X_{it} assuming no relation between all the covariates and the unobserved heterogeneity. Then we relax this assumption by allowing relationships between the covariates (we assume CON Indicator to be endogenous in this specification) and the unobserved heterogeneity in a HT Type model. We use a Hausman type of test to test the endogeneity of CON Indicator in both RE (by comparing it to the RE with CON Indicator as exogenous) and Hausman Taylor specifications (by comparing it to a HT model where the CON Indicator is treated as exogenous).

Next, we extend our analysis by controlling for the stringency of the CON Law on service spending using an identical configuration. It is vital to take this measure of the stringency of CON Law into account[9] to better understand the relationship between CON Law and utilization of hospital Inpatient care. This is because by only using the CON Indicator, we can only accurately differentiate between CON states and non-CON states in some cases. Namely, within CON states, there is a large variation in the features of the law and one source of variation that we are interested in is the stringency of the law. Moreover, states with CON Law can act similar to those without it by setting very high (in some cases, threshold is listed as "No limit") threshold beyond which hospital expenditures are subject to review. Similar to the previous section, we start our analysis by treating the stringency of CON Law as exogenous in a pooled OLS specification as follows:

[9] There could be some concern regarding the possible existence of multicollinearity between CON indicator and this measure on its stringency. In order to detect the multicollinearity, we calculate the variance inflation factor (VIF=8.93) and tolerance (0.1120). These statistics indicate that multicollinearity is not a serious problem in our study.

$$HospOcc_{it} = \alpha_0 + \alpha_1 CON_{it} + \alpha_2 CON\ stringency_{it} + \alpha_3 X_{it} + \varepsilon_{it} \quad (7)$$

We then extend our study to control for the existence of unobserved hospital heterogeneity by taking advantage the panel setting of our data. And our model of interest is presented below:

$$HospOcc_{it} = \alpha_0 + \alpha_1 CON_{it} + \alpha_2 CON\ stringency_{it} + \alpha_3 X_{it} + \tau_i + \varepsilon_{it}\ , \quad (8)$$

where τ_i represents time invariant unobserved hospital heterogeneity. This model can be estimated either by assuming no correlation between observed explanatory variables and the unobserved effect (random effects), or allowing for arbitrary correlation between the unobserved effect and the observed explanatory variables (fixed effects). We can then test whether the random effects specification or the fixed effect specification is more appropriate based on a Hausman type of test, and whether the former is more appropriate than the pooled OLS regression using a Breusch-Pagan test. For the reason provided earlier in this section, we use a HT model to identify the effects of the time invariant CON Indicator while allowing the existence of relationship between the observed factors and the unobserved heterogeneity. We then use a Hausman type of test to compare our results of the FE and HT model.

As noted earlier in this section, it is worth testing whether the CON Strigency should be treated as an endogenous variable as well. In order to tackle this empirical issue and test for the endogeneity of the law stringency, we estimate the effect of the CON Law on hospital occupancy by using a 2SLS Model as follows[10]:

Stage one: $CON\ Stringency_{it} = \theta_0 + \theta_1 CON_{it} + \theta_2 IV_{it} + \theta_{32} X_{it} + \vartheta_{it}$ (9)

Stage two: $HospOcc_{it} = \gamma_0 + \gamma_1 CON\ \widehat{Stringency}_{it} + \gamma_2 CON_{it} + \gamma_3 X_{it} + \mu_{it}$ (10)

In this specification, we use the following IVs for stringency: tech index, and GINI index. The relationship between techindex and service stringency could go either way. This is because

[10] In this model, we treat CON Law indicator as exogenous as suggested by our results from the Hausman test regarding the endogeneity of CON Law in equation (3) and (4).

a state with CON Law that is highly technological innovative and believes CON Law is beneficial could adopt a strict process with regard to review of service spending applications to ensure that only the most deserving (in terms of public health outcomes) get approved. This in turn would help improve the technological innovativeness standing of the state. This is analogous to the strict process an Ivy League school follows when reviewing student applications so only the best get accepted to sustain and/or improve the reputation of the school. This would support a positive relationship between techindex and service stringency. On the other hand, there could also be states that are technologically innovative and have a large technology sector that provides both jobs and taxes that are not in favor of a strict CON Law if they believe it could hurt business interests in the state. A low stringency index (equal to zero) would also capture those states that do not have CON Law for similar reasons. This would support a negative relationship between techindex and service stringency. As indicated earlier, hospitals in states that have a higher proportion of low income patient base get subsidies towards the cost of care and provisions to increase such payments for expensive patient cases. Therefore, the governments of such states would have valid concerns that hospitals could easily pass on the cost of unnecessary treatment to them. This would in turn provide the state an incentive to curb excessive expansion of hospital by lowering the threshold or increasing the stringency of the Law as it pertains to service expenditures by healthcare providers. This indicates that GINI index is less likely to influence the utilization but rather is more likely to impact the CON Law. Furthermore, we test on the endogeneity of CON Stringency in the panel setting first in a RE/FE specification (as below) and then in a HT Type of model (since our other key variable-CON Indicator is time invariant).

Stage one: $CON\ Stringency_{it} = \theta_0 + \theta_1 IV_{it} + \theta_2 CON_{it} + \theta_3 X_{it} + \phi_i + \vartheta_{it}$ (11)

Stage two: $HospOcc_{it} = \gamma_0 + \gamma_1 \widehat{CON\ Stringency}_{it} + \gamma_2 CON_{it} + \gamma_3 X_{it} + \omega_i + \mu_{it}$ (12)

In the RE model, we treat the CON Stringency as the only endogenous variable. Then we relax this assumption by allowing relationships between the covariates (we assume CON Stringency as endogenous and CON Indicator to be exogenous in this specification) and the unobserved heterogeneity in a HT Type model. We use a Hausman type of test to test the endogeneity of CON Indicator in both RE (by comparing it to the RE model where both CON Stringency and CON Indicator are treated as exogenous) and Hausman Taylor specifications (by comparing it to a HT model where both CON Stringency and CON Indicator are treated as exogenous).

IV. Results

In this paper, we explore the effects of CON Law on Inpatient utilization given one of the motivations to implement the CON Law was to regulate the unnecessary healthcare utilization and cost. The well documented concerns regarding unnecessary Inpatient utilization trends, which could lead to a waste of resources, noted across United States provides a second motivation for this analysis. The main results of our empirical analysis are presented in Tables 2-5 below, with our preferred specification presented in Table 4. Our main findings include: 1) In general, CON Law (represented by the variable CON Indicator in the result tables) helps reduce utilization of Inpatient care[11]. 2). The stringency of the law measured by service expenditure thresholds employed by states with CON Law does not have a statistically significant impact on the utilization. 3) Durbin-Wu test shows that we cannot reject the hypothesis that CON Law and its stringency could be treated as exogenous in estimation.

[11] We also use quantile regression to investigate whether the effects of CON law differ in different states with various occupancy rate. The results show the magnitude of effects of CON indicator decreases by 10% with increases in occupancy (from 1st to the 3rd quartile), while the magnitude of effects of the stringency of CON increases by 90%.

Table 2 below presents the results of estimation on Inpatient utilization only controlling for a binary indicator of whether a state has CON Law or not. We have included results from all the four models i.e. cross sectional (OLS), RE and FE panel models and then those from a HT type model given the inability of FE to estimate coefficients of time invariant variables. A couple of important items to note: 1) Breush Pagan test comparing RE and OLS models indicates existence of unobserved heterogeneity of hospital (p-value<0.01). 2) A Hausman type of test comparing RE versus FE models indicates that RE is inconsistent or misspecified (p-value <0.01) hence a FE model is more appropriate. 3) A Hausman type of test comparing FE with HT model results indicates that HT estimates are adequate (p-value>0.1). This can be also noted via a comparison of magnitudes and directional nature of coefficients associated with variables that have a statistical significant impact on Inpatient utilization in both these models. As mentioned above, the motivation for developing an HT type of model is the inability of FE to estimate coefficients of time invariant variables, in this case a key variable considered in our study. In short, the Hausman Taylor specification is our preferred one in Table 2 based on the test results mentioned above. On average CON law will reduce the occupancy rate by 33.61%[12].

----------Table 2 about here----------

As a next step, we evaluate the endogeneity of CON Indicator[13]. These results are presented in Table 3. In the endogenous OLS model, the Durbin-Wu test (with a p-value of 0.8787) shows that we cannot reject the hypothesis that CON Indicator could be treated as exogenous[14]. We also

12 We incorporate year dummies to check whether this effect of reduction could be driven by time effects. We do not observe any noticeable patterns over time. Further, using a treatment effect model, we find that if all states in US had CON law, the national average occupancy rate in our sample will be 57.11%, and if all states in US had no CON law, the average is 66.64%, which leads to a difference of 8.53% in occupancy rate of inpatient care.

13 The results of the first stage estimation are reported in Table A.3.

14 The first stage F-test yielded a p-value<0.0001. The over-identification test indicated a p-value=0.8186. In the Stock-Yogo test, Cragg-Donald Wald F statistic is 2715.85. These indicate we have strong and valid IVs.

perform an endogeneity test for our RE and HT specifications. A Hausman test for both specifications (RE – p-value>0.1 and HT – p-value>0.1) indicates that we are not able to reject the hypothesis that CON Indicator could be treated as exogenous.

----------Table 3 about here----------

Other findings include the following: 1) Inpatient utilization reduces with increase the size of population in a state. Intuitively, this could mean given constraints on Inpatient care resources or resources remaining the same, these states tend to use available capacity more judiciously so the population that require inpatient care can still receive it. We confirm this rationale via our robustness check featuring Inpatient LOS (Table 6). If the rationale we mention is indeed correct, then a negative relationship is expected between Inpatient LOS and population size. 2) We also find that utilization is positively related to proportion of female in state and the proportion of Asian-Americans. As mentioned earlier, this can be explained by the increased needs for health services for female population when compared to males (NCHS, 2012). Given the economic affluence and stability of Asian population (Census Bureau, 2013), a positive relationship exists between the size of this population group and utilization from a hospital revenue standpoint is understandable. 3) Similar economics based reasoning explains the statistically significant positive relationship noted between GDP and utilization and a negative one noted between utilization and proportion of population on Medicare. 4) As noted earlier, Emergency Department patients make up a significant proportion of Inpatient population. This explains the positive relation noted between population availing ED services in a state and Inpatient utilization. 5) As the number of democratic senators in a state increases, it has a negative impact on utilization of Inpatient services. 6). An increase in the proportion of patients

covered by Medicare is associated with a lower (28.57%) utilization of hospital beds, which can partly be explained by the story that the reimbursement of government provided insurance (Medicare) may have certain requirement on the efficiency of inpatient care.

As mentioned earlier, only accounting for the presence or absence of the CON Law can be problematic not only because the stringency of the CON Law can vary a lot across states that have this legislation in effect, but also because a state with a very relaxed CON Law is essentially not very different from a state without the law. Therefore, it is vital to take into account CON Law characteristics in order to better understand the effects of CON Law. In Table 4, we present our estimates of CON Law effects with the stringency of the law taken into account.

----------Table 4 about here----------

As in the case of exogenous models (Table 2) considering merely the effect of the indicator whether a state has CON Law or not, we have included results from all the four models i.e. cross sectional (OLS), RE and FE panel models and then those from a HT type model given the inability of FE to estimate coefficients of time invariant variables. A couple of important items to note: 1) Breush Pagan test comparing RE and OLS models indicates existence of unobserved heterogeneity of hospital (p-value<0.001). 2) A Hausman type of test comparing RE versus FE models indicates that RE is inconsistent or misspecified (p-value <0.001) hence a FE model is appropriate. 3) A Hausman type of test comparing FE with HT model results indicates that HT estimates are adequate (p-value>0.1).

As a next step, we evaluate the endogeneity of CON Stringency[15]. These results are presented in Table 5. In the endogenous OLS model, the Durbin-Wu test (with a p-value of 0.2807) shows that we cannot reject the hypothesis that CON Stringency could be treated as exogenous[16]. We also perform an endogeneity test for our RE and HT specifications. A Hausman test for both specifications (RE – p-value>0.1 and HT – p-value>0.1) indicates that we are not able to reject the hypothesis that CON Stringency could be treated as exogenous. In the endogenous FE model, the Durbin-Wu test (with a p-value of 0.9987) shows that we cannot reject the hypothesis that CON stringency could be treated as exogenous[17].

----------Table 5 about here----------

In light of our findings that both CON Law and its stringency should be treated as exogenous, we next elaborate on results from exogenous specifications included in Table 4, our preferred models. All our findings noted earlier in Table 2 hold i.e. 1) CON Law has a statistically significant negative impact on Inpatient utilization. 2) Inpatient utilization reduces with increase in the size of population in a state. 3) Inpatient utilization is positively related to proportion of female in state. 4) A statistically significant positive relationship exists between GDP and utilization and a negative one noted between utilization and proportion of population on Medicare. 5) A statistically significant positive relationship is noted between population availing ED services in a state and Inpatient utilization. 6) As the number of democratic senators in a state increases, it has a negative impact on utilization of Inpatient services.

[15] The results of the first stage estimation are reported in Table A.4.

[16] The first stage F-test yielded a p-value<0.0001. The over-identification test indicated a p-value= 0.9414. In the Stock-Yogo test, Cragg-Donald Wald F statistic is 286.53. These indicate we have strong and valid IVs.

[17] The first stage F-test yielded a p-value<0.0001). The over-identification test indicated a p-value= 0.9095. In the Stock-Yogo test, Cragg-Donald Wald F statistic is 1057.93. These indicate we have strong and valid IVs.

As a robustness check to role of CON Law in reducing utilization given its negative correlation with quality of Inpatient care noted in extant literature (Scholle et al. 2005), we extend our analysis to study the relationship between CON Law and Inpatient LOS. Specifically, we investigate if the same directional nature holds between CON Law and Inpatient LOS, another metric that has been found to be negatively associated with quality of Inpatient care (Coffman and Rundall, 2005; White and Glazier, 2011). We find that CON Law represented by CON Indicator i.e. whether a state has CON Law or not has a negative impact on Inpatient LOS i.e. a positive impact on quality of Inpatient care. This provides support to previously documented positive relationship noted between CON Law and emergency department quality of care (Paul et al, 2014). Further, the statistically significant negative relationship noted between Inpatient LOS and population size confirms the rationale we put forth when explaining the negative relationship between population size and inpatient utilization in an earlier discussion. The results from the Inpatient LOS models are presented in Table 6.[18]

----------Table 6 about here----------

V. Conclusions

As discussed in the first section of the paper, CON Law was designed to reduce healthcare costs. Given that increased Inpatient care utilization and related costs have continuously been highlighted as a serious concern in United States, it is worthwhile to study if the law is doing what it was originally intended for. Our results indicate that CON Law has a

[18] Unlike HT model and prior specifications, although the estimated effect of service stringency is statistically significant at the 10% level in the RE and OLS models, CON Indicator and service stringency index are tested to be jointly significant at the 10% level. Additionally, our analysis indicated that most states that have CON Law are found to have a stringent version of the law. Specifically, less than 40% of the states have a stringency index value less than 0.5, and more than 60% of the states have this index value higher than 0.75 (which indicates a strict law).

negative impact on Inpatient care utilization. Besides, we do not find sufficient statistical evidence to reject the exogenous assumption of CON and its features. Furthermore, we confirm the qualitative nature of these key findings by an analysis featuring Inpatient LOS.

The other key findings include the following: 1) Inpatient utilization reduces with increase in the size of population in a state. 2) Inpatient utilization is positively related to proportion of female in state and the proportion of Asian-Americans. 3) A statistically significant positive relationship exists between GDP and utilization and a negative one noted between utilization and proportion of population on Medicare. 4) A statistically significant positive relationship is noted between population availing ED services in a state and Inpatient utilization. 5) As the number of democratic senators in a state increases, it has a negative impact on utilization of Inpatient services.

In summary, our results indicate that CON Law can help mitigate the increased Inpatient care utilization issues. Our findings have significant policy implications with regard to CON Law's impact on healthcare. The implication of our results can aid public policy makers when deciding the appropriate health programs or legislative framework to control unnecessary use of health services and resulting costs.

VI.

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Table 1: Summary statistics for variables

	sample (n=22639)		**Hospitals in states without CON (n=8474)**		**Hospitals in states with CON (n= 14165)**	
	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation
Inpatient Utilization	0.595	(0.249)	0.577	(0.306)	0.606	(0.206)
CON Law						
CON Indicator	0.626	(0.484)	0.000	(0.000)	1.000	(0.000)
Stringency Index – Service	0.164	(0.331)	0.000	(0.000)	0.261	(0.387)
Hospital Characteristics						
Full Time Physicians and Dentists	16.269	(66.010)	13.036	(54.464)	18.204	(71.971)
Full Time Nurses	163.366	(262.751)	147.706	(241.313)	172.734	(274.359)
Member of Council of Teaching	0.063	(0.242)	0.045	(0.208)	0.073	(0.260)
Resident Training Approval	0.180	(0.384)	0.147	(0.354)	0.199	(0.400)
JCAHO Accreditation	0.732	(0.443)	0.674	(0.469)	0.766	(0.423)
Not For Profit	0.523	(0.500)	0.479	(0.500)	0.549	(0.498)
Government Ownership	0.036	(0.186)	0.037	(0.189)	0.035	(0.185)
Demographics						
Population Size	11.179	(9.653)	16.423	(12.596)	8.043	(5.267)
Proportion - Female	0.508	(0.006)	0.503	(0.005)	0.510	(0.004)
Proportion (age 0-17)	0.250	(0.017)	0.261	(0.019)	0.243	(0.012)
Proportion (18-44)	0.379	(0.016)	0.386	(0.018)	0.376	(0.014)
Proportion (45-64)	0.245	(0.017)	0.236	(0.018)	0.251	(0.014)
Proportion - Black	0.127	(0.088)	0.076	(0.036)	0.158	(0.096)
Proportion - Asian	0.034	(0.030)	0.044	(0.040)	0.028	(0.019)
Proportion - Amer Indian	0.010	(0.014)	0.016	(0.021)	0.006	(0.004)
Proportion - Pacific	0.001	(0.001)	0.002	(0.002)	0.001	(0.001)

Proportion - Oth Race	0.014	(0.005)	0.016	(0.005)	0.013	(0.004)
Illegal Immigrant	0.512	(0.717)	0.959	(0.969)	0.244	(0.264)
Health Status						
Obesity	24.843	(3.517)	24.261	(3.533)	25.191	(3.462)
Proportion - Smoke Daily	15.362	(3.477)	13.654	(3.280)	16.384	(3.178)
Proportion - Drink Heavily	5.170	(1.077)	5.235	(0.968)	5.131	(1.135)
Child Death Rate	2.045	(0.487)	1.977	(0.363)	2.087	(0.545)
Health Care Access and Supply						
Proportion - Emp Ins	0.535	(0.053)	0.522	(0.050)	0.543	(0.054)
Proportion - Priv Ins	0.090	(0.022)	0.096	(0.026)	0.087	(0.019)
Proportion - Medicaid	0.117	(0.030)	0.116	(0.029)	0.117	(0.030)
Proportion - Medicare	0.124	(0.018)	0.114	(0.016)	0.129	(0.016)
State ED Market	4.360	(3.175)	5.799	(3.967)	3.499	(2.172)
Number of Teaching Hospitals	16.876	(14.405)	20.142	(13.419)	15.083	(14.611)
Political and economic environment						
Senator Mean	0.529	(0.365)	0.436	(0.374)	0.585	(0.347)
Senator Deviation	0.223	(0.272)	0.198	(0.232)	0.238	(0.292)
Number of Democratic Senators	1.038	(0.870)	0.792	(0.900)	1.185	(0.817)
Gov_demo	0.423	(0.494)	0.279	(0.449)	0.509	(0.500)
Gov_ind	0.008	(0.091)	0.017	(0.130)	0.003	(0.054)
Median Income	41.693	(6.400)	42.607	(5.607)	41.147	(6.772)
Proportion - Inpatient Days - Medicare	0.449	(0.240)	0.447	(0.249)	0.451	(0.234)
Proportion - Inpatient Days - Medicaid	0.179	(0.178)	0.175	(0.176)	0.182	(0.179)
Unemployment Rate	0.062	(0.020)	0.061	(0.018)	0.062	(0.021)
GDP	0.395	(0.369)	0.591	(0.483)	0.278	(0.202)
Instrumental Variables						
GINI	228.250	(75.837)	224.834	(77.172)	230.294	(74.955)
Tech Index	55.469	(13.638)	61.840	(10.844)	51.657	(13.715)

Table 2: Effect of CON Indicator on Inpatient utilization

	CON Law as Exogenous										
	Cross Sectional			Random Effect			Fixed Effect			Hausman T	
Variables	**Coef.**	**Std. Error**	**Test Stat**	**Coef.**	**Std. Error**	**Test Stat**	**Coef.**	**Std. Error**	**Test Stat**	**Coef.**	**Std. Error**
CON Indicator	-0.027	(0.005)	-5.07***	-0.023	(0.007)	-3.12***	0	(omitted)		-0.200	(0.092
Full Time Physicians and Dentists	-0.00004	(0.00003)	-1.44	-0.00002	(0.00003)	-0.78	0.00001	(0.00005)	0.13	0.00005	(0.0000
Full Time Nurses	0.0001	(0.00001)	17.36***	0.0001	(0.00001)	12.38***	0.00002	(0.00002)	0.91	0.00003	(0.0000
Member of Council of Teaching	-0.0004	(0.008)	-0.05	0.013	(0.010)	1.27	0.002	(0.022)	0.10	0.020	(0.020
Resident Training Approval	0.018	(0.005)	3.67***	0.022	(0.006)	3.71***	-0.003	(0.010)	-0.33	0.002	(0.009
JCAHO Accreditation	0.089	(0.004)	24.40***	0.058	(0.004)	13.37***	-0.011	(0.007)	-1.61	-0.010	(0.006
Not For Profit	-0.004	(0.003)	-1.13	-0.002	(0.004)	-0.38	0.009	(0.011)	0.87	0.012	(0.010
Government Ownership	-0.184	(0.009)	-19.46***	-0.164	(0.013)	-12.52***	-0.108	(0.068)	-1.59	-0.012	(0.057
Population Size	-0.007	(0.003)	-2.13**	-0.008	(0.003)	-2.45**	-0.029	(0.008)	-3.75***	-0.034	(0.007
Proportion - Female	2.036	(0.764)	2.67***	2.754	(0.958)	2.87***	14.621	(4.848)	3.02***	16.720	(4.570
Proportion (age 0-17)	-2.365	(0.350)	-6.77***	-2.310	(0.394)	-5.86***	-1.825	(1.411)	-1.29	-1.322	(1.335
Proportion (18-44)	-1.039	(0.308)	-3.37***	-0.443	(0.346)	-1.28	1.445	(1.429)	1.01	1.668	(1.360
Proportion (45-64)	-0.681	(0.393)	-1.73*	-0.249	(0.445)	-0.56	0.789	(1.511)	0.52	1.025	(1.438
Proportion - Black	0.206	(0.039)	5.22***	0.176	(0.049)	3.58***	1.110	(0.780)	1.42	0.391	(0.707
Proportion - Asian	0.032	(0.298)	0.11	0.462	(0.334)	1.38	2.621	(1.721)	1.52	3.233	(1.629

Proportion - Amer Indian	-0.164	(0.151)	-1.09	-0.056	(0.211)	-0.26	-6.904	(4.511)	-1.53	-4.387	(4.223
Proportion - Pacific	4.803	(2.630)	1.83*	7.145	(3.460)	2.07**	53.572	(45.069)	1.19	53.390	(42.940
Proportion - Oth Race	-0.206	(0.522)	-0.39	-0.745	(0.715)	-1.04	0.245	(6.953)	0.04	2.929	(6.569
Proportion - Emp Ins	-0.145	(0.110)	-1.33	-0.119	(0.108)	-1.10	-0.216	(0.155)	-1.39	-0.193	(0.148
Proportion - Priv Ins	-0.714	(0.122)	-5.83***	-0.518	(0.129)	-4.02***	-0.333	(0.214)	-1.56	-0.325	(0.204
Proportion - Medicaid	-0.313	(0.131)	-2.39**	-0.215	(0.127)	-1.70*	-0.102	(0.179)	-0.57	-0.049	(0.170
Proportion - Medicare	-0.358	(0.258)	-1.39	-0.315	(0.224)	-1.41	-0.427	(0.252)	-1.69*	-0.405	(0.240
Obesity	-0.0003	(0.001)	-0.39	-0.001	(0.001)	-0.84	0.000	(0.001)	0.17	0.0001	(0.001
Proportion - Smoke Daily	0.001	(0.001)	1.48	0.0005	(0.001)	0.49	0.000	(0.002)	0.11	0.0004	(0.002
Proportion - Drink Heavily	0.002	(0.002)	1.25	0.002	(0.002)	0.88	0.000	(0.002)	0.10	-0.0003	(0.002
Child Death Rate	-0.009	(0.005)	-1.74*	0.001	(0.0005)	2.47**	0.002	(0.005)	0.42	0.003	(0.005
Number of Teaching Hospitals	0.002	(0.0004)	3.91***	-0.001	(0.004)	-0.29	0	(omitted)		0.001	(0.003
Illegal Immigrant	0.069	(0.021)	3.27***	0.056	(0.020)	2.75***	0.013	(0.034)	0.38	0.003	(0.032
State ED Market	-0.012	(0.006)	-2.08**	-0.002	(0.006)	-0.29	0.019	(0.010)	1.97**	0.021	(0.009
Senator Mean	0.037	(0.017)	2.12**	0.036	(0.016)	2.25**	0.028	(0.019)	1.48	0.027	(0.018
Senator Deviation	-0.007	(0.006)	-1.09	-0.004	(0.006)	-0.70	0.007	(0.007)	0.97	0.007	(0.007
Number of Democratic Senators	-0.014	(0.006)	-2.12**	-0.014	(0.006)	-2.24**	-0.017	(0.007)	-2.30**	-0.016	(0.007
Gov_demo	-0.003	(0.004)	-0.95	-0.007	(0.003)	-2.10**	-0.005	(0.004)	-1.36	-0.006	(0.004
Gov_ind	-	(0.017)	-0.77	-0.006	(0.015)	-0.38	0.020	(0.016)	1.24	0.018	(0.016

	0.013									
Median Income	0.003	(0.001)	4.01***	-0.256	(0.009)	-28.14***	0.001	(0.001)	1.29	0.002	(0.001
Proportion - Inpatient Days - Medicare	-0.307	(0.008)	-39.69***	0.037	(0.011)	3.35***	-0.166	(0.014)	-12.15***	-0.167	(0.013
Proportion - Inpatient Days - Medicaid	0.047	(0.010)	4.72***	0.003	(0.001)	3.52***	0.009	(0.014)	0.62	0.009	(0.014
Unemployment Rate	-0.159	(0.120)	-1.32	-0.284	(0.105)	-2.70***	-0.260	(0.164)	-1.58	-0.241	(0.157
GDP	0.163	(0.081)	2.02**	0.116	(0.071)	1.63	0.288	(0.098)	2.93***	0.296	(0.094
Constant	0.856	(0.525)	1.63	0.115	(0.640)	0.18	-6.984	(3.258)	-2.14	-8.202	(3.049
N	22963			22963			22963			22963	

* indicates statistical significance at the 10% level
** indicates statistical significance at the 5% level
*** indicates statistical significance at the 1% level

Table 3: Effect of CON Indicator on Inpatient utilization

	CON Law as Endogenous		
	Cross Sectional	**Random Effect**	**Hausman Taylor**

Variables	Coef.	Std. Error	Test Stat	Coef.	Std. Error	Test Stat	Coef.	Std. Error	Test Stat
CON Indicator	-0.025	(0.012)	-2.08**	-0.038	(0.022)	-1.78*	0.531	(0.323)	1.64
Full Time Physicians and Dentists	-0.00004	(0.00003)	-1.44	-0.00002	(0.00003)	-0.78	0.00001	(0.00004)	0.13
Full Time Nurses	0.0001	(0.00001)	17.37***	0.0001	(0.00001)	12.40***	0.00002	(0.00002)	0.94
Member of Council of Teaching	-0.0004	(0.008)	-0.05	0.013	(0.010)	1.26	0.002	(0.021)	0.10
Resident Training Approval	0.018	(0.005)	3.67***	0.022	(0.006)	3.72***	-0.003	(0.010)	-0.34
JCAHO Accreditation	0.089	(0.004)	24.36***	0.059	(0.004)	13.47***	-0.011	(0.007)	-1.66*
Not For Profit	-0.004	(0.003)	-1.15	-0.001	(0.004)	-0.28	0.009	(0.010)	0.89
Government Ownership	-0.184	(0.009)	-19.48***	-0.164	(0.013)	-12.56***	-0.108	(0.066)	-1.64
Population Size	-0.007	(0.004)	-1.85*	-0.009	(0.004)	-2.51**	-0.029	(0.008)	-3.85***
Proportion - Female	2.015	(0.775)	2.60***	2.981	(1.006)	2.96***	14.621	(4.714)	3.10***
Proportion (age 0-17)	-2.345	(0.373)	-6.29***	-2.465	(0.445)	-5.54***	-1.825	(1.372)	-1.33
Proportion (18-44)	-1.032	(0.311)	-3.32***	-0.473	(0.347)	-1.36	1.445	(1.390)	1.04
Proportion (45-64)	-0.665	(0.406)	-1.64	-0.346	(0.462)	-0.75	0.789	(1.470)	0.54
Proportion - Black	0.203	(0.044)	4.56***	0.202	(0.060)	3.37***	1.110	(0.758)	1.46
Proportion - Asian	0.033	(0.298)	0.11	0.472	(0.334)	1.41	2.621	(1.674)	1.57
Proportion - Amer Indian	-0.153	(0.168)	-0.91	-0.159	(0.251)	-0.64	-6.904	(4.387)	-1.57
Proportion - Pacific	4.774	(2.635)	1.81*	7.363	(3.464)	2.13**	53.572	(43.832)	1.22
Proportion - Oth Race	-0.256	(0.617)	-0.42	-0.323	(0.903)	-0.36	0.245	(6.762)	0.04
Proportion - Emp Ins	-0.149	(0.112)	-1.33	-0.107	(0.109)	-0.98	-0.216	(0.151)	-1.43
Proportion - Priv Ins	-0.709	(0.126)	-5.61***	-0.564	(0.142)	-3.98***	-0.333	(0.208)	-1.60
Proportion - Medicaid	-0.317	(0.134)	-2.37***	-0.206	(0.127)	-1.62	-0.102	(0.174)	-0.58
Proportion - Medicare	-0.356	(0.258)	-1.38	-0.318	(0.224)	-1.42	-0.427	(0.245)	-1.74*
Obesity	0.000	(0.001)	-0.38	-0.001	(0.001)	-0.90	0.0001	(0.001)	0.18
Proportion - Smoke Daily	0.001	(0.001)	1.38	0.001	(0.001)	0.71	0.0002	(0.002)	0.11
Proportion - Drink Heavily	0.002	(0.002)	1.20	0.002	(0.002)	1.01	0.0002	(0.002)	0.11
Child Death Rate	-0.009	(0.005)	-1.72*	-0.001	(0.004)	-0.33	0.002	(0.005)	0.43
Number of Teaching Hospitals	0.002	(0.0004)	3.91***	0.001	(0.0005)	2.31**	0.003	(0.003)	1.03

Illegal Immigrant	0.068	(0.022)	3.11***	0.059	(0.021)	2.85***	0.013	(0.033)	0.39
State ED Market	-0.012	(0.006)	-2.01**	0.000	(0.006)	-0.02	0.019	(0.010)	2.02**
Senator Mean	0.037	(0.017)	2.12**	0.037	(0.016)	2.30**	0.028	(0.019)	1.52
Senator Deviation	-0.007	(0.006)	-1.10	-0.003	(0.006)	-0.56	0.007	(0.007)	1.00
Number of Democratic Senators	-0.014	(0.007)	-2.12**	-0.013	(0.006)	-2.07**	-0.017	(0.007)	-2.36**
Gov_demo	-0.003	(0.004)	-0.95	-0.007	(0.003)	-2.17**	-0.005	(0.004)	-1.40
Gov_ind	-0.013	(0.018)	-0.73	-0.008	(0.015)	-0.53	0.020	(0.016)	1.27
Median Income	0.003	(0.001)	3.99***	0.003	(0.001)	3.32***	0.001	(0.001)	1.32
Proportion - Inpatient Days - Medicare	-0.307	(0.008)	-39.72***	-0.256	(0.009)	-28.22***	-0.166	(0.013)	-12.50***
Proportion - Inpatient Days - Medicaid	0.047	(0.010)	4.72***	0.037	(0.011)	3.38***	0.009	(0.014)	0.63
Unemployment Rate	-0.158	(0.121)	-1.31	-0.296	(0.107)	-2.78***	-0.260	(0.160)	-1.62
GDP	0.161	(0.081)	1.98**	0.125	(0.072)	1.73*	0.288	(0.096)	3.01***
Constant	0.856	(0.524)	1.63	0.075	(0.642)	0.12	-7.378	(3.127)	-2.36**
N	22963			22963			22963		

* indicates statistical significance at the 10% level
** indicates statistical significance at the 5% level
*** indicates statistical significance at the 1% level

Table 4: Effects of CON Indicator and its stringency on Inpatient utilization

	CON Law and Stringency as Exogenous										
	Cross Sectional			Random Effect			Fixed Effect			Hausman	
Variables	Coef.	Std. Error	Test Stat	Coef.	Std. Error	Test Stat	Coef.	Std. Error	Test Stat	Coef.	Std. Error
CON Indicator	-0.028	(0.006)	-4.55***	-0.025	(0.008)	-3.09***	0	(omitted)		-0.218	(0.09
CON Stringency - Service	-0.003	(0.005)	-0.52	-0.001	(0.005)	-0.25	0.001	(0.008)	0.09	-0.002	(0.00
Full Time Physicians and Dentists	-0.00004	(0.00003)	-1.34	-0.00003	(0.00003)	-0.89	-0.00001	(0.0001)	-0.23	-0.00001	(0.0000
Full Time Nurses	0.0001	(0.00001)	17.07***	0.0001	(0.00001)	12.22***	0.00002	(0.00002)	0.86	0.00002	(0.0000
Member of Council of Teaching	0.0002	(0.008)	0.02	0.013	(0.011)	1.23	0.003	(0.022)	0.13	0.003	(0.02
Resident Training Approval	0.013	(0.005)	2.66***	0.019	(0.006)	3.05***	-0.002	(0.010)	-0.17	-0.002	(0.01
JCAHO Accreditation	0.088	(0.004)	23.41***	0.058	(0.004)	13.01***	-0.011	(0.007)	-1.52	-0.011	(0.00
Not For Profit	-0.004	(0.003)	-1.11	-0.002	(0.005)	-0.39	0.009	(0.012)	0.80	0.009	(0.01
Government Ownership	-0.181	(0.010)	-18.52***	-0.163	(0.014)	-12.04***	-0.112	(0.089)	-1.26	-0.115	(0.08
Population Size	-0.007	(0.003)	-1.89*	-0.008	(0.003)	-2.38**	-0.030	(0.008)	-3.70***	-0.026	(0.00
Proportion - Female	1.331	(0.789)	1.69*	1.965	(0.995)	1.98**	14.455	(5.159)	2.80***	12.100	(4.80
Proportion (age 0-17)	-2.176	(0.366)	-5.94***	-2.280	(0.403)	-5.66***	-1.856	(1.438)	-1.29	-1.894	(1.42
Proportion (18-44)	-0.760	(0.321)	-2.37**	-0.405	(0.355)	-1.14	1.445	(1.550)	0.93	1.033	(1.50
Proportion (45-64)	-0.192	(0.425)	-0.45	-0.002	(0.464)	0.00	0.785	(1.553)	0.51	0.757	(1.53
Proportion - Black	0.195	(0.040)	4.86***	0.178	(0.050)	3.59***	1.064	(0.797)	1.33	0.622	(0.72
Proportion - Asian	0.576	(0.329)	1.75*	0.844	(0.360)	2.34**	2.488	(1.769)	1.41	1.112	(1.43
Proportion - Amer Indian	-0.258	(0.154)	-1.68*	-0.160	(0.214)	-0.75	-7.081	(4.612)	-1.54	-9.887	(4.08
Proportion - Pacific	9.619	(2.892)	3.33***	12.696	(3.868)	3.28***	57.748	(51.183)	1.13	84.054	(46.87
Proportion - Oth Race	-3.720	(0.949)	-3.92***	-4.189	(1.260)	-3.32***	0.289	(8.353)	0.03	-3.339	(7.82
Proportion - Emp Ins	-0.162	(0.111)	-1.46	-0.128	(0.111)	-1.15	-0.178	(0.169)	-1.05	-0.123	(0.16
Proportion - Priv Ins	-0.606	(0.135)	-4.51***	-0.479	(0.137)	-3.50***	-0.286	(0.229)	-1.25	-0.239	(0.22

Proportion - Medicaid	-0.260	(0.138)	-1.88*	-0.185	(0.135)	-1.37	-0.016	(0.200)	-0.08	0.005	(0.19
Proportion - Medicare	-0.227	(0.267)	-0.85	-0.282	(0.232)	-1.22	-0.452	(0.267)	-1.70*	-0.423	(0.26
Obesity	-0.001	(0.001)	-0.92	-0.001	(0.001)	-1.04	0.0001	(0.001)	0.17	0.0001	(0.00
Proportion - Smoke Daily	0.001	(0.001)	1.36	0.001	(0.001)	0.66	0.001	(0.002)	0.28	0.001	(0.00
Proportion - Drink Heavily	0.002	(0.002)	1.07	0.001	(0.002)	0.74	-0.00001	(0.002)	-0.01	0.0003	(0.00
Child Death Rate	-0.008	(0.005)	-1.54	-0.002	(0.005)	-0.38	0.002	(0.005)	0.37	0.001	(0.00
Number of Teaching Hospitals	0.001	(0.0004)	3.40***	0.001	(0.0005)	2.17**	0	(omitted)		-0.0001	(0.00
Illegal Immigrant	0.060	(0.022)	2.76***	-0.0001	(0.006)	-0.03	0.014	(0.035)	0.40	0.030	(0.03
State ED Market	-0.008	(0.006)	-1.31	0.049	(0.021)	2.30**	0.019	(0.010)	1.92*	0.020	(0.01
Senator Mean	0.043	(0.018)	2.41**	0.040	(0.017)	2.43**	0.028	(0.020)	1.39	0.032	(0.01
Senator Deviation	-0.008	(0.006)	-1.24	-0.005	(0.006)	-0.77	0.007	(0.007)	1.02	0.006	(0.00
Number of Democratic Senators	-0.015	(0.007)	-2.22**	-0.015	(0.006)	-2.32**	-0.017	(0.008)	-2.24**	-0.017	(0.00
Gov_demo	-0.006	(0.004)	-1.49	-0.008	(0.003)	-2.51**	-0.006	(0.004)	-1.51	-0.007	(0.00
Gov_ind	-0.020	(0.018)	-1.12	-0.008	(0.015)	-0.51	0.021	(0.017)	1.23	0.019	(0.01
Median Income	0.003	(0.001)	3.93***	0.003	(0.001)	3.58***	0.001	(0.001)	1.23	0.001	(0.00
Proportion - Inpatient Days - Medicare	-0.305	(0.008)	-38.07***	-0.258	(0.009)	-27.37***	-0.173	(0.014)	-11.98***	-0.173	(0.01
Proportion - Inpatient Days - Medicaid	0.049	(0.010)	4.88***	0.039	(0.011)	3.46***	0.010	(0.015)	0.70	0.010	(0.01
Unemployment Rate	-0.152	(0.124)	-1.23	-0.263	(0.109)	-2.43**	-0.240	(0.171)	-1.40	-0.261	(0.16
GDP	0.104	(0.083)	1.26	0.100	(0.073)	1.38	0.290	(0.101)	2.86***	0.259	(0.09
Constant	0.957	(0.533)	1.79	0.458	(0.655)	0.70	-6.921	(3.446)	-2.01	-5.330	(3.21
N	21764			21764			21764			21764	

* indicates statistical significance at the 10% level
** indicates statistical significance at the 5% level
*** indicates statistical significance at the 1% level

Table 5: Effects of CON Indicator and its stringency on Inpatient utilization

	CON Stringency as Endogenous											
	Cross Sectional			Random Effect			Fixed Effect			Hausman Taylor		
Variables	**Coef.**	**Std. Error**	**Test Stat**	**Coef.**	**Std. Error**	**Test Stat**	**Coef.**	**Std. Error**	**Test Stat**	**Coef.**	**Std. Error**	**Test Stat**
CON Indicator	-0.016	(0.012)	-1.34	-0.015	(0.013)	-1.19				-0.210	(0.098)	-2.14**
CON Stringency - Service	-0.044	(0.036)	-1.22	-0.030	(0.029)	-1.05	-0.003	(0.033)	-0.10	-0.001	(0.008)	-0.08
Full Time Physicians and Dentists	-0.00004	(0.00003)	-1.35	-0.00003	(0.00003)	-0.91	-0.00001	(0.00001)	-0.23	0.00003	(0.00005)	0.69
Full Time Nurses	0.0001	(0.00001)	16.83***	0.0001	(0.00001)	12.15***	0.00002	(0.00002)	0.87	0.00003	(0.00002)	1.63
Member of Council of Teaching	0.001	(0.008)	0.16	0.014	(0.011)	1.28	0.003	(0.022)	0.13	0.018	(0.021)	0.89
Resident Training Approval	0.013	(0.005)	2.64***	0.019	(0.006)	3.05***	-0.002	(0.010)	-0.18	0.003	(0.010)	0.32
JCAHO Accreditation	0.088	(0.004)	23.42***	0.059	(0.004)	13.08***	-0.011	(0.007)	-1.52	-0.010	(0.007)	-1.48
Not For Profit	-0.003	(0.003)	-0.98	-0.002	(0.005)	-0.38	0.009	(0.012)	0.80	0.012	(0.011)	1.07
Government	-0.182	(0.010)	-	-0.164	(0.014)	-	-0.112	(0.089)	-1.26	0.021	(0.072)	0.30

Ownership			18.57***			12.10***						
Population Size	-0.008	(0.004)	-2.23**	-0.007	(0.003)	-2.23**	-0.029	(0.009)	-3.42***	-0.034	(0.008)	-4.55***
Proportion - Female	0.439	(1.063)	0.41	1.383	(1.130)	1.22	14.568	(5.349)	2.72**	17.050	(4.888)	3.49**
Proportion (age 0-17)	-1.706	(0.507)	-3.36***	-2.161	(0.414)	-5.22***	-1.829	(1.472)	-1.24	-1.496	(1.380)	-1.08
Proportion (18-44)	-0.725	(0.322)	-2.25**	-0.416	(0.355)	-1.17	1.535	(1.943)	0.79	1.723	(1.490)	1.16
Proportion (45-64)	0.272	(0.545)	0.50	0.173	(0.487)	0.36	0.867	(1.854)	0.47	0.891	(1.496)	0.60
Proportion - Black	0.186	(0.041)	4.58***	0.176	(0.050)	3.54***	1.092	(0.874)	1.25	0.398	(0.733)	0.54
Proportion - Asian	1.000	(0.471)	2.12**	0.946	(0.374)	2.53**	2.464	(1.794)	1.37	3.173	(1.688)	1.88*
Proportion - Amer Indian	-0.185	(0.164)	-1.13	-0.120	(0.217)	-0.56	-7.181	(4.757)	-1.51	-3.900	(4.305)	-0.91
Proportion - Pacific	11.741	(3.281)	3.58***	14.056	(4.037)	3.48***	57.731	(51.122)	1.13	45.817	(49.132)	0.93
Proportion - Oth Race	-4.831	(1.285)	-3.76***	-4.799	(1.377)	-3.49***	0.272	(8.336)	0.03	4.941	(7.885)	0.63
Proportion - Emp Ins	-0.151	(0.112)	-1.36	-0.179	(0.120)	-1.49	-0.187	(0.209)	-0.89	-0.153	(0.162)	-0.95
Proportion - Priv Ins	-0.441	(0.179)	-2.47**	-0.433	(0.141)	-3.07***	-0.290	(0.231)	-1.26	-0.285	(0.220)	-1.29
Proportion - Medicaid	-0.218	(0.142)	-1.54	-0.215	(0.137)	-1.56	-0.025	(0.236)	-0.11	0.036	(0.192)	0.19
Proportion -	0.003	(0.322)	0.01	-0.239	(0.236)	-1.01	-0.456	(0.273)	-1.67*	-0.445	(0.257)	-1.73*

Medicare Obesity	-0.001	(0.001)	-1.43	-0.001	(0.001)	-1.24	0.0002	(0.001)	0.18	0.0001	(0.001)	0.12
Proportion - Smoke Daily	0.003	(0.002)	1.88*	0.001	(0.001)	1.19	0.001	(0.002)	0.29	0.001	(0.002)	0.42
Proportion - Drink Heavily	0.004	(0.003)	1.72*	0.002	(0.002)	1.05	-0.00002	(0.002)	-0.01	-0.001	(0.002)	-0.25
Child Death Rate	-0.007	(0.005)	-1.29	-0.001	(0.005)	-0.17	0.002	(0.005)	0.36	0.002	(0.005)	0.50
Number of Teaching Hospitals	0.001	(0.001)	1.01	0.001	(0.001)	1.25				0.002	(0.003)	0.72
Illegal Immigrant	0.037	(0.029)	1.29	0.031	(0.026)	1.18	0.013	(0.036)	0.37	0.004	(0.033)	0.11
State ED Market	0.002	(0.010)	0.22	0.002	(0.006)	0.33	0.019	(0.010)	1.92*	0.021	(0.010)	2.21**
Senator Mean	0.034	(0.019)	1.79*	0.040	(0.017)	2.42**	0.028	(0.020)	1.39	0.025	(0.019)	1.30
Senator Deviation	-0.009	(0.007)	-1.45	-0.005	(0.006)	-0.89	0.007	(0.007)	0.97	0.008	(0.007)	1.20
Number of Democratic Senators	-0.011	(0.007)	-1.58	-0.015	(0.006)	-2.42**	-0.017	(0.008)	-2.21**	-0.016	(0.007)	-2.23**
Gov_demo	-0.012	(0.006)	-1.93*	-0.010	(0.004)	-2.72***	-0.006	(0.004)	-1.51	-0.007	(0.004)	-1.62
Gov_ind	-0.025	(0.018)	-1.38	-0.009	(0.015)	-0.60	0.021	(0.017)	1.24	0.018	(0.016)	1.11
Median Income	0.003	(0.001)	3.73***	0.003	(0.001)	3.75***	0.001	(0.001)	1.17	0.001	(0.001)	1.32
Proportion - Inpatient Days - Medicare	-0.307	(0.008)	-37.82***	-0.259	(0.009)	-27.44***	-0.173	(0.014)	-11.99***	-0.173	(0.014)	-12.45***
Proportion - Inpatient Days - Medicaid	0.048	(0.010)	4.75***	0.039	(0.011)	3.43***	0.010	(0.015)	0.70	0.010	(0.014)	0.72

Unemployment Rate	-0.278	(0.158)	-1.75*	-0.291	(0.112)	-2.60***	-0.234	(0.183)	-1.28	-0.230	(0.165)	-1.40
GDP	0.111	(0.083)	1.34	0.110	(0.073)	1.50	0.292	(0.104)	2.82***	0.300	(0.098)	3.07***
Constant	1.095	(0.547)	2.00	0.686	(0.689)	1.00				-8.370	(3.243)	-2.58
N	21764			21764			21764			21764		

* indicates statistical significance at the 10% level
** indicates statistical significance at the 5% level
*** indicates statistical significance at the 1% level

Table 6: Effects of CON Indicator and its stringency on Inpatient LOS

	CON Law and Stringency as exogenous								
	Cross Sectional			Random Effect			Hausman Taylor		
Variables	**Coef.**	**Std. Error**	**Test Stat**	**Coef.**	**Std. Error**	**Test Stat**	**Coef.**	**Std. Error**	**Test Stat**
CON Indicator	-0.598	(2.484)	-0.24	-0.647	(2.563)	-0.25	-352.174	(198.490)	-1.77*
CON Stringency - Service	-4.430	(2.227)	-1.99**	-3.741	(2.265)	-1.65*	5.040	(8.606)	0.59
Full Time Physicians and Dentists	0.019	(0.019)	1.01	0.019	(0.019)	0.97	0.014	(0.063)	0.22
Full Time Nurses	-0.003	(0.004)	-0.72	-0.003	(0.004)	-0.71	-0.008	(0.024)	-0.33
Member of Council of Teaching	-5.132	(3.740)	-1.37	-4.812	(3.860)	-1.25	3.488	(22.129)	0.16
Resident Training Approval	-1.014	(2.203)	-0.46	-0.988	(2.275)	-0.43	2.195	(11.155)	0.20
JCAHO Accreditation	2.821	(1.815)	1.55	2.903	(1.863)	1.56	7.642	(7.224)	1.06
Not For Profit	-4.533	(1.563)	-2.90***	-4.503	(1.628)	-2.77***	1.136	(11.916)	0.10
Government Ownership	-28.673	(4.414)	-6.50***	-26.962	(4.553)	-5.92***	8538.173	(14745.080)	0.58
Population Size	2.560	(1.151)	2.22**	2.190	(1.144)	1.91*	7.341	(5.880)	1.25
Proportion - Female	1643.176	(358.770)	4.58***	1512.419	(367.788)	4.11***	-2042.432	(3680.587)	-0.55
Proportion (age 0-17)	4.879	(157.175)	0.03	14.404	(159.233)	0.09	-2307.086	(969.887)	-2.38**
Proportion (18-44)	-29.959	(137.803)	-0.22	-29.335	(140.330)	-0.21	1184.213	(1179.199)	1.00
Proportion (45-64)	99.716	(167.818)	0.59	110.956	(171.135)	0.65	-313.390	(1003.778)	-0.31
Proportion - Black	-50.071	(16.526)	-3.03***	-45.293	(16.992)	-2.67***	1874.862	(810.805)	2.31**
Proportion - Asian	-47.724	(118.445)	-0.40	-65.566	(121.691)	-0.54	-3999.068	(1817.364)	-2.20**
Proportion - Amer Indian	293.274	(55.120)	5.32***	266.567	(57.229)	4.66***	-25157.630	(4864.013)	-5.17***
Proportion - Pacific	1839.159	(613.148)	3.00***	1749.532	(634.577)	2.76***	-81004.590	(31775.800)	-2.55**
Proportion - Oth Race	-799.957	(365.725)	-2.19**	-721.980	(380.186)	-1.90*	22664.270	(5909.519)	3.84***
Proportion - Emp Ins	-167.681	(51.632)	-3.25***	-152.505	(51.706)	-2.95***	-135.674	(177.827)	-0.76
Proportion - Priv Ins	-367.656	(60.889)	-6.04***	-326.543	(60.915)	-5.36***	-33.300	(212.861)	-0.16
Proportion - Medicaid	-139.193	(58.999)	-2.36**	-118.809	(59.253)	-2.01**	-97.808	(211.124)	-0.46

Proportion - Medicare	-170.360	(110.995)	-1.53	-141.525	(109.432)	-1.29	-133.699	(246.130)	-0.54
Obesity	0.206	(0.295)	0.70	0.210	(0.293)	0.72	0.212	(0.778)	0.27
Proportion - Smoke Daily	-0.786	(0.401)	-1.96**	-0.718	(0.402)	-1.79*	0.536	(1.733)	0.31
Proportion - Drink Heavily	0.589	(0.764)	0.77	0.473	(0.767)	0.62	-0.224	(2.284)	-0.10
Child Death Rate	-2.751	(1.991)	-1.38	-2.454	(1.951)	-1.26	-1.689	(4.421)	-0.38
Senator Mean	-2.466	(7.515)	-0.33	-1.948	(7.547)	-0.26	11.397	(20.685)	0.55
Senator Deviation	-6.510	(2.741)	-2.38**	-6.983	(2.721)	-2.57**	-14.715	(6.328)	-2.33**
Number of Democratic Senators	0.048	(2.851)	0.02	0.064	(2.864)	0.02	-5.050	(8.148)	-0.62
Gov_demo	4.824	(1.545)	3.12***	4.335	(1.529)	2.83***	-1.673	(3.796)	-0.44
Gov_ind	-3.991	(6.316)	-0.63	-4.716	(6.161)	-0.77	-7.972	(13.597)	-0.59
Illegal Immigrant	-10.290	(7.789)	-1.32	-7.967	(7.809)	-1.02	-3.759	(34.381)	-0.11
Median Income	0.644	(0.315)	2.05**	0.697	(0.314)	2.22**	1.500	(1.089)	1.38
State ED Market	-6.824	(2.272)	-3.00***	-5.940	(2.260)	-2.63***	-6.608	(9.346)	-0.71
Proportion - Inpatient Days - Medicare	-47.045	(4.429)	-10.62***	-44.401	(4.512)	-9.84***	-8.556	(15.723)	-0.54
Proportion - Inpatient Days - Medicaid	-33.167	(3.799)	-8.73***	-30.980	(3.841)	-8.07***	-3.838	(10.259)	-0.37
Constant	-644.118	(254.947)	-2.53**	-607.867	(261.232)	-2.33**	1028.359	(2384.377)	0.43
N	4452			4452			4452		

APPENDIX

Table A.1: Variable description and data source

No	Variables	Detail Level	Type	Data source
1	Inpatient Days	Hospital	Dependent	www.aha.org
2	Hospital variables such as type of hospital (not for profit, government ownership, etc.), number of full time physicians and nurses, etc.	Hospital	Independent	www.aha.org
3	Extent of Con - stringent, None etc.	State	Independent	Hellinger (2009) see reference section for more details
4	CON Law characteristics	State	Independent	http://www.ahpanet.org/websites_copn.html
5	Age distribution	State	Independent	http://www.census.gov/popest/estbygeo.html
6	Race Distribution	State	Independent	http://factfinder.census.gov/servlet/DatasetMainPageServlet?_program=PEP
7	Population	County	Independent	http://www.census.gov/popest/data/
8	Illegal immigrant	State	Independent	http://immigrationroad.com/resource/illegal-immigrants-by-state.php
9	% of uninsured, medicaid, medicare patients in state	State	Independent	http://www.statehealthfacts.org/profileind.jsp?cmprgn=1&cat=3&rgn=12&ind=125&sub=39
10	Percentage of obese population	State	Independent	www.cdc.gov
11	Percentage of population that smoke daily	State	Independent	www.cdc.gov
12	Percentage of population that drink heavily	State	Independent	www.cdc.gov
13	Child death rate	State	Independent	www.cdc.gov
14	ED patient market	State	Independent	http://kff.org/other/state-indicator/emergency-room-visits/

15	Inpatient days covered by Medicare and Medicaid	State	Independent	www.aha.org
16	Median Income	State	Independent	http://www.bea.gov/regional/gsp/
17	GDP	State	Independent	http://www.bea.gov/regional/gsp/
18	Senators State Voting Record	State	Independent	http://www.adaaction.org/
19	Party in Power	State	Independent	http://www.nga.org/cms/home/governors/past-governors-bios.html;jsessionid=567B4C3B27E3CF6210B93BC608D3FED5
20	GINI coefficient	State	Instrumental	www.census.gov
21	Technology index	State	Instrumental	http://www.milkeninstitute.org/tech/tech2010.taf?sub=tswf

Table A.2: Variable categorization and description

Variable name	Variable Description
Outcome Variable	
Inpatient Utilization	Measure built using Inpatient days and beds in a hospital
Inpatient LOS	Measure built using Inpatient days and Inpatient discharges from a hospital
Independent Variables	
CON Law	
CON Indicator	Dummy variable for con law coverage
Stringency Index - Service	Index of strictness of con threshold on service, can take values between 0 and 1
Hospital Characteristics	
Full Time Physicians and Dentists	Number of full time physicians and dentists in a hospital
Full Time Nurses	Number of full time nurses in a hospital
Member of Council of Teaching	Dummy variable – whether hospital is a member of council of teaching
Resident Training Approval	Dummy variable – whether hospital has approval for resident training
JCAHO Accreditation	Dummy variable – whether hospital has Joint Commission of Healthcare Organizations Accreditation (JCAHO)
Not For Profit	Dummy variable – whether hospital is not for profit

Government Ownership	Dummy variable – whether hospital has government ownership
Demographics	
Population Size	Population size (millions)
Proportion - Female	Proportion of female
Proportion (age 0-17)	Proportion of people aged 17 or under
Proportion (18-44)	Proportion of people aged between 18 and 44
Proportion (45-64)	Proportion of people aged between 45 and 64
Proportion - Black	Proportion of population that is Black
Proportion - Asian	Proportion of population that is Asian
Proportion - Amer Indian	Proportion of population that is American Indian
Proportion - Pacific	Proportion of population that is Pacific Islander
Proportion - Oth Race	Proportion of population that belongs to two or more races
Illegal Immigrant	Illegal immigrants (millions)
Health Status	
Obesity	Proportion of population that is obese
Proportion - Smoke Daily	Proportion of population that smoke daily
Proportion - Drink Heavily	Proportion of population that drink heavily

Child Death Rate	Death rate of children 5 and under

Health Care Access and Supply

Proportion - Emp Ins	Proportion of individuals with employer provided insurance
Proportion - Priv Ins	Proportion of individuals with privately purchased insurance
Proportion - Medicaid	Proportion of individuals with Medicaid
Proportion - Medicare	Proportion of individuals with Medicare
Proportion of Population – ED Services	Proportion of State population that has availed Emergency Department Services
TeachHosp_Num	Number of Teaching Hospitals

Economic and Political Environment

Median Income	Median Income
GDP	State gross domestic product
Senator Mean	Mean of "yes" votes of the state senators
Senator Deviation	Absolute deviation in the voting record of the state senators
Gov_demo	Dummy variable of Democratic party governor
Gov_ind	Dummy variable of governor who is an Independent
Unemployment Rate	Self-explanatory
Proportion - Inpatient Days -	Proportion of Inpatientdays

Medicare	covered by Medicare
Proportion - Inpatient Days - Medicaid	Proportion of Inpatientdays covered by Medicaid
Instrumental Variables	
GINI	Gini Index (measure of Inequality)
Tech Index	Index of Science & Technology

Table A.3: First stage regression of CON Indicator on exogenous variables

	CON Law as Endogenous					
	Cross Sectional			Random Effect		
Variables	Coef.	Std. Error	Test Stat	Coef.	Std. Error	Test Stat
Full Time Physicians and Dentists	-0.00001	(0.00003)	-0.37	0.000003	(0.00003)	0.12
Full Time Nurses	0.00001	(0.00001)	1.46	-0.000001	(0.00001)	-0.11
Member of Council of Teaching	-0.008	(0.009)	-0.85	0.003	(0.009)	0.35
Resident Training Approval	-0.005	(0.005)	-0.95	0.004	(0.005)	0.84
JCAHO Accreditation	0.027	(0.004)	6.60***	0.025	(0.004)	6.79***
Not For Profit	0.027	(0.004)	7.35***	0.030	(0.004)	8.20***
Government Ownership	0.019	(0.011)	1.82*	0.011	(0.011)	1.01
Population Size	-0.086	(0.004)	-22.66***	-0.056	(0.003)	-20.22***
Proportion - Female	37.555	(0.929)	40.42***	30.547	(0.855)	35.73***
Proportion (age 0-17)	-12.324	(0.384)	-32.10***	-9.522	(0.325)	-29.31***
Proportion (18-44)	9.555	(0.402)	23.77***	6.743	(0.332)	20.28***
Proportion (45-64)	-1.851	(0.449)	-4.12***	-0.656	(0.388)	-1.69*
Proportion - Black	0.620	(0.046)	13.50***	0.918	(0.043)	21.43***
Proportion - Asian	-0.186	(0.337)	-0.55	2.115	(0.282)	7.49***
Proportion - Amer Indian	-5.087	(0.169)	-30.15***	-5.675	(0.175)	-32.35***
Proportion - Pacific	15.694	(2.944)	5.33***	15.523	(2.899)	5.36***
Proportion - Oth Race	31.668	(0.557)	56.85***	27.849	(0.575)	48.43***
Proportion - Emp Ins	2.286	(0.127)	17.99***	0.472	(0.093)	5.06***
Proportion - Priv Ins	-2.583	(0.140)	-18.39***	-2.654	(0.111)	-24.00***
Proportion - Medicaid	1.771	(0.149)	11.85***	0.015	(0.108)	0.14
Proportion - Medicare	-2.397	(0.288)	-8.33***	-1.051	(0.189)	-5.57***
Obesity	-0.002	(0.001)	-2.00**	-0.001	(0.001)	-1.18
Proportion - Smoke Daily	-0.034	(0.001)	-25.58***	-0.013	(0.001)	-13.61***
Proportion - Drink Heavily	0.042	(0.002)	22.36***	0.024	(0.001)	16.29***
Child Death Rate	-0.076	(0.006)	-13.48***	-0.030	(0.004)	-8.35***
Number of Teaching Hospitals	-0.008	(0.0005)	-17.70***	-0.006	(0.0004)	-14.03***
Illegal Immigrant	0.225	(0.024)	9.49***	0.021	(0.017)	1.23
State ED Market	0.147	(0.006)	23.34***	0.100	(0.005)	20.79***
Senator Mean	-0.220	(0.020)	-10.97***	-0.070	(0.014)	-5.00***
Senator Deviation	0.097	(0.007)	13.77***	0.051	(0.005)	10.40***

Number of Democratic Senators	0.156	(0.007)	21.49***	0.084	(0.005)	16.08***
Gov_demo	0.032	(0.004)	8.03***	-0.014	(0.003)	-5.30***
Gov_ind	-0.330	(0.019)	-17.02***	-0.173	(0.012)	-13.99***
Median Income	0.008	(0.001)	9.71***	0.003	(0.001)	4.59***
Proportion - Inpatient Days - Medicare	-0.013	(0.009)	-1.46	-0.011	(0.008)	-1.44
Proportion - Inpatient Days - Medicaid	0.020	(0.011)	1.79*	0.006	(0.009)	0.61
Unemployment Rate	0.474	(0.135)	3.51***	-0.515	(0.089)	-5.78***
GDP	0.367	(0.090)	4.09***	0.138	(0.060)	2.29**
Tech Index	-0.025	(0.0003)	-73.00***	-0.015	(0.0003)	-54.95***
GINI	0.0002	(0.0001)	3.76***	-0.0001	(0.00004)	-2.11**
Constant	-18.379	(0.639)	-28.78	-14.256	(0.578)	-24.66
N	22963			22963		

* indicates statistical significance at the 10% level
** indicates statistical significance at the 5% level
*** indicates statistical significance at the 1% level

Table A.4: First stage regression of CON Stringency on exogenous variables

	CON Stringency as Endogenous								
	Cross Sectional			Random Effect			Fixed Effect		
Variables	**Coef.**	**Std. Error**	**Test Stat**	**Coef.**	**Std. Error**	**Test Stat**	**Coef.**	**Std. Error**	**Test Stat**
CON Indicator	0.232	(0.007)	33.59***	0.274	(0.008)	35.04***			
Full Time Physicians and Dentists	-0.00001	(0.00003)	-0.38	-0.00001	(0.00003)	-0.45	-0.00002	(0.00003)	-0.75
Full Time Nurses	-0.00002	(0.00001)	-2.01**	-0.00002	(0.00001)	-1.91*	0.00002	(0.00001)	1.69*
Member of Council of Teaching	0.020	(0.009)	2.12**	0.016	(0.010)	1.55	-0.024	(0.015)	-1.62
Resident Training Approval	-0.002	(0.006)	-0.31	0.002	(0.006)	0.37	-0.012	(0.007)	-1.74*
JCAHO Accreditation	0.016	(0.004)	3.73***	0.011	(0.004)	2.40**	0.009	(0.005)	2.03***
Not For Profit	0.009	(0.004)	2.41**	0.003	(0.004)	0.56	0.011	(0.008)	1.5
Government Ownership	-0.022	(0.011)	-1.96**	-0.018	(0.013)	-1.34	0.040	(0.058)	0.68
Population Size	-0.021	(0.004)	-5.23***	0.026	(0.003)	7.81***	0.076	(0.005)	14.43***
Proportion - Female	-6.509	(1.059)	-6.15***	-1.904	(1.093)	-1.74*	65.701	(3.406)	19.29***
Proportion (age 0-17)	8.113	(0.420)	19.31***	2.866	(0.395)	7.25***	20.534	(0.986)	20.82***
Proportion (18-44)	6.019	(0.433)	13.91***	6.855	(0.406)	16.90***	38.784	(0.989)	39.21***
Proportion (45-64)	11.123	(0.487)	22.82***	9.510	(0.469)	20.30***	44.916	(1.056)	42.53***
Proportion - Black	-0.465	(0.048)	-9.64***	-0.335	(0.051)	-6.51***	11.777	(0.518)	22.74***
Proportion - Asian	8.609	(0.386)	22.31***	4.169	(0.356)	11.71***	-17.122	(1.211)	-14.14***
Proportion - Amer Indian	2.187	(0.181)	12.09***	2.402	(0.213)	11.25***	5.997	(3.152)	1.90*
Proportion - Pacific	32.191	(3.348)	9.62***	29.406	(3.805)	7.73***	101.665	(33.626)	3.02***
Proportion - Oth Race	-14.696	(1.165)	-12.62***	-10.750	(1.278)	-8.41***	-7.410	(5.585)	-1.33
Proportion - Emp Ins	0.148	(0.135)	1.10	-2.171	(0.113)	-19.26***	-3.896	(0.107)	-36.47***
Proportion - Priv Ins	2.841	(0.156)	18.17***	0.629	(0.138)	4.56***	-1.926	(0.151)	-12.78***

Proportion - Medicaid	0.552	(0.164)	3.38***	-1.765	(0.136)	-13.02***	-3.735	(0.129)	-29.06***
Proportion - Medicare	4.521	(0.309)	14.64***	0.934	(0.230)	4.06***	-1.898	(0.175)	-10.84***
Obesity	-0.009	(0.001)	-10.93***	-0.003	(0.001)	-5.33***	0.000	(0.001)	-0.6
Proportion - Smoke Daily	0.012	(0.001)	8.66***	0.001	(0.001)	0.65	-0.008	(0.001)	-6.12***
Proportion - Drink Heavily	0.053	(0.002)	24.88***	0.020	(0.002)	10.83***	-0.004	(0.002)	-2.51**
Child Death Rate	-0.002	(0.006)	-0.29	0.004	(0.005)	0.91	-0.011	(0.003)	-3.32***
Number of Teaching Hospitals	-0.016	(0.0005)	-34.11***	-0.011	(0.0005)	-23.17***			
Illegal Immigrant	-0.566	(0.025)	-22.52***	-0.619	(0.021)	-29.84***	-0.341	(0.023)	-14.96***
State ED Market	0.207	(0.007)	30.62***	0.085	(0.006)	14.72***	-0.002	(0.007)	-0.35
Senator Mean	-0.318	(0.021)	-14.98***	-0.159	(0.017)	-9.47***	-0.149	(0.013)	-11.17***
Senator Deviation	-0.035	(0.007)	-4.68***	-0.028	(0.006)	-4.76***	-0.050	(0.005)	-10.94***
Number of Democratic Senators	0.107	(0.008)	13.80***	0.030	(0.006)	4.77***	0.014	(0.005)	2.68***
Gov_demo	-0.116	(0.004)	-26.94***	-0.049	(0.003)	-14.70***	-0.003	(0.003)	-0.97
Gov_ind	-0.151	(0.020)	-7.42***	-0.079	(0.015)	-5.36***	0.049	(0.011)	4.46***
Median Income	0.004	(0.001)	3.89***	0.010	(0.001)	12.66***	0.013	(0.001)	17.06***
Proportion - Inpatient Days - Medicare	-0.038	(0.009)	-4.16***	-0.019	(0.009)	-2.06***	0.006	(0.009)	0.68
Proportion - Inpatient Days - Medicaid	-0.023	(0.012)	-2.01**	-0.018	(0.011)	-1.61	0.001	(0.010)	0.09
Unemployment Rate	-2.253	(0.143)	-15.71***	-0.926	(0.108)	-8.60***	2.241	(0.112)	20.00***
GDP	0.047	(0.095)	0.49	0.036	(0.072)	0.49	0.581	(0.066)	8.78***
Tech Index	-0.010	(0.0004)	-23.58***	-0.011	(0.0004)	-30.90***	-0.011	(0.000)	-24.04***

GINI	-0.0003	(0.0001)	-5.41***	-0.001	(0.0001)	-20.05***	-0.002	(0.000)	-40.65***
Constant	-4.388	(0.693)	-6.33	-3.116	(0.716)	-4.35			
N	21764			21764			21764		

* indicates statistical significance at the 10% level
** indicates statistical significance at the 5% level
*** indicates statistical significance at the 1% level