Financial Implications of the Medicaid Expansion for Academic Medical Centers

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Executive Summary

On March 23, 2010, President Obama signed into law the Patient Protection and Affordable Care Act (ACA), with the goal of reforming the United States health care system and providing insurance for millions of uninsured citizens and residents. One component of the legislation was the expansion of Medicaid eligibility, which would extend to include all individuals "under age 65 whose family income is at or below 138 percent of the federal poverty guidelines ($14,484 for an individual and $29,726 for a family of four in 2011)" (NCSL, 2015). This provision was challenged in the United States Supreme Court, which ruled that mandatory expansion was unconstitutional and held that Medicaid expansion must be implemented at the discretion of individual states. To date, 32 states, including Washington, D.C., have implemented Medicaid expansion; the majority of expansions became effective January 1, 2014.

One predicted effect of Medicaid expansion was an increase in hospital revenues, due to an increase in insured individuals, a likely increase in the number of individuals seeking care, and a decrease in uncompensated care. The intent of this research is to determine whether this effect has occurred, specifically in academic medical centers and teaching hospitals. There has yet to be substantial research on this topic; however, several factors are presented in the literature that bear on the effect of Medicaid expansion on hospital financial measures. First, the occurrence of a crowd out effect is likely as eligibility is expanded. Some individuals already insured through a private insurer have become eligible for Medicaid, and may change their coverage. Thus, the makeup of new Medicaid enrollees is unlikely to be solely the previously uninsured, which would limit the expansion's effect on hospital financial measures. Second, Medicaid programs often reimburse care providers at lower rates than do private insurers or Medicare. Depending on the size of the crowd out effect, revenues may be affected by these lower reimbursement rates.

To conduct this analysis, I collected utilization and financial data from 31 academic medical centers and teaching hospitals in 20 states. Sixteen hospitals are located in states that expanded Medicaid, while the remaining 15 hospitals are located in non-expansion states. I chose a fixed effects model, to control for time-invariant differences between the hospitals. I estimated four regressions, using different financial measures as dependent variables in each model: total revenue, total income, operating margin, and net patient revenue. I controlled for variables that could influence the aforementioned financial measures, including number of discharges, case mix index, and payer type.

The analysis found that Medicaid expansion was significantly associated with increases in total hospital revenue and net patient revenue, and with a decrease in operating margin. These results were robust to several checks. This analysis is important to gain a comprehensive understanding of the effects of the Medicaid expansion. Furthermore, Medicaid expansion is a highly dynamic issue. Expansion is actively under discussion in several states, while at least one state is considering reforming the expansion already in effect. Political changes at the federal level may also lead to changes in health care legislation. Thus, it is evident that further study is critical to understanding the short- and long-term effects of Medicaid expansion in the United States.

Introduction and Background Information

The Patient Protection and Affordable Care Act (ACA) is one of the most significant policies to be implemented in recent years. The legislation, signed into effect on March 23, 2010, represents a drastic change to the American health care system in an attempt to provide insurance coverage for the majority of the 42 million uninsured U.S. citizens and residents (Smith & Medalia, 2014). The primary mechanisms by which to increase coverage are the individual mandate, employer requirements, expansion of public programs, and subsidies. The individual mandate is the requirement that all U.S. citizens and legal residents have qualifying health insurance. Those who fail to acquire coverage must pay a penalty, which amounts to the greater of 2.5 percent of taxable income or a flat fee per family member, up to a maximum of $2,085 per year (U.S. Centers for Medicare & Medicaid Services, 2016). The employer requirements mandate that employers with at least 50 full-time employees provide employer-sponsored health insurance; if designated employers fail to do so, they also face a penalty (Kaiser Family Foundation, 2013). The public program expansion refers to a significant expansion of Medicaid, discussed in greater detail below, as well as the requirement that the Children's Health Insurance Program (CHIP) remains operational at its current levels for several years (Kaiser Family Foundation, 2013). Finally, subsidies to be used for the purchase of health insurance were made available to U.S. citizens and legal immigrants whose incomes are at or below specified income limits, as well as to qualifying small employers for their employees' coverage (Kaiser Family Foundation, 2013). These four components collectively attempt to ensure health insurance coverage for the majority of uninsured citizens and residents.

The Medicaid expansion is a significant, and contentious, component of the ACA. Provisions in the original act required expansion of Medicaid in all states to individuals "under

age 65 whose family income is at or below 138 percent of the federal poverty guidelines ($14,484 for an individual and $29,726 for a family of four in 2011)" (NCSL, 2015). However, this provision was challenged in the United States Supreme Court, which ruled that Congress may not withhold state Medicaid funding on the basis of failure to comply with the Medicaid expansion; this effectively made the expansion voluntary for states. For states that elected to expand Medicaid, the federal government will pay 100 percent of the cost of newly eligible enrollees through the end of the 2016 calendar year; federal funding will then gradually decrease to 90 percent by 2020, and remain at that level thereafter (Dorn et al, 2013). This is in contrast to the federal medical assistance percentage of 57 percent paid for other, previously enrolled Medicaid beneficiaries (Dorn et al, 2013). Currently, there are 19 states in which Medicaid has not been expanded, and 32 states (including Washington, D.C.) in which Medicaid was expanded (Kaiser Family Foundation, 2016). The majority of expansions became effective on January 1, 2014.

The expansion of Medicaid, in conjunction with the individual mandate and other mechanisms to encourage widespread health insurance coverage, was hypothesized to have several effects. One such effect was an increase in hospital revenues as the combined result of an increase in insured individuals, a likely increase in the volume of individuals seeking care, and a decrease in uncompensated care. This analysis seeks to understand the effect of Medicaid expansion on hospital revenue, income, and operating margin, by comparing financial measures of academic medical centers and teaching hospitals in states that did and states that did not expand Medicaid.

Literature Review

Predicted Effects on Hospital Revenues

Much of the literature studying the effects of the Medicaid expansion is focused on reductions in the number of uninsured individuals and improved health outcomes. Furthermore, because the Medicaid expansion has been operational for just over two years in most expansion states, there is a paucity of post-expansion data to be analyzed. However, the existing literature that makes reference to the financial implications of the Medicaid expansion for hospitals describes an anticipated immediate increase in revenues for hospitals.

The Medicaid expansion is not the only component of the ACA to have an impact on hospital revenues. The ACA will also decrease funding for "hospitals that serve a large number of Medicaid and low-income uninsured patients," called disproportionate share hospitals, by $56 billion between 2013 and 2022[1] (Rudowitz, 2013; Dorn et al, 2013). Additionally, the ACA reduces Medicare fee-for-service payments by $260 billion (Dorn et al, 2013). An intentional secondary effect of the Medicaid expansion, and other aspects of the ACA, was the expected increase in hospital revenues to counteract these payment reductions; a predicted increase of $294 billion in hospital revenues between 2013 and 2022 would help to offset the aforementioned revenue losses (Dorn et al, 2013).

The increase of $294 billion is not a net estimate. The expansion of Medicaid was also anticipated to have a crowd out effect; as Medicaid eligibility grew to incorporate millions of new individuals, some would already be insured through private coverage. Because Medicaid

[1] The disproportionate share hospital (DSH) classification is determined by a ratio that sums "the percentage of Medicare inpatient days attributable to patients eligible for both Medicare Part A and Supplemental Security Income (SSI), and the percentage of total inpatient days attributable to patients eligible for Medicaid [but] not Medicare Part A" (Centers for Medicare & Medicaid Services, 2015). All hospitals in this study are classified as DSH with the exception of the hospital in Maryland; all hospitals in Maryland are excluded from DSH payments.

would provide a new, lower-cost option for insurance, some individuals would likely shift their coverage from private to public providers by enrolling in Medicaid. Crowd out and its effects will be discussed in greater detail below, but generally speaking, it is possible that hospitals could lose over $100 billion in private payments from individuals who switched from private insurance to Medicaid coverage (Dorn et al, 2013). In spite of losses due to crowd out, however, hospitals were still likely to generate a net increase in revenues from Medicaid; an analysis from the Urban Institute predicted that the net increase in total U.S. hospital revenues due to the Medicaid expansion would be over $180 billion (Dorn et al, 2013).

Another significant anticipated effect of the Medicaid expansion was a decrease in uncompensated care. The vast majority of uncompensated care is provided to full-year uninsured individuals; those lacking any insurance account for approximately 85 percent of all uncompensated care, whereas part-year uninsured individuals comprise the remaining 15 percent (Hadley et al, 2008). Uncompensated care contributes to bad debt for hospitals, resulting in lower net income. Therefore, a significant increase in the number of individuals with insurance, due to the Medicaid expansion and other aspects of the ACA, should result in lower costs related to uncompensated care, and thus higher net income for hospitals.

Factors Specific to Medicaid Programs

There are factors inherent to Medicaid that must be considered as context for this analysis. First, though Medicaid is a federal program, it is administered by states. Thus, there is heterogeneity between state programs "in terms of enrollment procedures, demographics of the target population, and state politics" (Sommers & Epstein, 2010). Therefore, Medicaid will look different in each state that adopts the expansion, and estimates of its impact are, by necessity, generalizations of a great diversity of circumstances and effects.

Additionally, expansion of eligibility does not invariably lead to full enrollment. Lack of take-up of public programs such as Medicaid is not a new phenomenon. For example, in 1997, only 51 percent of nonelderly adults eligible for Medicaid were enrolled (Davidoff et al, 2001). Furthermore, a study following the 1994-1996 Medicaid expansion that aimed to provide coverage to uninsured children found that 47 percent of Medicaid-eligible children were unenrolled (22 percent were uninsured, while an additional 25 percent were covered under private insurance) (Selden et al, 1998). It is likely that take-up will be higher under the ACA than under previous expansions, due to the individual mandate, the employer requirements, and the penalties associated with noncompliance; however, less than complete take-up may result in smaller revenue increases than were originally estimated.

Finally, Medicaid reimbursement rates are substantially lower than those of Medicare and private insurers in most states (Decker, 2007; Gruber & Simon, 2008). Because Medicaid is a state-run program, states have significant discretion in setting their reimbursement rates, leading to great variation between states. In spite of this, reimbursement at a lower rate still provides more income to hospitals than does uncompensated care. Yet not all new Medicaid enrollees were previously uninsured. The next section discusses the effect of crowd out, which will be a key factor in determining the extent to which hospital revenues are affected as a result of Medicaid expansion.

Crowd Out

As described above, crowd out is likely to occur when the expansion of Medicaid causes more people to be eligible for coverage, some of whom were previously covered under private insurance. Because Medicaid is a lower-cost option for coverage, some people will shift their coverage to Medicaid, decreasing private insurance enrollment. Crowd out is more likely to

occur in higher-income populations (i.e. those above the federal poverty level), because higher-income individuals are more likely to already have private insurance coverage (Gruber & Simon, 2008). Studies of previous insurance expansions have had mixed findings regarding the prevalence of crowd out. Gruber and Simon (2008) find that, in recent public insurance expansions, "the number of privately insured falls by about 60 percent as much as the number of publicly insured rises." However, they acknowledge the propensity of similar estimates to vary significantly, as they are sensitive to methodology, type of data, and how crowd out and overlap are defined (Gruber & Simon, 2008).

The ACA increased the eligibility of Medicaid to those with incomes at or below 138 percent of the federal poverty level. Gruber and Simon (2008) find that "the rise in Medicaid coverage is largest for the group between 100 and 200 percent of poverty... [and] this is also the group that sees the largest decline in private coverage." This is relevant to the current analysis because, the greater the impact of crowd out, the less likely hospital revenues are to increase by a substantial margin. As discussed previously, health care covered by Medicaid is often reimbursed at a lower rate than care covered by Medicare or private insurance. The more individuals who trade their private coverage for Medicaid, the more losses in revenues are likely to be incurred by hospitals. This analysis will not attempt to calculate the effect of crowd out in the case of the ACA's Medicaid expansion; however, it is an important factor to consider when interpreting the results.

Results from Early Expansions

Five states—California, Connecticut, Minnesota, New Jersey, and Washington—and Washington, D.C. implemented limited Medicaid expansions between passage of the ACA and the widespread expansion date of January 2014. Their results are instructive, considering that

longitudinal data from the majority of Medicaid expansion states will not be available for several years. Key findings are discussed below.

Connecticut implemented a limited Medicaid expansion in April 2010. Prior to passage of the ACA, "parents and caretakers with incomes up to 185 percent of the federal poverty level were eligible for Medicaid in Connecticut" (Nikpay et al, 2015). However, adults without children were only eligible for a state-based medical assistance program with limited benefits; further, these adults had to have incomes below 56 percent of the federal poverty level, and hold less than $1,000 in assets (Nikpay et al, 2015). Upon passage of the ACA, Connecticut expanded full Medicaid coverage to adults without children, and removed the contingency based upon assets (the income requirement remained the same) (Nikpay et al, 2015).

Nikpay, Buchmueller, and Levy (2015) conducted a study to ascertain the effect of this expansion on Medicaid volume and uncompensated care in Connecticut. The results of their study find that, post-expansion, Medicaid discharges increased significantly when compared to the rate of change in other states (Nikpay et al, 2015). Additionally, "Medicaid revenues more than doubled: a relative increase of $148.5 million compared with a pre-expansion baseline of $135.8 million" (Nikpay et al, 2015). However, the increase does not represent a net gain for hospitals; approximately 56 percent of new Medicaid enrollees transferred from a different state health coverage program (Sommers et al, 2013). Therefore, as opposed to increasing total patient volume, the effect of the Medicaid expansion was mainly to change the hospital payer mix (Nikpay et al, 2015). Finally, uncompensated care in Connecticut neither increased nor decreased after the Medicaid expansion, whereas it increased significantly in other states (Nikpay et al, 2015). Thus, these results indicate that hospitals cannot definitively expect a net increase in revenues as a result of Medicaid expansion. The effect on revenues will depend in large part on

the extent of crowd out and, in particular, the number of newly insured individuals compared to previously insured individuals who shift their coverage to Medicaid.

Other findings from states that implemented early Medicaid expansions vary. California's expansion was notable in that its number of new enrollees was vastly higher than enrollees who transferred from existing state or local health coverage programs; 88 percent of enrollees were new, compared to 12 percent who transferred from other programs (Sommers et al, 2013). Although California expanded eligibility to incomes of up to 200 percent of the federal poverty level in some counties, Washington, D.C. did the same and had only 23 percent of total expansion enrollment comprised of new enrollees (Sommers et al, 2013).

Thus, it is challenging to find conclusive takeaways from early state adoptions of Medicaid expansion. In general, however, we may make two assumptions based on the literature. First, it is evident that Medicaid expansion is unlikely to have a homogenous effect in all expansion states. Second, the Medicaid expansion's effect on hospital revenues is inexorably tied to other factors, such as crowd out, the effect on uncompensated care, and state program differences, and is thus difficult to predict in a generalizable way.

Research Design

In this study, I investigate the question: To what extent has the Medicaid expansion affected hospital financial measures? The units of analysis are hospitals; more specifically, only not-for-profit academic medical centers and teaching hospitals are included in the analysis. Academic medical centers and teaching hospitals make up a critical component of the United States health care system. They “provide more than 40 percent of charity care, and account for 20 percent of all hospital admissions, surgical operations, and outpatient visits” (Health Research Institute, 2012). They also tend to care for more high-acuity patients and patients with more

complex medical issues than do other hospitals (Association of American Medical Colleges, 2014). Thus, these hospitals are integral in providing high-level care, particularly to populations with fewer resources, and therefore are likely to be affected by the expansion of Medicaid.

Data Collection

I collected existing longitudinal (panel) data related to hospital utilization and financial measures for 31 hospitals in 20 states for the fiscal years 2011 through 2015. Nine of the states in the analysis have expanded Medicaid, while the remaining 11 have not (as of April 2016). This corresponds to 16 of the hospitals in the analysis being located in expansion states, and the remaining 15 hospitals being located in non-expansion states.

I acquired data from two databases. All utilization data (i.e. number of discharges per year, average case mix index, etc.) were retrieved from Vizient, an alliance of nonprofit academic medical centers and teaching hospitals in the United States. I gathered corresponding financial data from Modern Healthcare's Healthcare Systems Financial Database, which collects quarterly and annual audited financial data for over 400 hospitals in the United States. Of the 128 hospitals with utilization data available in the Vizient database, only 40 hospitals also had financial data in the Modern Healthcare database. There is no relationship between the two databases. Thus, hospitals that appear in both databases do so by chance and are not related in any way.

I eliminated nine of the 40 hospitals because they are located in states that implemented limited early expansion of Medicaid (California, New Jersey, and Minnesota). This leaves 31 hospitals in the analysis. Due to Vizient's public disclosure guidelines, individual hospitals may not be identified or identifiable in this analysis.

Methodology

To conduct this study, I estimated four fixed effects regressions. Using a fixed effects model allows me to hold constant, or "fix," the average institutional effects of each hospital, an important aspect considering the model includes 31 hospitals in 20 states, which implies variance at the unit level.

In order to draw a causal inference, there is an identifying assumption that must be made with the use of a fixed effects model: any unobservable factors that might affect both the dependent and independent variables of the model are time-invariant. It is obvious that there are differences between hospitals; however, I assume that these inherent differences, which might include the political or economic climate of the hospital's state, do not change over time. Thus, by controlling for said unobservable variations between hospitals, I can use the model to estimate the change in the variables included in the model.

The basic equation for the fixed effects regression is as follows:

$$Y_{it} = \beta X_{it} + \alpha_i + u_{it}$$

where Y_{it} is the dependent variable, or one of several hospital financial measures (see Table 2), with *i* representing entity and *t* representing time; β is the coefficient for each independent variable; X_{it} represents each independent variable; α_i is the entity-specific intercept for each hospital; and u_{it} is the error term. In this model, there are 11 independent variables. They are described in further detail in Table 1 below. The key independent variable is Medicaid expansion, which is a dummy variable that has a value of zero for hospitals in states that have not expanded, or for years prior to expansion, and has a value of one for years during which Medicaid expansion is effective. The remaining independent variables were selected based on

their likelihood to affect hospital financial measures. Thus, by controlling for each independent variable, I eliminate their ability to influence the estimate results.

Table 1: Independent Variables

Variable	Type of Variable	Measurement	Hypothesized Relationship
Medicaid expansion	Dummy	0= no expansion/ pre-expansion; 1= post-expansion	Positive
Cases (discharges)	Continuous	Number of cases	Positive
Mean length of stay	Continuous	Days	Positive
Percent of cases that go to intensive care unit (ICU)	Continuous	Percent of cases	Positive
Mean ICU days	Continuous	Days	Positive
Cases with one or more complications	Continuous	Number of cases	Positive
Case mix index[2]	Continuous	Case mix index metric	Positive
Emergency admissions	Continuous	Number of admissions	Positive
% private payer	Continuous	Percent of cases with private payer	Positive
% Medicaid	Continuous	Percent of cases with Medicaid as payer	Negative
% Medicare	Continuous	Percent of cases with Medicare as payer	Varies

It is difficult to assess the financial condition of hospitals with a single measure. Therefore, I estimated four fixed effects regressions using different hospital financial measures as dependent variables: total revenue, total income, operating margin, and net patient revenue. Each dependent variable is described in Table 2 below. Total revenue represents all money that a hospital has taken in over the course of the fiscal year; in other terms, total revenue is a measure of gross

[2] Case mix index is a metric that describes average resource intensity of a patient's condition, i.e. how expensive it is to treat the patient. Patients are assigned to a diagnosis-related group (DRG) based upon their diagnoses. DRGs are weighted according to resource intensity; the average DRG weight for a hospital is its case mix index (CMI) (Centers for Medicare & Medicaid Services, n.d.) CMIs generally range between approximately 0.3 and 3.4, with higher numbers indicating greater average resource intensity.

financial gain. The primary component of total revenue is revenue from patient care, but it may include other sources of revenue such as research grants, investment or capital income, gift shop sales, and/or donations or bequests. Income represents net financial gain, or a hospital's surplus after subtracting expenses from revenue. Operating margin is a measure of profitability, which is calculated by dividing a hospital's income by its total revenues. Net patient revenue measures revenue derived solely from patient care. Estimating the effects of Medicaid expansion on several financial indicators allows a more comprehensive understanding of the effect of Medicaid expansion on hospital financial status.

Table 2: Dependent Variables

Variable	Type of Variable	Measurement
Total revenue	Continuous	Millions of dollars
Total income	Continuous	Millions of dollars
Operating margin	Continuous	Percent
Net patient revenue	Continuous	Millions of dollars

Summary Statistics

In order to provide context for the interpretation of the analysis results, Table 3 presents summary statistics for the four dependent variables. Note that the figures are means for all hospitals included in the study.

Table 3: Summary Statistics

Dependent Variable	FY2011 Mean	FY2012 Mean	FY2013 Mean	FY2014 Mean	FY2015 Mean
Total revenue	$1.58 billion	$1.68 billion	$1.78 billion	$1.94 billion	$1.95 billion
Total income	$105 million	$114 million	$117 million	$158 million	$216 million
Operating margin	3.16	3.73	2.88	3.63	5.45
Net patient revenue	$1.34 billion	$1.48 billion	$1.53 billion	$1.64 billion	$1.60 billion

Validity

The measurement validity of this study is clear. The analysis examines financial trends, which are shown directly through the variables discussed above. Additionally, the financial data is audited, which further strengthens its validity. Because there is not a need for proxy variables, or variables that are representative of other concepts, measurement validity exists inherently in this model.

Causal Inference

In order to posit causal inference (in this case, that Medicaid expansion caused certain changes in hospital financial measures), two assumptions must be made: that there are no omitted variables, and that there is no reverse causality. Omitted variable bias occurs when a variable that is correlated with both the dependent variable and one or more independent variables is excluded from the model. There are myriad demographic, economic, and environmental factors that may impact hospital financial measures. However, unobservable variables that are time-invariant are controlled for through the fixed effects model. Additionally, the factors that are directly observable within a hospital that are generally known to have an effect on hospital financial performance, such as cases with complications, number of discharges, and average length of stay, are included in the model. It is possible that there are time-variant factors that occurred or changed over the course of time included in this study; this is discussed further in the Limitations section, but does not pose a strong risk to the estimates presented here.

Reverse causality describes an occurrence when the dependent variable determines the independent variable; here it would mean that higher hospital revenues, income, or operating margin caused implementation of the Medicaid expansion. Intuitively, this is unlikely. First, the

decision to expand Medicaid is made at the state level, whereas the units of analysis in this research design are individual hospitals. Levels of revenue or income for individual hospitals would not determine the decision to expand or not expand Medicaid for an entire state. Second, even if individual hospitals' financial measures were indicative of average health care financial indicators for an entire state, it is more likely that lower hospital revenues would determine implementation of Medicaid expansion, due to its predicted effect of providing financial benefits to hospitals.

Analysis

The analysis shows that Medicaid expansion is significantly associated with increases in total revenue and net patient revenue, and with a decrease in operating margin. Table 4 presents estimates for the four fixed effects regressions.

In the states included in this analysis, Medicaid expansion is associated with an average increase in hospital revenues of approximately $237 million and an average increase in net patient revenue of approximately $150 million, controlling for other factors. Medicaid expansion is also associated with an average decrease in operating margin of -1.26 percentage points, all else equal. All three estimates are statistically significant at the $p < 0.1$ level. There was not a statistically significant effect of the Medicaid expansion on total income.

These results support the hypothesis that Medicaid expansion has a positive and significant effect on hospital revenue. The decline in operating margin warrants further commentary. As described previously, operating margin is a measure of profitability. Thus, these results indicate that, on average, hospitals are experiencing increased revenue, but lower profitability. This could be due to several factors. One is the increase in acuity of patients seeking medical care, thus requiring greater resources for treatment. According to a recent study

Table 4: Regression Statistics

	Total revenue	Total income	Operating margin	Net patient revenue
Medicaid expansion	237.0*	71.01	-1.260*	150.1*
	(125.9)	(54.24)	(0.640)	(78.32)
Discharges	0.0234	0.0118	0.000114	0.0144
	(0.0181)	(0.00789)	(0.000120)	(0.0110)
Mean length of stay	-54.94	2.020	-1.270	-166.2
	(207.2)	(84.62)	(2.180)	(163.8)
% ICU cases	-7.670	-3.009	-0.00887	-9.600*
	(8.214)	(4.231)	(0.0459)	(5.196)
Mean ICU days	-2.037	0.498	0.220**	1.874
	(6.273)	(2.650)	(0.0971)	(4.529)
Cases with 1+ complications	0.350***	0.141**	0.00236***	0.259***
	(0.126)	(0.0621)	(0.000585)	(0.0837)
Case mix index	1,726**	91.79	-8.971	1,408**
	(839.2)	(396.5)	(6.199)	(592.8)
Emergency admissions	-0.0463	-0.0234	-6.59e-05	-0.0262
	(0.0308)	(0.0140)	(0.000180)	(0.0189)
% private payer	-48.07	-26.78	0.383**	-12.52
	(36.55)	(18.01)	(0.186)	(20.93)
% Medicaid	-20.23	-13.20	0.250**	-0.679
	(26.14)	(11.73)	(0.0936)	(16.11)
% Medicare	-76.09	-33.46	0.404**	-25.64
	(48.33)	(21.49)	(0.163)	(27.75)
Constant	3,201	2,040*	-12.44	997.6
	(2,364)	(1,048)	(9.028)	(1,522)
Observations	124	124	124	124
Number of units	31	31	31	31
Rho	0.917	0.825	0.944	0.952
R-squared	0.396	0.228	0.252	0.462

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

of policyholders conducted by the Blue Cross and Blue Shield Association, "people newly insured under the Affordable Care Act were sicker, used more medical care and had higher medical costs than those who already had coverage" (Pear, 2016). Another reason could be an increased number of individuals covered by Medicaid seeking treatment. Because Medicaid generally reimburses at rates lower than those of Medicare and private insurers, a shift in payer

mix to a higher percentage of patients being covered under Medicaid would likely have a negative effect on operating margin.

Robustness Checks

I took several measures to check the robustness of these results. I first corrected for issues related to autocorrelation, heteroskedasticity, and multicollinearity in the original models. By eliminating an independent variable that was causing multicollinearity, and calculating robust and clustered standard errors, I addressed these issues.

I also estimated several other regressions as further robustness checks. First, I estimated similar regressions that used the percent change in the dependent variables between each fiscal year, as opposed to the dollar amounts utilized in the first regressions. The full regression table is presented in Appendix A. The use of percent change tends to reduce variability; while using the dollar amounts shows the trend across all five years, the percent change is calculated between each year (i.e. change from FY2011 to FY2012, then from FY2012 to FY2013, etc.) and shows whether the growth rate of the financial indicators is greater in hospitals located in expansion states. In these regressions, only the estimate for percent change of net patient revenue was statistically significant at the $p < 0.05$ level. The result showed that Medicaid expansion is associated with an average increase of seven percent in net patient revenue, all else equal. The lack of statistical significance of the estimates for percent change of total revenue and total income does not lessen their significant results in the previous regressions; it was expected that utilizing percent change would reduce variability and thus result in lower estimates. Therefore, this regression simply indicates that the growth rate of net patient revenue was statistically significantly higher after Medicaid expansion.

I performed two other robustness checks, to accommodate for a specific characteristic and a limitation of the data, respectively. First, while the majority of states included in this study expanded Medicaid effective January 1, 2014, three states expanded on later dates. To ensure that this variation did not bias the estimates, I estimated regressions without the four hospitals located in the late-expansion states. The full results are presented in Appendix B. The estimates for the effect of Medicaid expansion on the four dependent variables are similar to those presented in the first regressions; there are statistically significant increases in total revenue and net patient revenue, and a statistically significant decrease in operating margin. Additionally, the coefficients are marginally higher than those in the original regressions. This could be due to the fact that, for the hospitals in states that expanded Medicaid more recently, less time has passed during which an effect might be evident. Therefore, although the volume of the effect is slightly higher when only including hospitals in states that expanded Medicaid effective January 1, 2014, the effect is evident and strongly significant in both cases, and is thus robust to this change.

Additionally, I performed a robustness check because of missing data for the 2015 fiscal year. This issue is discussed in further detail in the following Limitations section; in short, because only approximately half of the hospitals included in this study had reported their fiscal year 2015 financial data as of March 2016, it is important to determine whether this missing data impacts the results. Thus, I estimated regressions using only data from fiscal years 2011 through 2014. The full regression results are presented in Appendix C. The results of these regressions show that Medicaid expansion is associated with statistically significant increases in total revenue and net patient revenue at the $p < 0.05$ level. However, in these results, the coefficients are marginally smaller than those in the original regressions. This is intuitive, considering that using data through fiscal year 2014 gives only six months of post-expansion data in the 2014

fiscal year, a relatively short time period from which to estimate an effect. Additionally, there is no significant effect on operating margin in this case, although the coefficient remains negative. The lack of significance could be due to the fact that, at the end of fiscal year 2014, hospitals' operating expenses had not yet caught up to their utilization of resources. Thus, in general, the results remain robust to the issue of missing data.

Limitations

There are limitations to note when considering the results of this study. The most evident limitation is the relative paucity of data post-Medicaid expansion. The expansion was implemented on January 1, 2014 in most states; thus, there are, at most, data for 1.5 fiscal years post-expansion. Therefore, it is difficult to extrapolate a long-term trend from this data. For that reason, this analysis should be considered preliminary, to be supplemented by further research when more post-expansion data is available.

Additionally, it is important to note that there are missing observations in the data. The data for all of the independent variables are complete. However, 16 hospitals have yet to report financial data for the 2015 fiscal year. Missing data may be classified as missing completely at random, in which the included data is a random sample, and thus representative, of the full data set; missing at random, in which the missing data is due to a factor related to a completely observed variable in the data set; or missing due to a factor directly related to the value of the variable (Pigott, 2001). The first two instances are considered ignorable; the only caveat is that estimates may be less precise due to the missing data, but they are still representative of the entire sample (Pigott, 2001). In this case, I consider the missing data to be missing completely at random, and thus ignorable. However, I estimated regressions identical to those in the study, but

using only data from fiscal years 2011 through 2014, as a robustness check. The results are discussed in the Analysis section.

Finally, Medicaid expansion is a time-variant variable. It is possible that there are other factors, such as economic occurrences or implementation of other regulations, which affect the estimates of these models. All time-invariant variables are controlled within the fixed effects model, but factors that have been implemented or changed over time, such as interest rate fluctuations or new or changed regulations, have the potential to impact the estimates. However, the models have proven robust to several checks. Therefore, the estimates presented in this study are effective in approximating the effect of Medicaid expansion on hospital financial measures.

Policy Implications

This analysis discusses the initial impact of Medicaid expansion on hospital financial measures. Though increasing hospital revenue was an anticipated effect of the Medicaid expansion, it was not a primary goal. Therefore, this study should not be considered an assessment of the effectiveness of Medicaid expansion, yet it is still important to understand all of a policy's implications and effects. As mentioned previously, the hypothesized increase in hospital revenue as a result of expansion was intended to help offset other funding decreases written into the ACA. It is beyond the scope of this study to conjecture as to whether the revenue increases will fully offset the other decreases; that will be an important topic for future research.

It is also difficult to conjecture whether this pivotal legislation will indeed reduce health care spending in the United States, particularly because the legislation has initiated a vast number of changes in the U.S. health care system, the effects of which are yet to be fully understood. In this paper, I discuss both increases and decreases in federal spending on health care. For example, federal spending on Medicare fee-for-service payments and disproportionate

share hospital assistance are sharply curtailed under the ACA, yet the federal government is paying a much higher share of the costs for new Medicaid enrollees than it does for those enrolled in Medicaid prior to the ACA. Therefore, future study will be necessary to gain a more comprehensive understanding of the effects of the ACA and Medicaid expansion on federal health care spending.

Conclusion

The expansion of Medicaid was predicted to have numerous effects, including increasing hospital revenue. This study shows statistically significant increases in hospitals' revenue and net patient revenue and a statistically significant decrease in operating margin, all else equal, immediately following Medicaid expansion. This analysis provides preliminary results as to the effect of Medicaid expansion on hospital financial measures. However, future research will be instructive in determining whether these effects remain constant, increase, or decrease as more time passes post-expansion.

Additionally, Medicaid expansion continues to be a highly dynamic issue. Expansion is actively under discussion in several states, while at least one state is reforming the expansion already in effect. At the federal level, the outcome of the highly contentious 2016 presidential election, as well as the possibility of significant change in the composition of U.S. Congress, could lead to changes in health care legislation. Finally, at the end of the 2016 calendar year, states that expanded Medicaid will begin to pay a small percentage of the costs associated with the expansion and new Medicaid enrollees. It is possible that this change will affect hospital financial measures, as states determine how to fund their expansions. Thus, it is evident that further study is critical to understanding the short- and long-term effects of Medicaid expansion in the United States.

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Appendix A:
Regression Estimates Using Percent Change

	Percent change, total revenue	Percent change, total income	Percent change, operating margin	Percent change, net patient revenue
Medicaid expansion	0.0487	1.088	1.600	0.0675**
	(0.0478)	(1.186)	(0.978)	(0.0300)
Discharges	1.43e-05*	0.000132	2.79e-05	1.01e-05
	(7.56e-06)	(0.000168)	(7.25e-05)	(6.16e-06)
Mean length of stay	0.230*	-1.441	-1.839	0.123
	(0.123)	(2.071)	(1.758)	(0.0793)
% ICU cases	0.00146	-0.0691	-0.0161	0.00277
	(0.00491)	(0.0967)	(0.0507)	(0.00433)
Mean ICU days	0.0116	0.104	0.0583	0.0117**
	(0.00754)	(0.112)	(0.0609)	(0.00544)
Cases with 1+ complications	0.000100*	0.00188*	0.000350	6.86e-05*
	(5.06e-05)	(0.000934)	(0.000497)	(3.55e-05)
Case mix index	-0.383	-6.004	-3.500	-0.579*
	(0.465)	(8.794)	(4.411)	(0.308)
Emergency admissions	-2.16e-05	-0.000244	9.34e-05	-1.17e-05
	(1.62e-05)	(0.000339)	(0.000177)	(1.32e-05)
% private payer	-0.0379*	-0.114	-0.0960	-0.0126
	(0.0187)	(0.228)	(0.290)	(0.0144)
% Medicaid	-0.0262**	-0.0293	0.225	-0.00886
	(0.0123)	(0.121)	(0.135)	(0.00915)
% Medicare	-0.0492**	-0.0280	0.133	-0.0306*
	(0.0213)	(0.229)	(0.187)	(0.0153)
Constant	2.540**	21.12	5.579	1.643*
	(1.230)	(17.37)	(18.63)	(0.861)
Observations	94	94	94	94
Number of units	31	31	31	31
Rho	0.921	0.654	0.824	0.917
R-squared	0.335	0.172	0.220	0.387

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix B:
Regression Estimates Excluding Hospitals in States that Expanded Medicaid After January 1, 2014

	Total revenue	Total income	Operating margin	Net patient revenue
Medicaid expansion	259.3*	86.44	-1.169*	162.3*
	(148.2)	(63.18)	(0.631)	(91.43)
Discharges	0.0211	0.0104	0.000104	0.0128
	(0.0183)	(0.00784)	(0.000115)	(0.0110)
Mean length of stay	-63.20	28.37	-0.392	-170.8
	(223.5)	(89.34)	(2.094)	(165.8)
% ICU cases	-10.14	-2.402	0.0234	-11.93**
	(7.246)	(4.187)	(0.0513)	(4.562)
Mean ICU days	-0.561	0.564	0.232**	2.921
	(6.908)	(3.175)	(0.112)	(4.637)
Cases with 1+ complications	0.332**	0.135**	0.00244***	0.242**
	(0.133)	(0.0629)	(0.000554)	(0.0895)
Case mix index	1,712*	-23.27	-13.25**	1,415**
	(930.2)	(431.8)	(5.517)	(619.0)
Emergency admissions	-0.0390	-0.0221	-6.38e-05	-0.0190
	(0.0311)	(0.0140)	(0.000175)	(0.0185)
% private payer	-43.17	-25.34	0.401**	-9.075
	(38.29)	(18.86)	(0.180)	(21.68)
% Medicaid	-20.58	-13.49	0.259***	-1.532
	(26.59)	(11.79)	(0.0877)	(16.67)
% Medicare	-71.82	-32.10	0.422**	-21.46
	(49.13)	(21.82)	(0.169)	(28.12)
Constant	2,843	1,987*	-11.78	659.2
	(2,371)	(1,054)	(9.641)	(1,541)
Observations	110	110	110	110
Number of units	27	27	27	27
Rho	0.870	0.788	0.952	0.923
R-squared	0.406	0.228	0.294	0.496

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix C:
Regression Estimates Using Only Fiscal Years 2011 through 2014

	Total revenue	Total income	Operating margin	Net patient revenue
Medicaid expansion	196.3**	43.45	-0.699	143.3**
	(94.36)	(34.08)	(0.796)	(66.72)
Discharges	0.00223	0.00416	4.74e-05	-0.00132
	(0.0122)	(0.00476)	(0.000130)	(0.00885)
Mean length of stay	43.62	10.38	0.668	-41.49
	(209.3)	(84.97)	(2.494)	(164.8)
% ICU cases	-2.197	-0.740	0.0222	-5.016
	(4.491)	(2.339)	(0.0550)	(3.871)
Mean ICU days	-9.692	0.493	0.116	-7.128
	(5.853)	(2.797)	(0.0962)	(5.635)
Cases with 1+ complications	0.162**	0.0825***	0.00199**	0.129**
	(0.0712)	(0.0290)	(0.000734)	(0.0585)
Case mix index	1,477**	-175.0	-14.65**	1,186**
	(550.5)	(314.3)	(7.127)	(558.5)
Emergency admissions	-0.00609	-0.0102	2.32e-05	0.00332
	(0.0227)	(0.00894)	(0.000204)	(0.0167)
% private payer	-20.51	-3.218	0.270	-1.683
	(26.29)	(8.359)	(0.344)	(19.19)
% Medicaid	-3.251	0.0518	0.0837	2.418
	(19.07)	(6.910)	(0.199)	(15.11)
% Medicare	-43.12	-9.739	0.211	-13.96
	(29.36)	(7.389)	(0.230)	(18.51)
Constant	1,013	694.5	1.587	121.6
	(1,995)	(670.2)	(16.02)	(1,547)
Observations	109	109	109	109
Number of units	31	31	31	31
Rho	0.960	0.837	0.942	0.972
R-squared	0.447	0.226	0.192	0.445

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1