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The Balanced Budget Act of 1997 and Hospital Cost Shifting

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Abstract

In 1997, the Balance Budget Act (BBA) was implemented to slow future Medicare expenditure growth by eliminating or limiting inflation updating factor and other adjustments to inpatient diagnosis-related group (DRG) payments in the subsequent fiscal years. It is widely concerned whether a hospital would engage in cost shifting as response to the Medicare reimbursement cut. In addition, there are also great concerns about whether the quality of health service would deteriorate in hospitals because of the increasing financial pressures by the BBA of 1997.

In this study I utilize the long-difference model to examine the evidence of cost shifting during the period of 1998 to 2002, given the exogenous payment cuts by the BBA of 1997. I further examine the possible impacts of the BBA of 1997 on health outcomes in terms of the Hospital Acquired Infection (HAI) rate.

I find that during the study period, hospitals on average were able to shift the expected revenue loss of BBA to private patient primarily on a one-dollar-to-one-dollar basis. It appears that hospitals shifted most cost during the first three years after the implementation of the BBA of 1997, whereas the cost shifting during the period of 2001 to 2002 was not statistically significant. I also find that the greater financial distress hospitals had the more cost-shifting they did. In addition, the results based on the Hospital Acquired Infection (HAI) rate suggest that the BBA of 1997 has no significant impact on the Hospital Acquired Infection (HAI) rate.

Chapter 1 Introduction

Since Medicare with "retrospective cost-based reimbursement" system was established in 1965, Medicare's hospital costs have dramatically increased. The annual Medicare costs rose from $3 billion in 1967 to $37 billion 1998.[1] Medicare accounts for a large share of the federal fiscal budget. In 2010, three health insurance programs — Medicare, Medicaid, and the Children's Health Insurance Program (CHIP) — sum up to $753 billion, altogether accounting for 21% of the federal fiscal budget. Further, nearly two-thirds of this amount, or $468 billion, goes to Medicare, which provides health coverage to around 46 million people who are over the age of 65 or have disabilities (Center on Budget and Policy Priorities, 2010).

During the past two decades, the Congress has been trying various ways to control the rising Medicare expenditure. In 1982, the Congress implemented a prospective payment system (PPS), which pays hospital a fixed flat rate for each Diagnosis-related group (DRG). In 1997, Balance Budget Act (BBA) was implemented to slow future Medicare expenditure growth by eliminating or limiting inflation updating and other adjustments to inpatient diagnosis-related group (DRG) payments in subsequent fiscal years. Balanced Budget Act (BBA) of 1997 created the most substantial reductions in Medicare payments to hospitals since the introduction of the Prospective Payment System (PPS) (Newhouse 2002).

The Congressional Budget Office (1999) estimated that the BBA totally saved $112 billion from Medicare program during the period of 1998 to 2002. The savings from all hospital

[1] U.S. Department of Health & Human Services, Office of Inspector, General Office of Evaluation and Inspections. 2001. "Medicare Hospital Prospective Payment System". http://oig.hhs.gov/oei/reports/oei-09-00-00200.pdf (last access: Aug. 13, 2010).

Medicare reimbursement[2] was estimated to be about $72 billion for the period of 1998 to 2002 and $119 billion for the period of 1998 to 2004 (Heiber-White 1997). Even though the 1999 Balanced Budget Refinement Act and the 2000 Benefits Improvement and Protection Act subsequently relaxed or delayed several original BBA provisions and were estimated to restore about $21 billion (or 17.6%) of reimbursement cut for the period of 1998 to 2004, the financial pressures brought to PPS hospitals by BBA of 1997 were still substantial (Bazzoli 2004).

Facing the substantial reimbursement cut by a major public payer, hospitals have a variety of choices when making response decisions. Hospitals may manage to become more efficient and absorb the major part of the reimbursement cut. Hospitals may choose to accept fewer patients with public payer or reduce the medical service provided to this group of patients or all of their patients. Apart from all of these possibilities, hospitals may also engage in "cost shifting.

In this study, cost shifting is defined as the phenomenon in which changes in administered prices of one payer lead to compensating changes in prices that are charged to other payers. In other words, a hospital shifts the loss due to the price cut by a public payer to private payers, by raising the price charged to privately insured patients. Cost shifting is different from price discrimination. These two concepts can be differentiated from the following ways. First of all, cost shifting is a dynamic phenomenon, while price discrimination is static one. Cost shifting is not due to the different price elasticities of the payers. When cost shifting occurs, reductions in payment rates by a public payer are dynamically associated with increases in the rates charged to

[2] Medicare reimbursement includes the payment for inpatient, medical education and DSH adjustments, capital payments, outpatient, home health, and nursing home services.

privately insured patients (Morrisey 2003, Ginsburg 2003). However, when health care providers practice price discrimination, they may charge a payer with inelastic demand a higher price. Different prices for public and private payers may be observed as results of price discrimination strategies, but those price differences are static artifacts of having some degree of market power, rather than dynamic changes of prices. Additionally, we can also differentiate price discrimination from cost shifting from the motivation of practice. Price discrimination is motivated by utilizing inelasticities of demand to increase producer's profit, while cost shifting is motivated by the additional constraint on revenue imposed by prospective payment for some, but not all, patients (Friesner & Rosenman 2002). In other words, cost shifting is usually motivated by reducing hospitals' financial loss caused by public payers' reimbursement cut policy.

There has been a debate about whether hospitals actually do cost shifting in practice since 1980s (Morrisey 1994). The controversy arose again after Levit et al (2004) reported a close timing association between the growth of medical care spending and the BBA of 1997. Some researchers doubted that hospitals could still do cost shifting under the PPS system in a competitive market environment (Lee *et al* 2003), while other researchers believed that cost shifting was likely to be more pronounced than was the case in the 1990s (Ginsburg 2003).

Cost shifting is a policy issue of importance, because cost shifting is a dynamic response and decides who eventually bears the cost of medical expenditure. If many hospitals tend to shift losses to private payers by increasing the payment, the cost of private payers will increase and private payers will in turn pass on the increased cost to the working population by charging higher premiums. Eventually, the initial policy change does nothing to reduce the real cost of health care. In fact, cost shifting may also cause an increase in the uninsured population because some healthy individuals may drop out of their health insurance plan when facing an increasing premium. A larger uninsured population may in long term bring a higher rate of hospital utilization, especially readmission after discharge, due to lack of preventive health care (Fuchs 2009). In this way public health care expenditure reducing policies eventually cannot reach their initial goals, but may even reduce the social welfare by increasing the uninsured population.

While a direct test of cost shifting looks at the effect of government price reductions on the prices charged to private patients, an indirect test of cost shifting would look at the effect of health care service volume and quality. There are great concerns whether the BBA of 1997 has substantial negative impacts on the quality of healthcare service. If hospitals responded to price cut with cost cutting, quality of care could be compromised to some degree, since average cost and quality are uniquely related and most hospitals face quality constraint and efficiency-enhancing constraint (Zwanziger et al 2000). Deficiencies in the quality of health care are often found when hospitals are in financial difficulties or experience financial stress (Shen 2003, Seshamani, Zhu & Volpp 2006). In either case of cost shifting or cost cutting, it is still important to understand whether the price cut by the BBA of 1997 adversely affect the health care service quality.

A large volume of research has examined hospital cost shifting since the 1980, using the exogenous financial impact imposed by the introduction of PPS (Morrisey 1994), however, there is few empirical research on hospitals' cost shifting after the BBA of 1997 in the dramatically changing hospital market environment (Frakt 2011, Wu 2010). Additionally, existing research of hospital cost shifting focus on the industry organizational aspect, or in other words, the market power of hospitals (Morrisey 2003).

This study examines whether hospitals did cost shifting during the period of 1998 to 2002 by analyzing how the private patient price changed given the exogenous payment cuts by the BBA of 1997. I further examine the possible impacts of the BBA of 1997 on the Hospital Acquired Infection (HAI) rate. This study may contribute to the literature in several aspects. Firstly, the literature on cost shifting due to the BBA of 1997 was updated by analyzing how the private price changed during each year from 1998 to 2002, whereas previous studies only looked at one difference period from 1996 and 2000 (Wu 2010). Secondly, the heterogeneity in cost shifting by hospital financial distress status was analyzed, which enriches understanding of why hospitals get engaged in cost-shifting. Thirdly, the HAI rate is a better health service quality measurement than the mortality of Acute Myocardial Infarction patients in most current literature (Wu & Shen 2011, Volpp *et al* 2005, Seshamani, Schwartz & Volpp 2006), because the HAI rate is not subject to the potential "Window Dressing" effect and can well reflect the overall operation and management in a hospital.

This rest of this paper proceeds as follows. Chapter 2 introduces the Medicare and Prospective Payment System (PPS), under which BBA of 1997 was introduced and changed the way how the PPS payment was calculated. Chapter 2 also briefly describes the possible shift of market power between hospitals and the plans, because the market environment of hospitals operation observed dramatic changes during the 1990's and hospitals' cost shifting behaviors were subject to the shifts of market power.

Chapter 3 reviews the literatures of cost shifting. The literature can be largely divided into theoretical models and empirical tests. I reviewed the models based on market power hypothesis and strategic game hypothesis regarding cost shifting in for-profit hospitals and non-for-profit hospitals. The empirical method of testing cost shifting plays an important role in finding cost shifting evidence, and therefore is a central issue among the literature. In Chapter 3, I followed the standards set by Morrisey (1994) and Frakt (2011), and categorized the empirical methods of testing cost shifting into three types, namely cross-sectional studies, fixed-effect models, and long-difference models. Apart from the changes in private price upon the price cut by public payer, the changes in health outcome or in health care quality are also considered as indirect evidence of cost shifting.

Chapter 4 briefly describes the datasets used in this study. The major data source for constructing the BBA Financial Impact Index and analyzing cost shifting is from Healthcare Cost Report Information System (HCRIS) maintained by the Center of Medicare and Medicaid Service (CMS). I used the Pennsylvania Health Care Cost Containment Council (PHC4) dataset to examine the health outcome in terms of the Hospital Acquired Infection (HAI), using occurrence rate of sepsis and pneumonia associated with invasive surgical procedures as the proxy.

In Chapter 5, I found that during the period of 1996 to 2002, hospitals on average were able to shift the expected revenue loss of BBA to private patient almost on a one-dollar-to-one-dollar basis. However, the hospitals did not shift the expected loss equally every year. It appears that hospitals shifted most cost during the first three years after the implementation of the BBA of 1997, whereas the cost shifting during the period of 2001 to 2002 was not measurable. I also found that while cost-shifting did not vary by ownership or teaching affiliation, hospitals with financial distress did more cost-shifting than those without financial distress.

In Chapter 6, I studied the impacts of the BBA of 1997 on health outcome. I found that the BBA of 1997 had no significant impact on the health outcome measured by the HAI rate. At last, I summarize the major finding of this study and discuss future research directions in Chapter 7.

Chapter 2 Background

2.1 Medicare and Prospective Payment System (PPS)

Medicare is a social insurance program administered by the United States government, providing health insurance coverage to the persons who are aged 65 and over; to those who are under 65 and permanently physically disabled or who have a congenital physical disability; or to those who meet other special criteria (Newhouse 2002). Medicare program was initially enacted according to the Social Security Act of 1965. The original Medicare payment system was designed to be a modified fee-for-service model, following the existing health insurance market dominated by Blue Cross-Blue Shield. Medicare reimbursed hospitals retrospectively for the customary, prevailing, and reasonable charges, which are defined as the lowest of the following charges: (1) the physician's actual charge, (2) the physician's customary charge (i.e., the median of an individual physician's charges for a specific service within a specific time interval), or (3) the prevailing charge (i.e., the fee in the 90th, and later the 75th, percentile charged by specialty-specific physicians within a Medicare payment area). Under this system of cost reimbursement, Medicare reimbursed hospitals for a share of their capital and labor inpatient expenses, which was proportionate to Medicare's share of patient days in the hospital. This reimbursement system set no limits on the cost, therefore physicians were not motivated to do cost-control but had the incentives to raise charges, leading to a rapid increase in the program payments (Newhourse 2002, Hariri 2007).

In an attempt to slow the rapid growth of health care costs and Medicare spending, Medicare Prospective Payment System (PPS) was implemented in October 1983 (fiscal year 1984) (Newhouse 2002). A Prospective Payment System is a method of reimbursement in which

Medicare payment is made based on a predetermined and fixed amount. PPS adopts a per-case reimbursement mechanism, under which inpatient admission cases are classified into relatively homogeneous categories called diagnosis-related groups (DRGs). For hospital care provided to each DRG, Medicare pays hospitals a flat rate per case. The purpose of PPS is to reward efficient hospitals for their efficiency and to force inefficient hospitals to become more efficient.[3]

CMS uses separate PPSs for reimbursement to acute inpatient hospitals, home health agencies, hospice, hospital outpatient, inpatient psychiatric facilities, inpatient rehabilitation facilities, long-term care hospitals and skilled nursing facilities. The Social Security Act (the Act) establishes a system of payment for the operating costs of acute care hospital inpatient stays under Medicare Part A (Hospital Insurance) based on prospectively set rates. This payment system is referred to as the Inpatient Prospective Payment System (IPPS).[4]

The IPPS payment system includes the core elements as below:

- The MS-DRG relative weights, which account for the differences in the mix of patients treated across hospitals.
- The standardized amounts, which are the basic payment amounts.
- A wage index to account for the differences in hospital labor costs.
- An add-on payment for hospitals that serve a disproportionate share of low-income patients.

[3] CMS: Medicare, Prospective Payment Systems (General Information), http://www.cms.gov/ProspMedicare FeeSvcPmtGen/

[4] Acute Inpatient PPS, http://www.cms.gov/AcuteInpatientPPS/01_overview.asp#TopOfPage

- An add-on payment for hospitals that incur indirect costs of medical education.
- An add-on payment for cases utilizing technologies that are approved under the new technology add-on payment criteria.
- An additional payment for cases that are unusually costly, called outliers.

The direct costs of medical education for interns and residents are paid based on a per resident payment amount. The following costs continue to be paid on a reasonable cost basis: Hospital bad debts attributable to nonpayment of the Medicare deductible and coinsurance; heart, liver, lung and kidney acquisition costs incurred by an approved transplant facility.

The average Medicare prospective payment for hospital *i* at time *t* can be calculated using the formula[5] (Research Data Assistance Center 2006) in Equation (2.1):

$$PPS\ payment_{it} = [base\ payment\ rate]_{it} \times [CMI]_{it} \times [adjustments]_{it} \qquad (2.1)$$

Where, $base\ payment\ rate_{it} = (base\ payment)_{it-1} \times (1 + update\ factor_{it})$

$adjustments_{it} = (1 + IME_{it} + DSH_{it}) \times (1 + OUT_{it})$

IME = Indirect medical education adjustment;

DSH = Disproportionate share adjustment;

OUT = Expected outlier share for costs.

[5] The formula for calculating hospital average DRG payment is based on the formula for calculating the hospital specific DRG payment for a single case, which is provided by Research Data Assistance Center at http://www.resdac.org/tools/TBs/TN-004_CalculatingHospitalDRG_508.pdf .

The base payment rate

The base payment rate is comprised of a standardized amount, which is divided into a labor-related and non-labor share as in Equation (2.2). The labor-related share is adjusted by the wage index applicable to the area where the hospital is located and if the hospital is located in Alaska or Hawaii, the non-labor share is adjusted by a cost of living adjustment factor.

Base payment rate = (Standardized Labor Share × Operating Wage Index) + (Standardized Non-Labor Share × Operating COLA Adjustment for Hospitals Located in Alaska and Hawaii) (2.2)

Since October 1, 1996, the labor-related share accounts for 71.2 % of the standardized amount of operating costs, while the non-labor-related portion is 28.8 %. The labor-related portion of the standardized amounts is decided by summing the percentages of the labor-related items, which include wages and salaries, employee benefits, professional fees, business services, computer and data processing services, postage, and all other labor-intensive services in the operating hospital market basket.[6]

The standardized amounts are based on 1981 hospital costs per Medicare discharge that have been adjusted to account for differences in certain hospital costs, such as case-mix, wage rates and any additional payment received for disproportionate share status (DSH) and indirect medical education (IME).

[6] Federal Register / Vol. 62, No. 168 / Friday, August 29, 1997 / Rules and Regulations, pp 45995.

The base year costs are increased by an update factor (commonly known as the inpatient hospital market basket) for every year since 1981. These update factors are set by the Congress, and are intended to account for annual inflation while maintaining incentives for hospitals to be efficient. Under current laws, hospitals that do not report hospital quality data are subject to a reduced update factor.

Case Mix Index (CMI)

Case Mix Index (CMI) is constructed to measure the average DRG relative weight[7] for a hospital. A hospital's CMI is calculated by summing the DRG weights for all Medicare discharges and dividing by the number of discharges. CMI is one of the most commonly used indicators of the intensity of hospital resource utilization in health services research. On the basis of transfer adjustment, CMI can be classified into transfer-adjusted and unadjusted cases. Since 1998 CMS has started compute Final Rule Case Mix Index and updated it annually in Final Rule of the IPPS.

Hospital market basket

[7] Under the IPPS, each case is categorized into a *diagnosis-related group* (DRG). Each DRG has a payment weight assigned to it, based on the average resources used to treat Medicare patients in that DRG. Hospitals submit a bill for each Medicare patient they treat to their Medicare fiscal intermediary (a private insurance company that contracts with Medicare to carry out the operational functions of the Medicare program). Based on the information provided on the bill, the case is categorized into a Medicare Severity Diagnosis Related Group (MS-DRG), which determines how much payment the hospital receives.

The hospital ‘‘market basket’’ refers to the hospital input price index, which is the inflation component update factor for operating costs of hospitals.[8] The market basket composites cost category weights and price proxies based on the mix of goods and services used to produce hospital care. The basket includes four major expense categories, namely, wages and salaries, employee benefits, pharmaceuticals, and a residual category. Since fiscal year 1997, the market basket’s cost structure was rebased from FY 1987 to FY 1992.[9] The data of major expense categories are from Medicare hospital cost reports for the periods beginning in FY 1992. (The fiscal year 1992 begins on or after October 1, 1991 and ends before October 1, 1992.)

Wage Index

The wage index is an adjustment factor to reflect area differences in hospital wage levels. The wage index indicates the relative hospital wage level in the geographic area of the hospital compared to the national average hospital wage level.

$$wage\ index\ = \frac{an\ area's\ average\ hourly\ wage}{the\ national\ average\ hourly\ wage} \tag{2.3}$$

A labor market area's *wage index* value is the ratio of the area's average hourly wage to the national average hourly wage.[10] And the wage index adjustment factor is applied only to the

[8] Federal Register / Vol. 62, No. 168 / Friday, August 29, 1997 / Rules and Regulations, pp45993 (Final Rule: FY1998 Changes to the hospital IPPS).

[9] Rebasing means moving the base year for the structure of costs of an input price index. Revising means changing data sources, cost categories, or price proxies used in the input price index for a given base year.

[10] Average hourly wage for each labor market area = total wage costs/total hours for all hospitals in the geographic area. National average hourly wage= total wage costs/total hours for all hospitals in the nation.

labor portion of the standardized amounts. The wage index is updated annually on the basis of a survey of wages and wage-related costs of short-term, acute care hospitals. CMS derives the wage index using data from the Medicare Cost Report, the Hospital Wage Index Occupational Mix Survey, hospitals' payroll records, contracts, and other wage-related documentation.

Currently hospital geographic areas (labor market areas) are defined on the basis of *Core-Based Statistical Areas* (CBSAs), which were established by the Office of Management and Budget and announced in December 2003.

Disproportionate Share Adjustment (DSH)

Disproportionate share hospital (DSH) adjustment is an add-on payment applied to the DRG-adjusted base payment rate for hospitals that are qualified the condition of treating a high-percentage of low-income patients. There are two statutory formulas designed to identify hospitals that serve a disproportionate share of low-income patients, namely, (1) DSH-patient-percentage method and (2) special-exception method.

The primary method is DSH-patient-percentage method, which is based on a formula that results in the DSH patient percentage. The DSH patient percentage, as shown in Equation (2.4), is equal to the sum of 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 by not Medicare Part A.

DSH Patient Percent = (Medicare Supplemental Security Income Days / Total Medicare Days) + (Medicaid, Non-Medicare Days / Total Patient Days) (2.4)

Medicare Supplemental Security Income Days are the hospital patient days used by patients who were entitled to both Medicare Part A and Supplemental Security Income (SSI). Total Medicare Days are patient days used by patients under Medicare Part A for that same period. Medicaid, Non-Medicare Days includes hospital patient days used by patients who were eligible for medical assistance under a state plan approved under title XIX (Medicaid), but who were not entitled to Medicare Part A. Total patient days are the total number of hospital patient days for that same period.

The alternate special exception method is for large urban hospitals that can demonstrate that more than 30% of their total net inpatient care revenues come from the State and local governments for indigent care (other than Medicare or Medicaid). Hospitals whose DSH patient percentage exceeds 15% are eligible for a DSH payment adjustment based on another statutory formula.[11]

Indirect medical education adjustment (IME)

IME is an added-on designed to reflect the higher patient care costs of teaching hospitals relative to non-teaching hospitals. An approved teaching hospital, which has residents in an approved graduate medical education program, receives indirect medical education adjustment. Under the IPPS, IME adjustment for operating costs depends on the ratio of residents-to-beds and for capital costs on the ratio of residents-to-average daily census.

The teaching IME adjustment to DRG payments is calculated as in Equation (2.5)

[11] The formula varies for urban hospitals with 100 or more beds and rural hospitals with 500 or more beds, hospital that qualify as rural referral centers or sole community hospitals, and other hospitals.

$$IME\ percentage = c \times [(1 + r)^{0.405} - 1] \quad (2.5)$$

Where c is a multiplier that is set by the Congress and has been subject to change in different legislation, and r is hospital's resident-to-bed ratio. Thus, the amount of IME payment that a hospital receives is dependent upon the number of residents the hospital trains and the current level of the IME multiplier. Based on the computing formula, IME percentage is traditionally interpreted as a certain percentage increase in payment for every 10% increase in the resident-to-bed ratio.

Outlier payment (OUT)

In addition to the basic prospective payments, outlier payment is made for outlier cases, which are some particular cases and incur extraordinarily high costs. To qualify for outlier payments, a case must have costs exceeding a fixed-loss outlier threshold amount. CMS publishes the outlier threshold in the annual Inpatient Prospective Payment System (IPPS) Final Rule. For Federal fiscal year (FY) 2005, the existing fixed-loss outlier threshold was $25,800.

The qualifying factors of outlier payment include operating cost, capital costs and DRG payments. The operating and capital costs are computed by multiplying the total covered charges by the operating and capital cost-to-charge ratios, respectively. Outlier payments are then made based on a marginal cost factor equal to 80% of the combined operating and capital costs in excess of the fixed-loss threshold (90% for burn DRGs).The thresholds are also area-wage-index-adjusted.

2.2 The Balanced Budget Act (BBA) of 1997

The Balanced Budget Act (BBA) of 1997 tried to exercise cost-containment in Medicare in various ways and made many changes to the Medicare reimbursement policies. It affected all core factors of Medicare payments for hospital inpatient services under the prospective payment systems.

1) Hospital operating payment update factor

The BBA of 1997 tried to slow down the growth of medical expenditures by reducing the update factor of the standardized amount in the base payment. It ruled that the applicable percentage change in the standardized amounts was 0% for FY 1998, the market basket percentage increase minus 1.9 percentage points for all hospitals in all areas for FY 1999, the market basket percentage increase minus 1.8 percentage points for hospitals in all areas for FY 2000, the market basket percentage increase minus 1.1 percentage points for hospitals for all areas for FYs 2001 and 2002, and the market basket percentage increase for hospitals in all areas for FY 2003 and subsequent fiscal years.[12]

2) Disproportionate Share Payments

BBA reduce the DSH payments by 1 %; 2 % for October 1, 1998; 3 % for October 1, 1999; 3 % for October 1, 2000 through March 31, 2001; 1 % for April 1, 2001 through September 30, 2001; 3 % for October 1, 2001 through September 30, 2002; and 0 % thereafter.[13]

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[12] BBA of 1997, Section 4401(a).

[13] BBA of 1997, Section 4403; HICRS Pr2_3630 Manual.

3) Indirect Medical Education

The BBA reduced the level of the IME multiplier over a 4-year period, because there was a concern that the IME adjustment overpaid hospitals relative to their additional teaching costs. The BBA revised the IME formula to reduce the IME adjustment factor from 7.7 % to 7.0 % in FY 1998, 6.5 % in FY 1999, 6.0 % in FY 2000, and 5.5 % in FY 2001 and subsequent fiscal years.[14] However, the Balanced Budget Refinement Act (BBRA) of 1999 Reforms slowed the transition set by the BBA for the IME adjustment factor. For FY 2000, special payments were made to each hospital to maintain the IME factor at 6.5 %. For FY 2001, the factor increased to 6.25 %. The implementation of the factor at 5.5 % was delayed until FY 2002.

Benefits Improvement and Protection Act (BIPA) of 2000 Reforms changed the IME payment add-on for FY 2001 to 6.25 % for discharges occurring on October 1, 2000 and before April 1, 2001, and to 6.75 % for discharges occurring after April 1, 2001 and before October 1, 2001. The IME adjustment was 6.5 % in FY 2002 and 5.5 % in FY 2003 and subsequent years.

Beginning in FY 1998, *IME and DSH payments* was made on the base of DRG payment rates rather than outlier payments. The *IME formula* was revised to reduce the IME adjustment factor from 7.7 % to 7.0 % in FY 1998, 6.5 % in FY 1999, 6.0 % in FY 2000, and 5.5 % in FY 2001 and subsequent fiscal years. Or, on or after October 1, 1988, and before October 1, 1997, ‘c’ (the IME multiplier in the formula) is set to be 1.89, 1.72 for fiscal year 1998, 1.6 for fiscal year 1999, 1.47 for fiscal year 2000, and 1.35 for fiscal year 2001 and after. In Table 2-1 I

[14]BBA of 1997, Section 4621(a).

summarize the actual IME multipliers hospitals received, which have reflected the amendments by BBRA and BIPA.

4) Outlier Payments

In determining outlier payments, the fixed loss cost outlier threshold will encompass payments for IME and DSH (Section 4405). BBA changed the formula of calculating outlier payment in two ways. First, BBA rules that the IME and DSH adjustment factors are applied only to the base DRG payment, rather than the sum of the base DRG payment and any cost outlier payments. Second, BBA requires that the fixed loss cost outlier threshold is based on the sum of DRG payments and IME and DSH payments for purposes of comparing costs to payments. Thus,

Before the Change of BBA

Standard Cost = Billed Charges Cost to Charge Ratio × (1 + IME + DSH)

Outlier Payments = 80% × Standard Cost Threshold × (1 +IME + DSH)

Total Payments = (Outlier Payments +Federal Rate) × (1 + IME + DSH)

After the Change of BBA

Standard Cost = Billed Charges × Cost to Charge Ratio

Outlier Payments = 80% × Standard Cost Threshold

Total Payments = Federal Rate × (1 + IME + DSH) +Outlier Payments

As indicated above, the BBA of 1997 changes the calculation of outliers' payment in the following ways:

First, in the old formula, the standard cost is adjusted downward by "1 + IME + DSH" to reflect the IME and DSH adjustments that hospitals already received. The BBA of 1997 will not standardize the costs of the case to account for IME and DSH payments. Therefore, an IME-and-DSH hospital and a Non-IME-and-DSH hospital will face the same standard cost, and an IME-and-DSH hospital has a higher standard cost than before. Second, BBA took IME and DSH adjustment out of the outlier payment .Given the same standard cost and threshold, the outlier payment after the change of BBA would be smaller than before. Under the new method, the outlier threshold also increases for all hospitals. Third, BBA outlier payment is distracted from the base payment when calculating the total payment.

It is possible that the impact of changes on the outlier payment might be heterogeneous given hospitals' IME and DSH status. Final Rule FY 1998 shows a numerical example, in which outlier payment in an IME-and-DSH hospital increases by 1.1% from $51043.96 to $51592.13, whereas outlier payment in a non-IME-and-DSH hospital decreases by 1.9% from $52207.19 to $51210.24. However, in this example CMS did not take into consideration the impact on the total payment due to taking outlier payment out of the base payment.[15] In the case that the majority of hospitals under the PPS system are non-IME-and-DSH hospitals, the net effect of the changes of outlier payment will be reducing the total payment.

[15] Federal Register / Vol. 62, No. 168 / Friday, August 29, 1997 / Rules and Regulations, pp 45997.

In addition, BBA tried to remove hospitals' financial incentives to lower cost by substituting hospital stay with post-acute services. BBA chose ten DRGS with high use of post-acute services and modified the DRG payment for patients who were discharged relatively sooner than the mean length of stay and used post-acute services.

2.3 Shifting of Market Power: Hospitals *verses* Managed Care

Many economists believe that cost shifting is a symptom of market power by hospitals (Morrisey 2003). The major feature of market environment in the late 1990s and early 2000s is characterized by the shifting of market power between hospitals and managed care plans. Market power is defined as the degree of control or influence that an organization has over another organization (Devers 2003). In other words, whether a hospital can actually do cost shifting depends on how much market power this hospital has over the private insurance payers. During the 1990s and early 2000s with different growth stages of HMO enrollment, there were shifts of market power between hospitals and healthcare management organizations. This section briefly reviews three stages of the market power shifts between hospitals and HMOs during the 1990s and early 2000s.

"Contract taker" hospitals during 1990-1996

During the rising era of managed care from 1992 to1997, managed care plans using selective contracting strategy obtained some degree of market power from hospitals. In the early 1990s, HMO enrollees grew from 3 million in 1970 to the peak of over 80 million in 1999. This increase equated to a 12 % increase every single year, and the national enrollment grew every single year during this period as well. By 1995, survey results show that managed care covered nearly 75% of insured working Americans. Even small employers are switching to managed care (Jensen 1997). Selective contracting was one of the major innovations of managed care that changed competitive dynamics in the hospital sector and increased plans' negotiating leverage with hospitals. Under selective contracting, plans would contract with a subset of hospitals in the market and, through a variety of techniques, strongly encourage physicians and members to only utilize those facilities.

Facing the selective contracting strategies by the insurance plans, hospitals found it difficult to do cost shifting for several reasons. First, the priority of a hospital's surviving strategy was to secure a contract with a plan and to secure large blocks of patients channeled by the plans. Second, the competition between hospitals had evolved from the arm-race or the equipment-and-quality competition in the 1980s and become a price-oriented one. Prices played a larger role in the hospital competition because purchasers of the plans usually were employers rather than patients per see. These employer plan-purchasers were more price-sensitive than individual insures were. And they also can push insurance plans hard to negotiate with hospitals for better terms, especially lower payment rates with hospitals. Additionally, managed care also acquired a certain portion of the market power through exercising utilization review and management, hospitalization length reduction, or shifting to outpatient. As the results of selective contracting strategy, hospitals may subject to a relative oversupply of hospital beds and this excess capacity further enhanced plans negotiation power of threatening to switching large group of patients from one hospital to another. Most hospitals became "contract takers" during 1990-1996 and the market power was largely shifted to the plans (Devers *et al* 2003).

Backlash against Managed Care in late 1990s and early 2000s

With the rapid growth of managed care, a managed care backlash, which is a collective behavioral response led by attacks from threatened professional, provider, and special interest, became widely shared in the health policy community (Havighurst 2001). Because many managed care health plans were provided by for-profit companies, their cost-control efforts created widespread perception that they were more interested in saving money than providing health care. These public perceptions have been fairly consistent in polling since 1997. The backlash included vocal critics, including disgruntled patients and consumer-advocacy groups, who argued that managed care plans were controlling costs by denying medically necessary services to patients, even in life-threatening situations, or by providing low-quality care (Mechanic 2004, Blendon 1998). The Patient's Bill of Rights was passed by the United States Congress in 1998. Many states passed laws mandating managed-care standards and weakening the plans' negotiating leverage with hospitals. During the late 1990s, due to a tight labor market and rising corporate profits, employers no longer pushed hard to control health plan but took the strategy of retaining employees by maintaining or improving their health insurance benefits.

In early 2000 there were some signs that plans were losing market powers. First, plans became less selective contracting, emphasizing wide geographic coverage and having more providers in their networks to increase the attractiveness to purchasers and consumers. A survey of Managed Care plans in 2000-2001 revealed that many plans set no rule to exclude providers from their networks (Devers *et al* 2003). Since the selective-contracting strategy of plans was weakened, plans had lost a large portion of market power when negotiating with providers. Second, plans showed declining ability to channel patients to providers. Since patient channeling ability plays an important role in the price negotiation (Wu 2009), when providers realized that managed care plans could no longer guarantee greater patient volume, they would no longer agree to give the price discounts as great as they used to.

Considering the market environment featured by backlash again managed care during this period, Ginsburg (2003) points out that the market conditions in the late 1990s and the early 2000s are much more favorable to cost shifting than was the case in the 1980s. Ginsburg argues that even though in general hospitals had less market power under managed care than before, some hospitals appeared to have regained some of the market power that they had lost by the mid-1990s. Indeed, hospitals might increase the level of consolidation, or implement physician-integration strategies to build greater hospital–physician alignment, strengthened negotiating power over plans.

Finally, the mounting financial pressure resulted from the BBA of 1997 may prompt hospitals to exercise their market power with private plans (Devers *et al* 2003). Many hospitals suffered greatly from the cutbacks in Medicare reimbursement rates by BBA. At the same time, emerging labor shortages, new technologies (including investment in information systems), and pharmaceuticals pushed hospital costs to even higher level. After hospital sector had been relatively consolidated, mounting financial pressure was believed to be one of the primary reasons for hospitals' more aggressive negotiating stances.

Table 2-1: Changes in IME calculation formula

Formula	FY94 to FY97	FY 98	FY 99	FY00	FY01
1	$1.89\times[(1+r)^{0.405}-1]$	$1.72\times[(1+r)^{0.405}-1]$	$1.6\times[(1+r)^{0.405}-1]$	$1.47\times[(1+r)^{0.405}-1]$	$1.35\times[(1+r)^{0.405}-1]$
2	7.7×R	7.0×R (BBA 97)	6.5×R (BBA 97)	6.25×R (BBRA 99)	6.5×R

Chapter 3 Cost Shifting Literature Review

3.1 Theoretical models of cost shifting

In theory, cost shifting can occur only if two conditions are met. First, the provider must have sufficient market power to raise prices to private payers. Second, the provider must not have been fully exercising that power (Morrisey 1994). Based on profit-maximization theory, cost shifting should not occur because a hospital with market power should be profit-maximizes, exercising its market power on all payers at all times. In utility-maximizing model, cost shifting could occur because a non-for-profit hospital may selectively exercise its market power on the basis of temporal financial conditions. Emphasizing the largely weakened market power of hospitals in a competitive market environment, "strategy models" is aimed to explain cost-shifting as the dynamic pricing games between public payers and private payers.

3.1.1 Market power hypothesis

With different assumptions about hospitals' objective function, profit-maximizing and utility maximizing models are used to model hospitals behaviors and lead to different conclusions regarding if hospitals have marketing power to do cost-shifting.

A. Cost shifting in profit maximization model

Hay (1983) and Foster (1985) used simple profit maximization models to examine theoretically the relationship of government price cut with the changes of private price given a certain type of economy of scale. Hay (1983) has concluded that declines in government reimbursement induce cost shifting only if a profit-maximizing provider incurs diseconomies of scale in production. In profit maximization models, hospitals are assumed to be monopolistic profit-maximizers, providing identical services to both the private and government sectors. Because government price has been decided and does not change with volume, a profit-maximizing hospital produces services setting the marginal revenue equals the marginal cost of care.

Profit-maximizing-hospital models generally suggest there are no direct correlations between payment cut by public payer and the price increase by private payers, because a profit-maximizing hospital with market power has already set prices at profit-maximizing level. When a hospital is operating with an increasing return to scale, profit-maximizing model implies a lower price for private sector as the response to the public payer's price cut. This is because a profit-maximizing hospital has already fully exploited its market power before the government price change by choosing respectively the quantity of services provided to the government programs and private market to maximize profits. When the public payer cut the reimbursement rate (the price), the hospital will reset the service quantity provided to the public sector and the private sector to maximize its profit. Given the lower public price, it will shift part of its capacity from the public patient market to private patients market. Facing a downward sloping demand curve in the private market, a profit-maximizing hospital has to lower the private patient price to realize larger utilization of the medical service. This phenomenon is called "reverse cost shifting" (Morrisey 1994).

In short, in response to lower public payments, profit maximization model predicts that hospitals may NOT engage in dynamic cost-shifting. Instead, there will be a volume shift (lower public volume, higher private volume) and a price spillover effect, or "reverse cost shifting" (lower private payments as well) (Foster1985, Morrisey 1994).

Morrisey (1994) believes that profit-maximizing model is also applicable to non-for-profit hospitals because in order to maximize resources for charitable purposes these hospitals can also charge profit-maximizing prices to some payers. Therefore, "reverse cost shifting" or no-cost-shifting response is also expected from non-for-profit hospitals that seek to maximize revenue in service to charitable work.

However, non-for-profit hospitals actually are the major members of this industry, and many economists feel resistant to generalize the profit-maximizing model to all hospitals and to accept the prediction of "reverse cost shifting" or no cost shifting by appealing to a profit-maximization assumption. Zwanziger (2000) points that the fundamental weakness of Profit-maximizing model about hospital cost shifting lies in the assumption of profit-maximizing rules. Ginsburg (2003) argues that non-for-profit hospitals may not consistently maximize anything because they can be guided by vague missions and influenced by stakeholders with differing objectives.

B. Cost shifting in non-for-profit hospitals (utility maximization)

Instead of simple profit-maximizing model, Dranove (1988) developed a utility-maximization model with fixed average cost across payers to analyze cost-shifting. Dranove incorporated Newhouse's assumption that NFP hospitals' utility is decided together by the volume of services and profits as administrators would derive benefit from institutions that were large and had a reputation for providing high quality. In this model, hospitals are capable of cost shifting by raising prices to private payers in response to reductions in public payer payment. Hospital's underutilized market power is a critical condition that enables cost shifting to occur. Hospitals would not do cost shifting if demand in the private sector is elastic and an increase in prices to private insurers would reduce hospital profits.

On the basis of Dranove (1988) and Newhouse's utility function for non-for-profit hospitals, Zwanziger *et al* (2000) assume that most hospitals face quality constraint and efficiency-enhancing constraint. Average cost and quality are uniquely related, so that cost cutting will compromise quality to some degree, rather than increases operational efficiency. This model also assumes that hospitals can adjust the average price to private payers and the average cost two parameters to maximize their utility. This model inferred that hospitals would be able to respond to external operating changes with two generic strategies: one is to adjust prices to their privately ensured patients, and the other is to adjust the cost (quality) level.

Using the same utility-maximizing model, Cutler (1998) has graphically shown that both cost-shifting and cost cutting are possible as hospitals' response to a public price cut. In his model, a hospital makes zero profits on the hospital's income from Medicare and private patients, but may gain "residual claimants" to finance its self-perceived mission, such as caring for the uninsured, teaching, research, or investment in new technologies. Hospitals value both lower price (charity care) to private patients and more profit available for its mission. When there is a Medicare payment reductions, the utility maximizing hospital will reduce both its "charity" care to private patients and its profits. In other words, the impacts of Medicare payment reductions on increasing private patient price will be observed as "cost shifting", while the impacts on reduced profits, and thus the ability of the hospital to pursue its other missions, is termed "cost cutting".

Cutler (1998) also indicates that hospitals in more competitive markets, with the rise of managed care, are facing more price elastic demand and that Medicare cuts in the market will result in more cost cutting and less cost shifting than in the market with less elastic demand. Cutler predicts that despite of the possibility, cost shifting should be less prevalent in markets where managed care has wide penetration and strong negotiation power.

3.1.2 Strategic game hypothesis

Emphasizing the important role of market power in explaining why hospital costs shift, market power models assume that dynamic cost-shifting is caused by the price cut of public payers. However, there is another group of researchers who believe that the market power of hospitals is probably diminishing as more and more payers adopt price-setting policies and selective hospital contracts (Ma & McGuire, 1993). Wu (2010) terms this group of theories as "strategy models". Instead of emphasizing the role of hospital ownership or market power, strategy hypothesis tries to capture the dynamic pricing games between public payers and private payers. According to this group of models, public payers may behave strategically in setting price (intentionally set the price low as responses to the price setting of private payers).

Assuming a price-taking hospital interested in profit-maximizing, Ma and McGuire (1993) analyze a regulatory game between a public and a private payer to finance hospital joint costs (mainly capital and technology expenses). To reflect the difficulty of specifying technology and capital cost in health care, they assume that the payments to hospitals can be based upon the level of joint costs ex post, but that hospitals can not be directed to adopt a level of joint costs ex ante. Partially reimbursing the joint costs is a feasible policy, but specifying a particular level is unrealistic. The public payer may both directly reimburse for joint costs ("pass-through" payments) and add a margin over variable costs paid per discharge, while the private payer can only use a margin policy. The hospital chooses joint costs in response to payers' overall payment incentives. The model demonstrates that without “pass-through” payments public payer may under-reimburse hospital joint costs and enjoy free-riding due to the first-mover advantage. According to this study, cost-shifting does not depend on the market power of hospitals. Instead, it is decided by the public payer’s relative ability of free riding and the private payer’s ability to commit to a strategy, and the availability of other strategies.

Following the same utility-maximizing hospital assumption, Glazer and McGuire (1994) assume that both public and private payers have to enter contracts with the hospital on the basis of allocated cost because the true cost per patient is not a possible basis for payment. Payers can set fully prospective payment system or fully retrospective fee-based payment system, or a mixture of these two systems. The model demonstrates that in equilibrium hospital input decisions are distorted by the payers’ incentives to engage in cost shifting.

In a related research, Glazer and McGuire (2002) studied the interactions between a public payer (Medicare) and a private payer. The public payer sets the price as the first mover and takes any provider who is willing to participate. The private payer pays a price on the basis of quality, and a provider/plan, in the presence of shared elements of quality. Because the public payer has different objectives and contracting practices from a private payer, the service qualities desired by these two payers from the provider are believed to be different. However, the provider faces a challenge of “shared elements of quality”, which means that some service characteristics or quality by the provider can not be offered separately and have to be shared by both payers.

The provider compromises on quality in response to divergent incentives from payers. In this way, shared elements of quality provide chances of free-riding.

According to Glazer and McGuire (2002)'s model, when Medicare is a small payer in a market and when it makes pricing mistakes by focusing too much on the details of its payment formulae with little effect on the quality of services offered by plans, private payers practice reasonably efficient contracting and can mitigate the mistakes by Medicare. As a result, Medicare initiatives of price setting will be diluted. Therefore, if Medicare behaves strategically by setting its prices too low and committing to a price, it can free-ride on the quality set by the private payer.

Strategy hypothesis has several empirical implications. First, hospitals that largely rely on private payers should do little cost shifting, because the joint cost and quality level have been set close to the utility maximization level, or the dilution effects by private sectors will offset the impacts by public sector. This also implies that testing an "interaction term" of Medicare policy change with share of Medicare at a provider or plan level. Second, hospitals that have high degree of commonality in shared quality will easily do cost shifting, because hospitals can easily shift joint cost to private payers if the public payer strategically set the price low. However, it is very hard to test the second empirical implication because it is difficult to measure the degree of commonality in shared quality, although some researches try to check if "practice-level" incentives matter along with "payer-level" incentives in the behavior of providers, in order to check for commonality.

3.2 Empirical approaches and tests

During the past twenty years there has been a debate about whether hospitals and physicians actually are engaged in the practice of cost shifting. The majority of empirical study about cost shifting focuses on empirical evidences of cost shifting and finds mixed results. Many empirical studies are based on the utility maximizing model and market power model hypothesis (Zuckerman 1987, Dranove 1988, Zwaniger 2000, Friesner & Rosenman 2002). There are few empirical studies aiming at testing the market power hypothesis and strategic hypothesis, or explaining the causes of hospital cost shifting and the heterogeneous degree of cost shifting except Wu (2010).

3.2.1 The empirical models

The empirical method of testing cost shifting plays an important role in finding cost shifting evidence, and therefore is a central issue among the literature. It can be classified into three types: 1) cross-sectional studies, 2) fixed-effect model, and 3) long-difference model (Morrisey 1994, Wu 2010, Frakt 2011).

1) Cross-sectional studies

Cross-sectional studies examine the variation of profits or payment-cost ratio across providers at a specific point of time. They do not include year effects or provider effects. The price differences captured by this model are static price phenomenon and actually are price-discrimination in nature, rather than dynamic cost shifting, which is the variation or the changes across the time. In a cross sectional study, any local market-specific factors that change the hospital's market power with private payers will lead to the variations in private prices accordingly. For this reason, the evidences that are found in cross-sectional studies are not observing cost shifting per se, but price discrimination, which is the simple difference in market power (Morrisey 1994).

2) Fixed-effect model

This model applies panel data techniques to control dynamic properties of cost shifting, using a hospital-year level OLS model of per patient private payment with hospital and year fixed effects. Panel data approach estimates how private prices change due to the changes in public prices relative to their provider-specific means. It has become quite common in the literature (Friesner & Roseman 2002).

3) Long difference model

This approach differences out all time-invariant factors, but still keeps time-variant coefficient of the change. Dranove (1988)'s analysis points out potential omit-variable bias in empirical tests studying movements in profits. Any unobserved cross-sector profit shocks may cause a positively correlated movement in the profits across sectors and may bias the results towards no cost-shifting. By taking the difference of base period and observation period, the long-difference model efficiently solves the unobservable omitted variable problem in changes of private price. The hospital-specific fixed factors and other potential biases from uncontrolled hospital or market fixed effects are all differenced out in this way. The advantage of long difference model over fixed effect model is that this model gives more flexibility to control additional variables. Researches by difference model provide strong evidence of cost shifting (Morrisey 1994, Wu 2010, Frakt 2011).

3.2.2 Empirical Evidence of cost shifting

During the past twenty years there has been a debate about whether hospitals actually do cost shifting in practice. It is believed that under cost-based reimbursement system, hospitals might easily pass through cost cut to private payers, however, some scholars doubted that hospitals could still do cost shifting under the current health care system and the increasingly competitive operation environment (Lee et al. 2003). Studies from the late 1970s to early 1980s found mixed results (Morrisey 1994). During the 1990s, the market condition of hospitals has experienced dramatic changes. With the rising Managed Care penetration and the increasing market competition, it has become more difficult for cost shifting since their market power has been weakened (Morrisey 2003). Other researchers reviewing data from the same time period found that "without exception, for all hospital types during all time periods, lower Medicare prices were associated with statistically significant increases in private pay prices" (Zwansiger, Melnick, & Bamezai 2000).

The controversy was intensified after Levit *et al* (2004) reported that private health care spending, especially in the hospital sector, had been growing rapidly since the late 1990s. This close timing association between growth of medical care spending and the BBA of 1997 has brought up hot discussion about whether hospitals engaged in cost shifting in responses to the payment cut of the BBA of 1997.

A. <u>Positive Evidence of Cost-shifting</u>

Using hospital data from the 1979 AHA Reimbursement Survey, Sloan & Becker (1984) was the first to use multivariate methods to examine the cost-shifting hypothesis. This study examined the impact of discounts and third-party reimbursement on hospital costs and profitability. They find that the cost-containment efforts of the dominant payers have reduced total payments to hospitals to some degrees, but a substantial amount of cost-shifting remains. However, Morrisey (1994) criticizes that Sloan & Becker's research is purely cross-sectional in nature and any market-specific factors that enhance the hospital's market power with local commercial payers will lead to higher private prices. Their findings are actually about price-discrimination, rather than cost-shifting.

Using a difference model, Dranove (1988) studies how the change in the private patient price varied together with the change of the profits from government reimbursement during 1981 and 1982. Dranove (1988) finds that hospitals raised prices to partially offset government cutbacks. He estimates that a \$1000 reduction in government revenue led to a \$0.15 to \$0.50 increase in the average price per admission. Additionally, Dranove (1998)'s results lend strong support to a specification recognizing that hospitals with many private payers need not raise price as much in order to recover a given dollar loss provides the strongest evidence of cost shifting .

The majority of current empirical researches about cost shifting utilize the impacts from the implementation of Medicare Prospective Payment System. Rosenman *et al* (2000) has found that nonprofit hospitals tend to do more cost shifting when it suffered from a larger negative profit shock due to the price cut of Medicare PPS reimbursement. Using data from California for the period of 1983–1991, a time of increasingly intense price competition, Zwanziger *et al* (2000) finds that hospitals did increase their prices to private payers in response to reductions in Medicare rates. Hospital ownership and the competitiveness of the hospital market both affected this behavior. Zwanziger and Bamezai (2006) further uses 1993–2001 data from private hospitals in California to investigate whether decreases in Medicare and Medicaid prices are associated with the increases in prices paid for privately insured patients. They find that a 1% decrease in the average Medicare price is associated with a 0.17% increase in the corresponding price paid by privately insured patients. Cost shifting from Medicare and Medicaid to private payers is estimated to account for 12.3% of the total increase in private payers' prices from 1997 to 2001.

Most recently, using Hospital Cost Report data, Wu (2010) conducts rigorous study to test the cost shifting hypothesis. She uses a long difference model to examine cost shifting in 1990s due to the Medicare payment cut by BBA of 1997. In this study, she simulates a Medicare financial loss index to capture the exogenous impact by Medicare price cut in the BBA of 1997. She then uses this "BBA Bite" to instrument for actual change in Medicare revenue between 1996 and 2000 and finds evidence that urban hospitals were able to shift a small part of the burden of Medicare payment reduction onto private payers.

Apart from examining the average effect of cost shifting, Wu (2010) also analyzes the heterogeneity in the degree of cost shifting by testing hospital's bargaining power and its interaction terms. Her empirical findings suggest that hospitals with various characteristics may have different ability to do cost shifting. Actually, the overall estimated degree of cost shifting may vary greatly according to the hospitals' market power, which is measured by a hospital's share of private patients among all patients. In hospitals with large share of private patients, up to 37% of BBA cuts can be transferred through higher payments, while hospitals with large share of Medicare patients have no way to transfer the price cut to private patients.

B. <u>No/Small cost shifting evidence</u>

Zukerman (1987) provides strong evidence that dynamic cost shifting is not a significant problem. He uses the financial stresses associated with Medicare's Prospective Payment System (PPS) for hospitals to test hospitals' response. His identification strategy relied on the hypothesis that the hospitals with greater need to shift cost at the beginning of the period would increase their private price more. He found that limited amounts of cost-shifting occurred during the period from 1980 to 1982, and that the lower growth in Medicare payments has not resulted in cost-shifting on a widespread basis. Payment reduction of inpatient rate causes hospitals to contain costs, to seek greater outpatient revenues and to accept lower margins, however his results suggest that it is not the "need-to-cost-shift" that leads a hospital to raise its prices to commercially insured patients. Given the same need to cost shift, a hospital with 25% of commercially insured patient days actually reduced its commercial prices by 2.1%. Zuckerman (1987)'s finding supports the market power hypothesis that hospitals with larger share of privately insured patients have less power to raise the price upon a payment cut by a public payer.

While providing strong evidence of hospitals' cost shifting from the past, Dranove (1988) indicates that there are some market prerequisites for the existence of hospital cost shifting. In other words, in order to enable hospitals to do cost-shifting, patients should not be price-sensitive and hospitals have not charged the profit-maximizing price. Dranove predicts that when the market competition intensifies, hospitals will move closer to profit-maximizing prices and cost-shifting will likely disappear.

Cutler (1998) examines how reductions in hospital payments by Medicare affect hospital operations. He looks at two episodes of payment reductions: the late 1980s and the early 1990s. He finds that in the 1980s hospitals could shift the Medicare payments cut by increasing prices to private insurers on almost a one-dollar-to-one-dollar basis. However, in the 1990s, hospitals could no long do the same cost shifting as they did in the 1980s. With the growing role of managed care in private insurance during the 1990s, hospitals instead had to respond to the payments cut by cutting cost (reducing the number of beds and nurses) and sometimes by closing entirely.

Dranove & White (1998) examine how private short-term hospitals in California with large Medicaid revenue shares would respond to substantial government reimbursement cutbacks during the period from 1983 to 1992. They compare changes in hospital net prices and service volume for Medicaid, Medicare, and privately insured patients. They find no direct empirical evidence of cost-shifting among Medicaid-dependent hospitals.

Rosenman *et al* (2000) also found that the ability of a firm to obtain grants can influence a provider's decision of engaging in cost shifting. They find that hospitals who obtain substantial amounts of government grants may use these resources to offset cost shifting.

Wu (2010)'s empirical finding greatly stresses the heterogeneity of cost shifting among hospitals and suggests that hospitals serving disproportionate numbers of Medicare patients did limited cost shifting in response to BBA cuts.

3.2.3 Indirect evidence of cost shifting and impacts on health outcome

While a direct test of cost shifting looks at the effect of government price cut on the private patient prices, an indirect test of cost shifting looks at the effect of government price cut on the volume of medical service provided to eligible patients in the program and the effects of various cuts by public payers (Morrisey 1994). Upon the financial pressures caused by a public payer's price cut, a hospital may respond by both cost-shifting and cost-adjustment in various ways.

- ***Hospitals' non-price responses to financial shock***

Hospitals' non-price responses to financial shock can be further categorized into quantitative and strategic responses. Quantitative responses include patient-selection, upcoding, reducing service volume to Medicare patients, cutting the cost by reducing health care input such as staffed-beds and staff number. Strategic responses may include switching patients to outpatient departments, which are not impacted by payment cuts.

Hospital may shift less severely ill patients into outpatient care. As a result, the case-mix of average post-PPS patients may appear to be higher than before PPS implementation (Carter *et al* 1990, Russell and Manning 1989). Ellis and McGuire (1996) labeled this type of response to financial incentive as "selection effect". Hospitals also may try to reduce underutilized fixed inputs at hospital level, for example, hospital beds, or reduce variable inputs such as hospital staffing (Cutler 1998, Wu & Shen 2011).

Hospitals may change the service volume or intensity on the basis of patients' insurance status. For patients who have less generously paid insurance (e.g. Medicare), hospitals may reduce the treatment intensity or discourage their visiting. A large volume of literature report that two-years after the imposition of PPS, Medicare's average length of stay per discharge paid fell sharply and share of Medicare patient declined (Bazzoli *et al* 2004). Dranove and White (1998) find that service intensity levels fell for Medicaid (and Medicare) patients relative to those for privately insured patients after Medicare or Medicaid reimbursement cut.

There are a small number of literatures studying how service volume may change after the BBA of 1997 and the majority finds no significant evidence. Volpp *et al* (2005) finds no systematic pattern of different treatment or process-of-care measures for AMI patients among the insured and uninsured in high versus low BBA impact hospitals.

Since hospitals have substantial control over the number and types of services available to the public, hospitals also may try to reduce potential loss by strategically expanding services that are not affected by the BBA. Since the BBA of 1997 has great impact on the Inpatient Prospective Payment System, but no changes on outpatient reimbursement system, hospitals may cost shifting between outpatient and inpatient departments by sending more patients to outpatient treatment if it can reduce potential loss (Leslie & Rosenheck 1999). Bazzoli *et al* (2004) find empirical evidence showing that during the study period of 1996-1999, outpatient services in hospitals facing greater potential financial loss from BBA expanded faster by 7 percentage points than those facing less financial potential loss from BBA. And for both types of hospitals, the growth rates of outpatient services far exceeded those of inpatient admissions and days. Friesner & Rosenman (2004) uses a panel of hospitals from Washington during 1994-1999 and finds some weak evidence that non-for-profit hospitals may practice cost shifting between inpatients and outpatients as well as between patients paid by government and by private payers.

- ***Financial shock and health outcome***

When facing large exogenous financial pressures, hospitals may have to cut cost due to efficiency-enhancing constraints (Zwanziger *et al* 2000). Since average cost and quality are uniquely related in many cases in hospital industry, it has been widely concerned that price cutbacks in health care services and the following cost cutting may compromise quality to some degree and have negative impact on patient outcomes, rather than only increases operational efficiency.

There is a large body of empirical researches taking advantage of the price change by PPS to investigate the effect of exogenous financial shocks on quality of medical service. They have found evidence that financial shocks may negatively affect the health outcome of patients. Cutler (1998) found that changes in the PPS have a direct effect on the quality of care (measured by mortality), and the relationship is stronger for short-term mortality rates. Cutler (1998) examines how reductions in hospital payments by Medicare affect hospital operations and find that hospitals shifted financial loss from Medicare cutbacks in the 1980s to the private sector, however, hospitals had to cut cost to finance Medicare cutbacks in the 1990s due to the deceasing ability of hospitals to shift costs. His finding provides positive support to the theoretical model in Zwanziger *et al* (2000). Shen (2003) shows that a decrease in PPS reimbursement from 1985 to 1994 has adversely affected short-term health outcomes, but does not affect patient survival beyond one year after hospital admission.

There is a small body of literature studying financial shock impacts on service quality and patients outcome due to the BBA of 1997. Most researchers find little or no evidence on health outcomes. Using 236,506 patients from the National Registry of Myocardial Infarction (NRMI) and Medicare Cost Reports from 1996 to 2001, Volpp et al (2005) finds that process-of-care measures for both insured and uninsured patients with AMI were not appreciably affected by the revenue reductions created by the BBA of 1997. Based on analyzing the mortality rates of patients with postoperative complications in Pennsylvania, Seshamani, Zhu and Volpp (2006) reports that BBA has negative impacts on health outcomes in the short term, but not in the long term. Again using hospital discharge data in Pennsylvania from 1997 to 2001, Seshamani, Schwartz and Volpp (2006) reports that the increased financial strain from the BBA of 1997 has no significant adverse impact on patient mortality either among all patients or among the uninsured. Wu & Shen (2011) examine the BBA of 1997's long-term impact on AMI mortality outcomes and find empirical evidence of negative impact in the longer period. They find that BBA payment cut has no significant impact on Medicare AMI mortality across hospitals through the study periods. However, when examining in the post-BBA period (2001-2005), empirical evidence controlling for the pre-BBA trends suggests that the mortality rate in hospitals suffering from larger payment has greater increases relative to that of hospitals facing smaller cuts. Wu & Shen (2011) also find association between the increased mortality rate of AMI patients and the reduction of operating cost in the hospitals with large BBA bites.

Chapter 4 Data

There are three data sources for this study: Hospital Cost Report maintained by the Center for Medicare & Medicaid Services (CMS), the Pennsylvania Health Care Cost Containment Council (PHC4) dataset and American Hospital Association (AHA) survey data.

4.1 Datasets for cost shifting

For the empirical tests of cost-shifting, I obtained the total number of Medicare patient discharge, inpatient revenue and other hospital financial information from Hospital Cost Report by CMS.[16] Additionally, hospital Case Mix Index (CMI) is obtained from the PPS Payment Impact Files maintained by CMS. The total hospital revenue includes revenues from general hospital inpatient routine care (SNF swing bed excluded) and inpatient intensive care. I also extract "hospital inpatient services under PPS" as the value of hospital PPS payment.

Because BBA was passed in 1997 and came into implementation since fiscal year 1998, I use the cost report data for fiscal years 1996-2006. I include the data of 1996 in my research to compare how hospital's strategies change after BBA.

To receive reimbursement for health care services delivered to Medicare patients, Prospective Payment System (PPS) hospitals are required to submit an annual cost report in a standardized electronic format to Centers for Medicare & Medicaid Services' (CMS). These

[16] The data can be downloaded from http://www.cms.hhs.gov/CostReports/CostReportsFY/list.asp. The documentation can be found from http://www.cms.gov/costreports/02_hospitalcostreport.asp (last access: Aug. 11, 2010)

datasets are updated at the end of each calendar quarter and are available on the last day of the following month.

CMS released Hospital 2552-96 Cost Report Data files for fiscal years 1996-2010. These data files contain the highest level of cost report status for cost reports. In other words, if both submitted report and final settled report for a hospital for a particular year are available in the Healthcare Cost Report Information System (HCRIS), the data files will only contain the final settled report. If both final settled report and reopened report are in HCRIS, the data files will only have the reopened report.[17]

CMS receives comments from the public and other interested parties on Medicare operation and capital payments for hospitals. In May, CMS publishes its proposed updates in the Federal Register for public comment. In August, CMS publishes in the Federal Register its final updates which are effective in October in that year. [18] CMS maintains home pages of 2009-2011 Hospital Inpatient Prospective Payment System (PPS) final rule, providing the downloadable files. However, for historical files of Final Rule during 1996-2006 are only available from GPO Access for the Federal Register at http://www.gpoaccess.gov/fr/advanced.html.

To estimate payment impacts of various policy changes on the IPPS proposed and finalized in the Federal Register, CMS also creates PPS Payment Impact Files, which are

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[17] HCRIS Production Notes For Hospital Cost Report Data: http://www.cms.gov/CostReports/Downloads/HospitalReadme09302009.pdf , last access at July 10, 2011.

[18] Final Rule home pages for 2009-2010FY can be accessed at https://www.cms.gov/AcuteInpatientPPS/IPPS2009/list.asp#TopOfPage, last access at July 10, 2011.

available from 1994 on.[19] PPS Impact Files contain hospital specific information, such as Medicare provider number, hospital's name, geographic labor market area of the hospital, Wage index IME, DSH and Cost of Living Adjustment (COLA).

The data of Standardized Labor Share and Standardized Non-Labor Share are from the Final Rule. The data are published in "Table 1a & National Adjusted Operating Standardized Amounts, Labor/Nonlabor" of the Final Rule. The data of Operating Wage Index, Operating IME Adjustment, Resident-to-bed Ratio, Operating DSH Adjustment Factor and Operating Outlier Percentage are extracted from PPS Payment Impact Files.

I also extract the transfer-adjusted CMI from PPS Payment Impact Files 1996-2006. I use the transfer-adjusted CMI because transfer-adjusted CMI can better reflect the average level of actual patient severity in a hospital. Hospital characteristics data are obtained from American Hospital Association annual surveys.

4.2 Datasets for health outcome

The patient discharge data for identifying Hospital Acquired Infection (HAI) in this study are extracted from the Pennsylvania Health Care Cost Containment Council (PHC4) dataset from 1994 to 2002.

The PHC4 data contain all discharges from hospitals in the Commonwealth of Pennsylvania. The discharge information includes patient age, gender, race, zip code, region in Pennsylvania, diagnoses and procedures codes and discharge status. Especially, PHC4 data

[19] CMS Impact Files are available from http://www.cms.gov/AcuteInpatientPPS/HIF/list.asp#TopOfPage.

contains the severity information in term of MediQual Atlas Admission Severity, which is a score of 0 to 4, describing the risk of in-hospital mortality as derived from 250 key clinical findings on admission, such as blood pressure, serum sodium, and hematocrit. This admission-based severity index enables comparison of admission based risk adjusted outcomes.

Chapter 5 Empirical Evidence of Cost Shifting after the BBA of 1997

In this chapter I discuss the empirical methods used to identify cost shifting effects and report the main findings. I first discuss the potential bias and endogenous problems that I may encounter in this empirical analysis. I then describe the methods and models used to help solve the problems. I describe in details how I construct an exogenous variable as the proxy of the BBA Financial Impact. I also discuss the advantages of long-difference model and how this model fits into this study. In the rest of this chapter, I report the findings of hospital cost shifting and how underlying financial health status may affect a hospital's cost-shifting decision.

5.1 Methods for Empirical Analysis

5.1.1 Endogenous problems

I assume that the basic model for private patient prices in the period *t* can be set as in Equation (5.11):

$$P_{it} = \alpha_t + \beta \textit{ Medicare price}_{it} + \delta X_{it} + \sigma_i + \varepsilon_{it} \tag{5.11}$$

where P_{it} and Medicare price_{it} represent the price for private payers and the Medicare price at hospital *i* in year *t*, respectively. X_{it} and σ_i are hospital-specific observable and unobservable determinants of price for private payers, respectively. To simplify the discussion, I assume in (5.11) that both β and δ are constant over time. In other words, Medicare price and other hospital characteristics have constant impact on private prices over time.

Endogenous problems will occur if one uses OLS to estimate equation (5.11). Firstly, there is measurement error in Medicare price, which may cause the coefficient estimates to be biased toward zero (Greene 1993). The measurement error in this case means that the observed Medicare price or average revenue may not correctly represent the expected ones, because hospitals may change payer mix, engage in upcoding (Carter *et al* 1990), or change other input parameters in PPS price calculating formula to increase final Medicare revenues.

Secondly, there may be some omitted variable bias in the estimation. Direct estimate of private price change leaves the hospital-specific unobservable factor (σ_i) into the error term. However, this factor may be correlated with both private price changes and Medicare service volume changes. In this case, an endogeneity problem occurs. For example, if a hospital has very good patient relationship skill that is valued by both Medicare patients and private patients, it may attract larger share of Medicare patients than other hospitals may do, and thus the private patient price in that hospital may be higher.

Thirdly, there also exists endogeneity problem due to simultaneous changes of both Medicare and private prices. Given the association between a higher private price and a lower public price, the causal effect could be either from the private price or from the public price. As suggested in market power models, a higher private price could be set as hospital's responses to a price cut by the public payer. At the same time, Glazer and McGuire (2002)'s strategic model suggests that a generous private price may cause a price cut by the public payer because a public payer can strategically set its prices very low to have a free ride.

To solve the unobservable omitted variable problem and isolate the variations in private price change, I use long-difference model, which is discussed in detail in Section 5.2. To address the concern about simultaneous changes of Medicare price and private price, I construct an exogenous variable "BBA Financial Impact Index" to measure the potential financial loss caused by the BBA of 1997. The impact index is then used as an exogenous proxy for actual changes in Medicare price and Medicare revenue received by hospitals. I will describe in Section 5.1.2. how to construct this impact index

5.1.2 BBA Impact Index

Based on a BBA impact simulator constructed by the AHA, I construct an exogenous BBA Financial Impact Index to measure the financial impact of BBA (reflecting BBRA's amendment) on hospitals. The index is the difference between the simulated PPS price assuming no BBA impact and a Laspeyres PPS price. Because the Laspeyres price holds hospital behavior or operational variables fixed,[20] the BBA Financial Impact Index reflects the actual policy changes made by BBA only. This method is similar to those used in Cutler (1998), Shen (2003), and Wu (2010). The BBA Impact simulator constructed by AHA also summarized updating factors of PPS inpatient prices under different policy situations during the period from 1998 to 2002. AHA simulator was also adopted in Volpp *et al* (2005) and Seshamani, Zhu and Volpp (2006)

Assuming that there is no change in the PPS price formula or hospitals behavior, I simulate the expected PPS price. Assuming that there are no changes in hospitals' policy changes or other behavioral strategy, I compute the Laspeyres PPS price index, which fixes input variables such as case-mix-index or bed-to-resident ratio as in the base year. When calculating

[20] The behavior and operational variables included here are case-mix index (CMI), percentage of poor patients in the DSH adjustment formula, the residents-to-bed ratio in the IME adjustment, and the proportion of outlier cases. I will control for the major operational variables, such as CMI, hospital bed number and ownership in my empirical estimation model.

the Laspeyres PPS price index, I also incorporate the new price formula of PPS reimbursement under BBA. In this way, the expected financial loss index of BBA contains only the expected financial shocks to the hospitals as a result of the BBA policy change, therefore it is a valid exogenous variable of the financial impact of BBA. Specifically, I follow three steps as below to construct the BBA Impact Index.

Step 1: I simulate a hypothetical PPS price in the absence of any policy change as shown in Equation (5.12) and Equation (5.13) below. If there were no any policy changes, PPS price will be updated each year by the full market basket. This means that the PPS price will increase by the annual inflation rate (the health care market basket index) (Cutler 1998, Shen 2003, Wu 2010).

$$\textit{Hypothetical PPS Price}_{FY1998} = \textit{Actual PPS Price}_{FY1997} \times (1 + \textit{Market Basket Index}_{FY1998}) \tag{5.12}$$

$$\textit{Hypothetical PPS Price}_{FY\,t} = \textit{Hypothetical PPS Price}_{FY\,t-1} \times (1 + \textit{Market Basket Index}_{FY\,t}) \tag{5.13}$$

$(t = 1999 \sim 2006)$

To generate a hypothetical PPS price for a hospital during each fiscal year from 1998 to 2006, I set fiscal year 1997 as the base year, and multiply the actual PPS price of fiscal year 1997 by the full market basket index of health care during 1998-2006.

Step 2: To estimate the mechanical effect of BBA, I construct Laspeyres PPS price index using the 1997 volumes of hospital production input variables, and update the base year price to 2002, using factors reflecting actual policy changes made by both BBA97 and the BBRA99.[21]

By holding the inputs constant, I assume that hospitals do not change their behaviors in response to any policy changes of BBA. I set the following input fixed in the base year FY1997: case-mix index (CMI), percentage of poor patients in the DSH adjustment formula, the residents-to-bed ratio in the IME adjustment, and the proportion of outlier cases.

Step 3: The mechanical effect of BBA's impact can be estimated as the difference between the Laspeyres PPS price with BBA's impact and the hypothetical PPS price without BBA's impact, as shown in Equation (5.14).

$$\textit{BBA Financial Impact}_t = \textit{Laspeyres PPS price}_{t\_with\ BBA} - \textit{Hypothetical PPS price}_{t\_no\ BBA} \qquad (5.14)$$

5.2 Empirical Model

5.2.1 Long-difference model

- *Long-difference model in general*

Griliches and Hausman (1986) illustrate the derivation of Long-difference model in great detail. Under the assumption that the true model of estimation is equation (5.1), the long-difference model does not utilize information from adjacent years in the panel data. Instead, it eliminates the state-specific fixed effects by differencing observations that are more than one

[21] For example, the policy parameters of IME adjustment during FY2000 and FY2001 were initially set low by THE BBA OF 1997, but later adjusted up by BBRA99.

period apart. Taking the difference between the base period t and the study period j, a long difference mode can be written as

$$P_{ij} - P_{it} = (\alpha_j - \alpha_t) + \beta\ (Medicare\ price_{ij} - Medicare\ price_{it}) + \delta\ (X_{ij} - X_{it}) + (\varepsilon_{ij} - \varepsilon_{it}) \quad (5.21)$$

After setting $P_{ij} - P_{it} = \Delta P_{ij}$, equation (5.21) can be simplified as

$$\Delta P_{ij} = \Delta\alpha_j + \beta\ (\Delta Medicare\ price_{ij}) + \beta\ \Delta X_{ij} + \mu_{ij} \quad (5.22)$$

Because the correlation between two far apart periods is usually much smaller than that between two adjacent periods, the long-difference model is better in solving auto correlation problem of the error term than the first-difference model. Therefore, it is less inconsistent than the first-differences model (Griliches and Hausman 1986). By taking the differences in the observations that are less correlated with each other, the variance of the signal is increased relative to the noise in long-difference model. As long as the auto correlation between periods declines when the distance between two periods increases, the estimation of β in long-difference model converges to the cross-sectional result when the difference in the periods becomes longer.

Assuming exogenous policy impacts and declining correlation between periods, Griliches and Hausman (1986) compare some general results of Long-difference model, Fixed-Effects model and First-Difference model. They summarize that for T>2, (a) the inconsistency of Fixed-Effects and Long-difference is less than that of First-Difference model; (b) the inconsistency of the (T-1) Long-difference model estimator is less than that of the fixed-effects estimator; and (c) in the absence of measurement errors, fixed-effects and difference models are all consistent.

Long-difference model is adopted in cost shifting researches (Dranove 1988, Dranove & White 1998, Friesner & Rosenman 2002), as well as research on hospitals' response to financial stress (Shen, 2003).

- *Long-difference model in this study*

While differencing out the unobservable omitted variables, the Long-difference model is also capable of eliminating hospital characteristics, if we assume that impacts of hospital characteristics are constant over time. In the reality, with the growth of managed care and implementation of the BBA of 1997, the operation environment of hospitals changed dramatically from the 1990s to the 2000's and the impacts of hospital characteristics on private price may also change accordingly. To address this concern, in this study I model the impacts of time-variants on hospital characteristics. Another reason for this is to enable the including of time-invariant hospital characteristics and market dummies to control hospital and market specific shocks that may be correlated with both Medicare and private revenues. This model is also adopted in Wu (2010).

The underlying model of private price now is assumed to be

$$P_{it} = \alpha_t + \beta \, Medicare \; price_{it} + \delta_t X_{it} + \sigma_i + \varepsilon_{it} \quad (5.23)$$

The difference between equations (5.11) and (5.23) is that the δ_t in (5.23) allows time-variant effects of hospitals characteristics on the private price. The long-difference model solves the unobservable omitted variable problem by taking into account the difference of the prices in Periods *t* and *s*.

$$P_{is} - P_{it} = (\alpha_s - \alpha_t) + \beta\ (Medicare\ price_{is} - Medicare\ price_{it}) + (\delta_s X_{is} - \delta_t X_{it}) + (\varepsilon_{is} - \varepsilon_{it}) \qquad (5.24)$$

The terms $(\delta_s X_{is} - \delta_t X_{it})$ in Equation (5.24) for changes in hospital characteristics can be further decomposed as

$$\delta_s X_{is} - \delta_t X_{it} = \delta_s X_{is} - \delta_s X_{it} + \delta_s X_{it} - \delta_t X_{it} = \delta_s (X_{is} - X_{it}) + (\delta_s - \delta_t) X_{it} = \delta_s \Delta X_{is} + \Delta\delta_s X_{it} \qquad (5.25)$$

where δ_s measures the current effect of any change in hospital characteristics, while $\Delta\delta_s$ represents the changing effect on the initial level of X. After Equation (5.25) is plugged into Equation (5.24), the final estimation equation can be simplified as

$$\Delta P_{is} = \Delta\alpha_s + \beta\ \Delta\ Medicare\ price_{is} + \delta_s \Delta X_{is} + \Delta\delta_s X_{it} + \mu_{is} \qquad (5.26)$$

where t is the base year 1996 and s is any year during the period from 1998 to 2002.

5.2.2 Variable specification

Dependent variables

Change of Private Patient Price

Average private price in a year is calculated as total non-Medicare inpatient revenue divided by total non-Medicare inpatient discharges. Even though non-Medicare inpatients may also include Medicaid patients, I have to use non-Medicare inpatients as the closest estimation of private patients because CMS HCRIS data does not report revenues by Medicaid or other payers separately. I define the total net private inpatient revenue as the difference between the total net inpatient revenue and Medicare inpatient revenue. In the same way, the total private inpatient discharges are defined as the non-Medicare inpatient discharges, which are the difference between total inpatient discharges and Medicare inpatient discharges. The total inpatient revenue and total discharges exclude both swing bed and Skilled Nursing Facility (SNF).

The formula I use to calculate the private price is as below:

$$Private\ price = \frac{Private\ inpatient\ revenue}{Private\ inpatient\ discharge} = \frac{Total\ inpatient\ revenue - Medicare\ inpatient\ revenue}{Total\ discharges - Medicare\ discharges}$$

When I calculate the variable using data from the Hospital Cost Report, I take the discount factor into consideration and the final formulas for calculating the private price technically are as follows:

$$Private\ price = \frac{Total\ inpatient\ revenue\ \times (1 - Discount) - Medicare\ inpatient\ revenue}{Total\ discharge - Medicare\ discharges}$$

wherein,

Total inpatient revenue = General inpatient routine care service (hospital) + Intensive care type inpatient hospital services + Ancillary Services,

Discount = Contractual Allowances and Discounts/ Total Patient Revenue,

and

Medicare inpatient revenue = Medicare PPS total amount

Independent variables

BBA Financial Impact Index (BFI)

I have price impact index and revenue impact index, two index variables to measure the BBA's impacts. The price index constructed in Section 5.1.2 measures the average potential loss for each inpatient admission. BBA's revenue impact index is constructed as the multiplication of the price index and the Medicare patient shares in a hospital. Since it takes the Medicare patient shares into consideration, Revenue impact index can better reflect the final financial impact on a hospital. Negative sign of the coefficients of the Impact Index will indicate that a hospital sets the private price higher in face of an expected loss from the BBA of 1998.

Hospital Bargaining Power

I include hospital bargaining power to capture the price changes due to the hospital negotiating strength based on the proportion of private and Medicare patients. The Bargaining power is the difference between the private patient share and the Medicare patient share. A hospital with relatively higher Medicare share may be under greater financial pressure when Medicare cuts the payment rates, therefore this type of hospitals may have stronger incentive to shift cost. However, if Medicare patient share is high and the share of private patients is low, that hospital may not have many private patient chances to do cost-shifting. For this reason, I also include the interaction term of bargaining power and the BBA Financial Impact Indexes in my tests.

Hospital Financial Ratios

I use the debt and current ratios to measure the major features of a hospital's financial distress conditions. Debt-Equity Ratio is often used to measure the leverage level of a regular company. It compares a company's total liabilities to its total shareholders' equity. In this study the debt ratio is defined as the ratio of the Total Liability to the Total Asset. It describes the capital structure of a hospital and is among the best measures of financial distress (Dafny 2005, Das 2009).

The current ratio is defined as current assets divided by current liabilities, where "current" means assets that are likely to be converted into cash within a year or liabilities that have to be paid in cash within a year. The ratio indicates the ability of a hospital to meet its short-term obligations with cash or other assets that can quickly be converted to cash (e.g. patient accounts receivable). Lower values suggest potential problems in meeting payroll or making payments to vendors. Most often, a current ratio of two (2) or higher is assumed to indicate that an organization is financially sound. Because of its definition, the current ratio is considered as a good measure of a company's liquidity.

Because of their definitions, the debt and current ratios may correlate with each other since they can also be interpreted as total debt ratio and short-term debt ratio, respectively. Therefore, I include only one of the financial ratios in the empirical estimation at one time. I use the debt ratio in the main regression, and use the current ratio for robustness tests. I expect that a hospital with greater financial distress pressure and larger BBA financial shock has a greater incentive to get engaged in cost shifting.

Hospital Operational Characters

I use Medicare Case-Mix-Index (CMI) and occupancy rate to measure hospital operation. Medicare CMI captures the variations due to the patient severity in each hospital. I use hospital's Medicare CMI as a proxy for private patient CMI, which is not reported in HICRIS (Dafny 2009, Wu 2009). I use the occupancy rate that as a proxy of operational performance of the hospitals. Because hospitals may change the Medicare Case Mix and occupancy rate as a response to the Medicare price change, I fix both Medicare CMI and occupancy rate in 1996 level.

Hospital Institutional Characters

I use dummy variables to indicate a hospital's system membership and network participating status as indicated by the AHA. Burgess (2005) finds positive network effect on hospital pricing. Bazzoli *et al* (2000) finds that a hospital in highly centralized networks had better financial performance than those belonging to decentralized networks. Therefore, I also use a dummy variable to indicate whether a hospital is in a centralized network or not.

I control hospital ownership types in the form of non-for-profit, for-profit and the government hospitals. The base group is for-profit hospital. I include dummy variables to indicate the teaching and the accreditation statuses[22] respectively.

The size of a hospital is controlled by using bed-size category variables. The base group includes small hospitals with fewer than 100 beds. Group 2 includes middle-size hospitals with beds from 100 to 299. Large hospitals have more than 300 beds. This sample includes hospitals from both urban and rural areas. Therefore, I use a dummy variable to control this feature.

Hospital Market Competition

Hospital market competition is measured by Herfindahl-Hirschman Index (HHI), which is calculated as the summation of market share squared. The market share is calculated using hospital bed numbers and the market is defined at the zip code level. Though HMO penetration is routinely controlled in past studies, I do not explicitly control HMO penetration in this study for two reasons. First, previous research shows that hospital cost shifting decision is not

[22] The accreditation status is by Joint Commission on Accreditation of Health Care Organizations (JCAHO).

significantly affected by the HMO penetration or the change of HMO penetration (Wu 2010). Second, HMO penetration data are only at the MSA level. I will have to drop hospital observations from rural area to include HMO penetration information. Since the effects of HMO penetration are not the main variable in this study, I include county dummies to control geographical fixed effects, and the potential variation from the effect of HMO penetration will be controlled accordingly. Additionally, I include year dummies to control for year fixed effects and the base year is 1998.

5.3 Sample Data and Descriptive Statistics

I select from HICRIS database only general medical and surgical hospitals in the 50 US states according to AHA's classification of hospital primary service. I use hospital observations during the period from 1996 to 2002 for which all variables are available from HICRIS, AHA and PPS Impact files. To calculate the changes of private price and other variables, I match the observations from 1996 with those in each year from 1998 to 2002. Because the revenue data in Medicare HCRIS database often contain extremely high and low values, the dependent variable, i.e., the change of private price that is constructed using hospital revenue from HCRIS database, is censored at the 5th and 95th percentile (Dafny 2009, Wu 2009).

I exclude the hospitals with negative debt ratios. The negative debt ratios were generated due to negative total asset value or negative total liability value of hospitals. Most of them have negative total liability value, which indicates the capital lending activities, rather than the borrowing activities, in these hospitals. These capital-lending hospitals may have characteristics that are fundamentally different from the majority of the American hospitals, which are borrowing capital for their operation. Based on this, One hundred and eighty hospitals with negative debt ratios are dropped from the sample.

The final sample for this chapter includes 3696 hospital-year observations, having 683 to 800 observations in a single year during 1998 to 2002. There are in total 928 unique hospital ID, among which 421 hospitals have five-year continuing observations, 245 have four-year observations, 135 have three-year, 79 have two-year and 48 have one-year observations.

Table 5-1 shows the descriptive statistics of variables used in this study. There is no significant difference between the Medicare patient share in 1996 and 1998 to 2002. Hospital financial status did not change significantly over the research time. Debt ratio and current ratio almost remained the same. Comparing with those in 1996, the Transfer-Adjusted-Case-Mixed-Index slightly increased by 0.026 point, while occupancy rate decreased by 3.5 percentage points and hospitals downsized by 11.3 beds or by 5.8% on average. Among the hospital institutional characteristics, the percentage of system hospital increased by 3 percentage points, network participating increased by about 1.7 percentage points, while the percentage of centralized hospital system, accreditation and teaching status decreased slightly. These small changes could be caused by hospital behavioral changes or reporting errors. HHI shows that the hospital market structure during research period were stable.

Figures 5-1 to 5-4 show the distribution of the change of private price, BBA Financial Impact Index (price/revenue) and the share of Medicare patients. The change of private price and the share of Medicare patients are close to normal distribution. The distribution BBA Financial Impact Index (price) is slightly skewed to the right due to a few observations of very large value, while the revenue cut impact's distribution is very close to a normal distribution.

Figure 5-5 shows the trend of the BBA Financial Impacts and the change of private price. While the expected financial loss increases during the study period from 1998 to 2002, the change of private price also increases proportionally. The associations between the change of private price and the financial distress are not apparent as shown in Figure 5-6, while confirming the correlation between the debt ratio and the current ratio.

5.4 Empirical Results and Discussion

5.4.1 Cost shifting in long run and short run

My basic estimating equation is equation (5.26). I first estimate the average cost shifting effects during 1998 to 2002. Table 5-2 reports the estimated coefficients of the BBA financial impacts on the change of private price. Columns (1) and (2) include the BBA financial price or revenue impact only. Column (1) indicates that for every one dollar of expected price cut by the BBA of 1997, hospitals on average increase the private price by about 77.8 cents. This estimated coefficient is very close to the result of 68.1 cents reported in Wu (2010). For a hospital at the mean with 43% of Medicare patient share, this estimate means a net gain of about 1 dollar per 100 dollars BBA price cut.[23] This means that for a hospital with average Medicare patient share, the revenue increase brought by a private price hike is just enough to offset the expected revenue loss caused by Medicare price cut. However, if the Medicare patient share increases slightly to 45%, based on the same calculation, the hospital suffers from a net revenue loss of 2 dollars per 100 dollars BBA price cut.

[23] Given a BBA price cut of 100 dollars, the net gain of a hospital can be calculated as [-\$100 × 43% + \$77.8 × (1-43%) ≈ \$1.35.

Column (2) suggests that for every one dollar of expected revenue loss due to Medicare price cut, a hospital has to increase the private price by about 2.78 dollars, which means that hospitals not only can compensate the expected loss due to BBA price cuts, but also can make extra money by lifting the private price. This result may suggest that the cost shifting effect in this model is over-estimated and there may be confounding factors.

Columns (3) and (4) further include the expected price or revenue cut variable and their interaction terms with hospital bargaining power, as well as the bargaining power separately. In Column (3), the coefficient of the interaction between BBA Financial Impact (price) and Bargaining Power is not significant, while the coefficient of BBA Financial Impact (price) is very close to the estimate in Column (1). Column (4) reports that for every one dollar of expected revenue loss due to BBA, a hospital on average will increase the private patient price by 1.59 dollars plus an amount depending on the interaction effect of BBA Financial Impact (revenue) and bargaining power with private health insurance plans. The marginal effect estimated at the average payer mix of the sample suggests that during the period of 1998 to 2002 for every dollar of BBA expected revenue loss, hospitals increase the private price by about two dollars.[24] Meanwhile, the highest estimate of cost shifting in existing literature is 100% (Cutler 1998).

To have better understanding about how hospitals' responses to BBA price cut change over time, I estimate the basic model using the subsample of each year from 1998 to 2002. The

[24]As from Table 5-2, the coefficient for BBA Financial Impact (Revenue) is (-1.592), and the coefficient for the interaction term is (-3.458). Given sample average Medicare patient share of 0.44, the bargaining power of 0.12 (= 1-0.44-0.44), the change of private price at mean Medicare patient share can be calculated as $200.7 [= -$100*(-1.592) + (-$100)*(-3.458)*0.12].

estimated coefficients are reported in Table 5-3. The equations in Panel A include BBA Financial Impact (Revenue) Index and those in Panel B include BBA Financial Impact (Price) Index. In Panel A the calculated marginal effects of cost-shift in 1998-2000 are reported on the bottom line of the table.[25] The marginal effect of cost shifting in 1998 is 258%, which means that for every one dollar of expected revenue loss by BBA price cut in 1998, hospitals on average increase the shift about $2.58 to private patients. However, the cost shifting ratio decreases quickly to 121% in 1999 and further decreases to 45% in 2000. During the period 2001 to 2002, there is no significant evidence of cost-shifting.

The results in Table 5-3 suggest that during the first two years after the BBA of 1997 came into implementation, hospitals responded very strongly to the expected BBA's price cut by increasing private patients' price, however, in the long run hospitals adjusted their pricing strategies and largely absorbed the price cut. The change in cost-shifting degree with time could be explained by several reasons. First, after the earlier financial shocks due to the introduction of PPS system, hospitals might find it difficult to further absorb the price cut by the BBA of 1997 soon after its implementation. Second, hospitals make price decision on the basis of ration expectation and the cost shifting in short run has incorporated expected price cut in future years. When the BBA of 1997 was enacted in 1997, hospitals had known that the price cutting would last from 1998 to 2002 and they might shift the expected financial loss according to the rational expectation with a long horizon rather than on a year-by-year basis. The cost-shifting effects disappeared after 2001 could due to the fact that 1999 BRRA and 2000 Benefits Improvement and Protection Act largely relaxed some BBA price cuts in 2001 and 2002. Given the relaxed

[25]The calculation of the marginal effects is the same as explained in Footnote 24 for Column (4) in Table 5-2.

BBA price cut, since hospitals already shifted the expected loss during the five-year period to private patients, there was no more cost shifting on average during 2001 and 2002.

5.4.2 Cost shifting in financially distressed hospitals

I further examine how hospital financial distress may affect hospital cost shifting decision. Table 5-4 reports the estimated cost shifting results, based on equation (5.23) while controlling financial distress variables of debt ratio and current ratio in 1996 respectively. Neither debt ratio nor current ratio's coefficient is significant, which means that financial distress indicators don't directly affect the change of private price.

To test whether cost shifting varies with financial distress levels, I divide the sample into four subsamples according to four quartiles of debt ratio and run the same regression in Table 5-4. Panel A of Table 5-5 reports the estimated cost shifting by debt ratio. Hospitals in the 1st and 2nd quartile of debt ratio have low level of financial distress and their cost-shifting is not significant. For hospitals in the 3rd and 4th quartile of debt ratio, the financial distress is relatively severe and the coefficient of cost shifting term is significant.

Panel B of Table 5-5 reports the results using current ratio to classify financial distress level. Since current ratio is the ratio of current asset to short term liability, the 1st quartile of current ratio means the lowest level of liquidity or the highest level of financial distress in short term, whereas the 4th quartile means the highest level of liquidity or the lowest level of financial distress in short term. Panel B shows that hospitals with higher short-term debt ratio tend to do more cost-shifting. The coefficients of the interaction term of BBA Financial Impact (Revenue) and Bargaining Power for the hospitals in the first three quartiles of current ratio are statistically significant. However, the coefficients for the hospitals in the 4th quartile of current ratio are statistically insignificant. This means that hospitals which experience the highest liquidity and the least financial distress in short term did little cost shifting. The findings from tests using debt ratio are consistent with those obtained from using current ratio.

I further use three-way interaction term to test how cost shifting varies with hospital financial distress status. I include the interaction between BBA Revenue Impact, bargaining power and a financial distress indicator (debt ratio or current ratio). The results are reported in Table 5-6. The coefficients of three-way interaction term for both debt ratio and current ratio are statistically significant. The three-way interaction term using debt ratio has negative sign, which means that the higher the debt ratio is, the larger the cost shifting is. When using the debt ratio, the coefficient of the three-way interaction term has largely absorbed the two-way interaction effect between BBA Revenue Impact and the bargaining power. As the result, the coefficient of the two-way interaction term is not statistically significant. In the case of current ratio, the three-way interaction term has positive sign, which means that the higher the current ratio is, the less cost a hospital would shift to private patients. The coefficients of BBA revenue impact and its interaction term with bargaining power remain highly significant.

As a sum, the findings in this study suggest that hospitals got involved in cost shifting as response to the price cut by the BBA of 1997 and the degree of cost shifting decreases quickly after the initial years. Further, hospitals with financial distress do more cost-shifting than those without financial distress.

Figure 5-1: Distribution of Change of Private Price

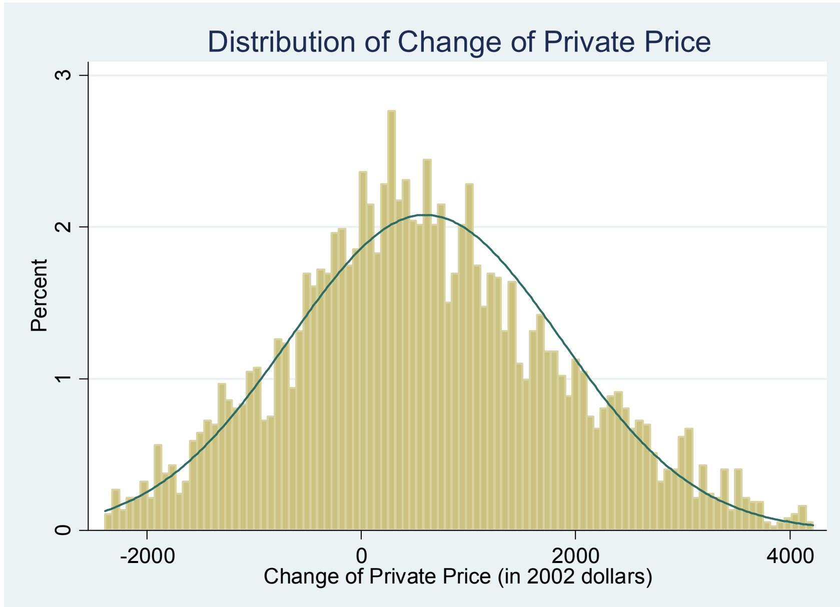

Figure 5-2: Distribution of BBA Financial Impact (Price)

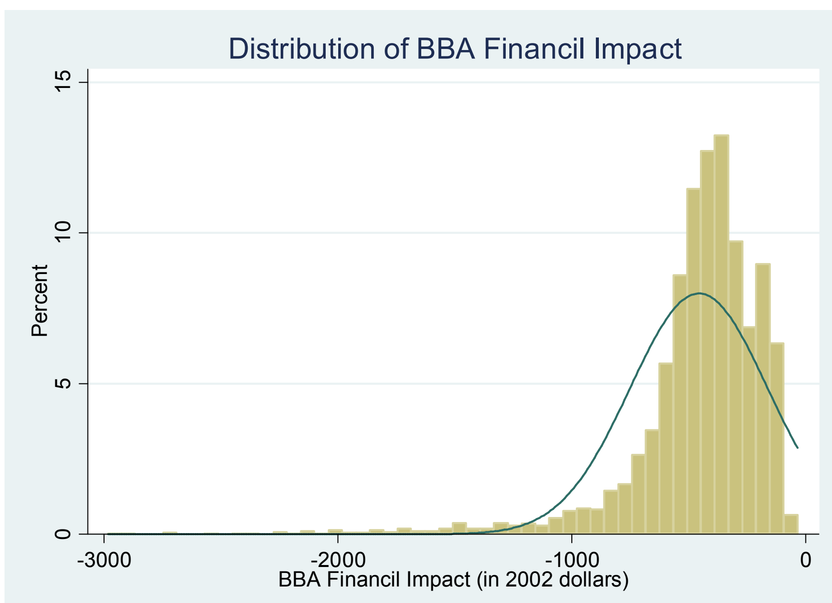

Figure 5-3: Distribution of BBA Financial Impact (Revenue)

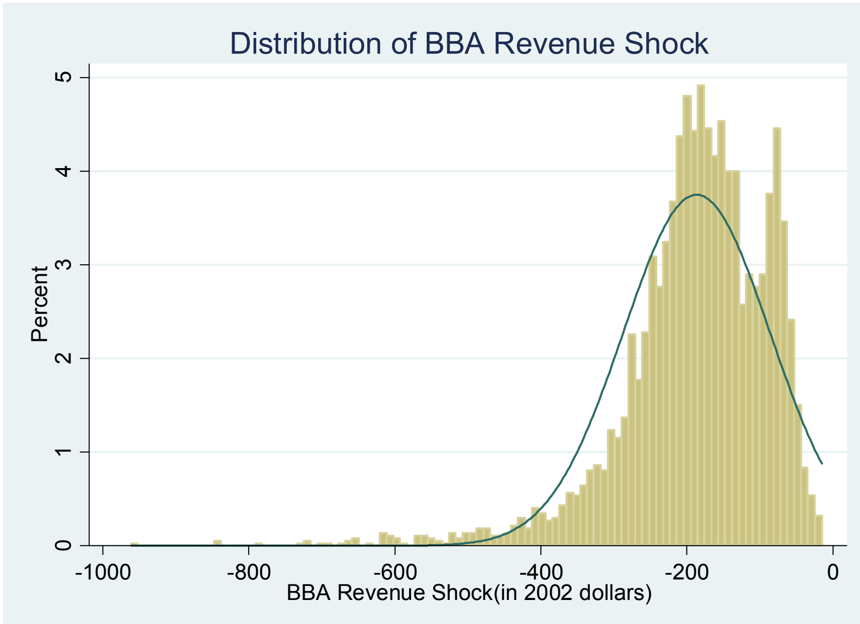

Figure 5-4: Distribution of Share of Medicare Patients

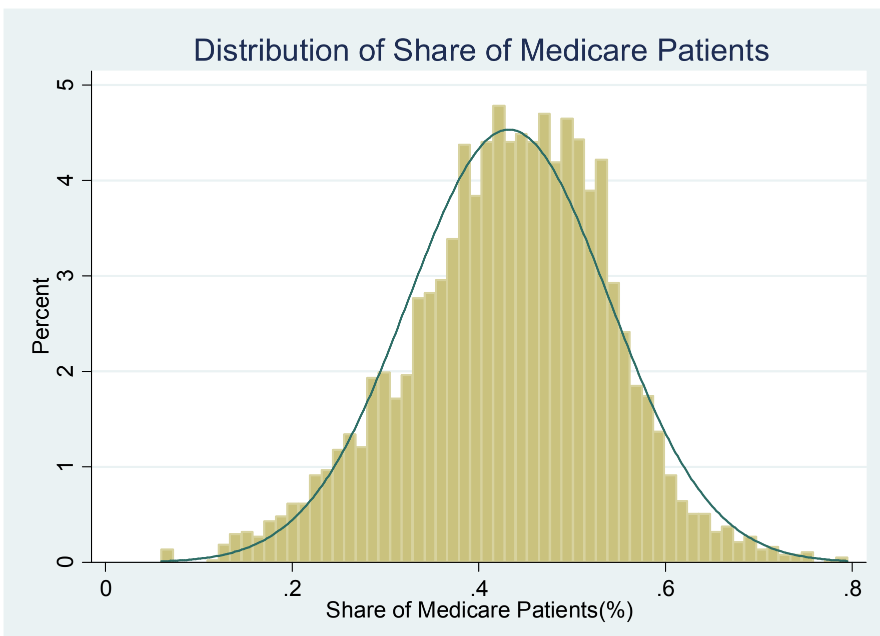

Figure 5-5: Time Series of BBA Impact and Private Price

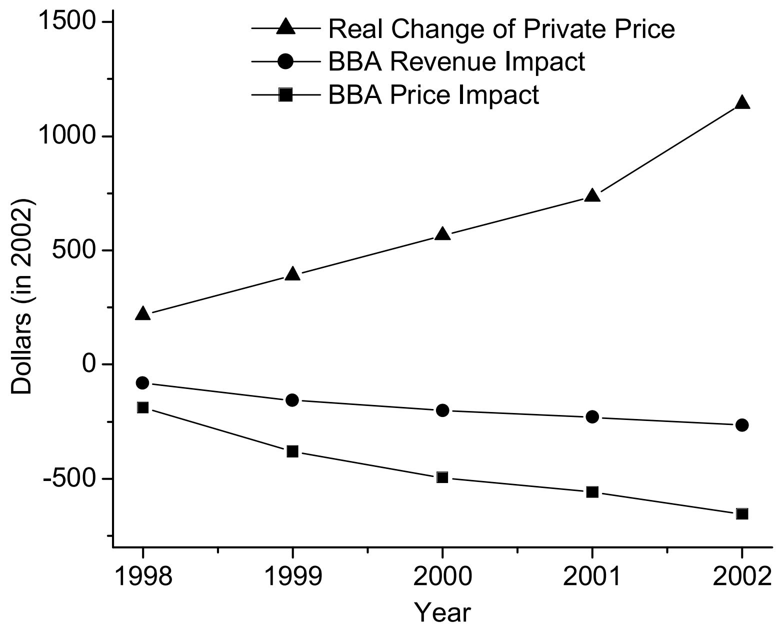

Figure 5-6: Correlation between the Change of Private Price and the Financial Distress Status

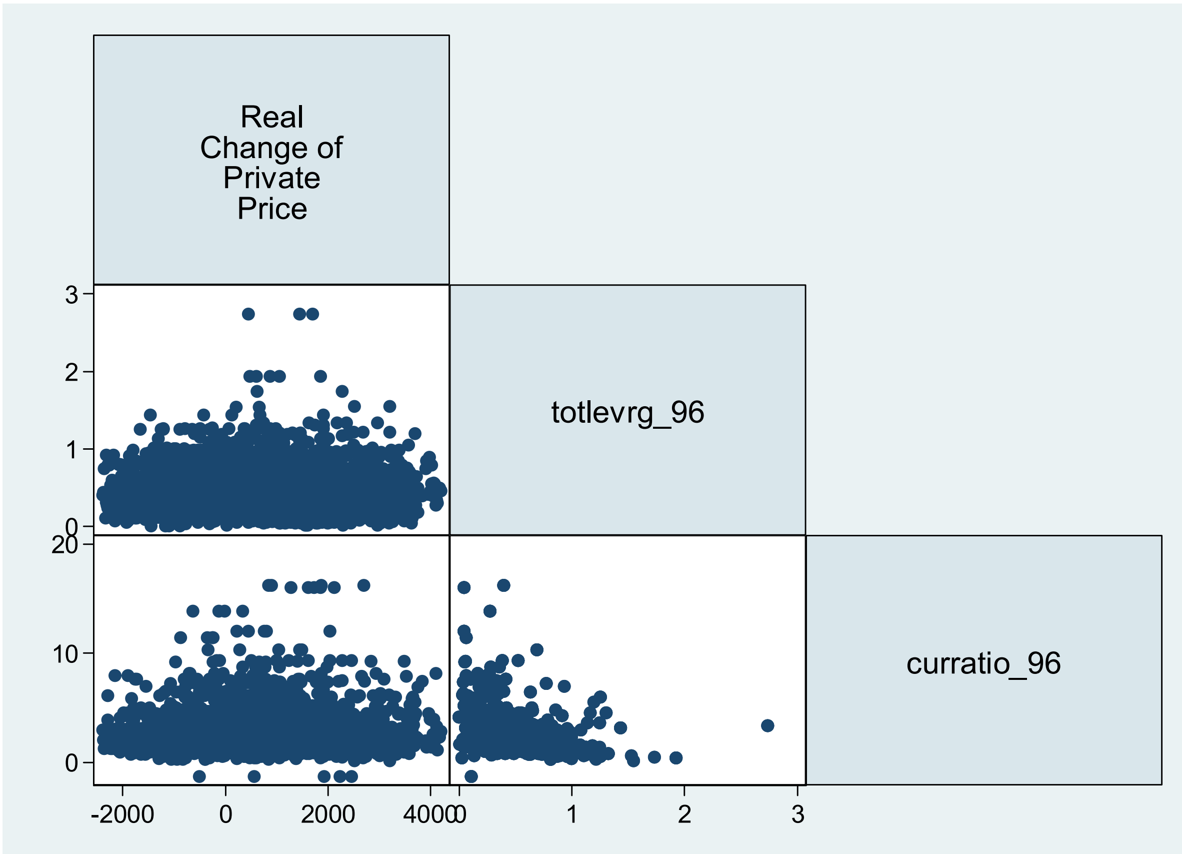

Table 5-1: Descriptive Statistics of Hospital and Market Characteristics

Dependent Variable	1998-2002		1996	
	Mean	S.D.	Mean	S.D.
Change of Private Price	606.5	(1,267)		
BBA Financial Impact Index				
BBA Financial Impact (price)	-456.3	(294.9)		
BBA Financial Impact (Revenue)	-187.1	(100.8)		
BBA Financial Impact (price) * Bargaining Power	-82.16	(167.9)		
BBA Financial Impact (Revenue)* Bargaining Power	-21.96	(47.36)		
Hospital Bargaining Power				
Medicare Patient Share	0.433	(0.107)	0.437	(0.107)
Bargain Power(private *vs.* Medicare)	0.133	(0.215)	0.127	(0.213)
Hospital Financial Status				
Debt Ratio	0.474	(0.460)	0.474	(0.259)
Current Ratio	2.519	(2.886)	2.486	(1.716)
Hospital Operational Characteristics				
TACMI	1.320	(0.201)	1.294	(0.182)
Occupancy	52.0%	(0.159)	55.5%	(0.161)
Beds	184.8	(136.5)	196.3	(142.9)
Bedsize group 1 (<100)	24.8%	(0.432)		
Bedsize group 2 (100<299)	55.8%	(0.497)		
Bedsize group 3 (300<)	19.4%	(0.395)		
Hospital Institutional Characters				
System Membership (=1)	47.8%	(0.500)	44.8%	(0.497)
Network (=1)	32.7%	(0.469)	30.9%	(0.462)
Centralized system (=1)	24.6%	(0.431)	26.7%	(0.442)
In urban (=1)	67.6%	(0.468)		
Accredited (=1)	93.8%	(0.242)	94.7%	(0.223)
Teaching status (=1)	21.8%	(0.413)	24.0%	(0.427)
Hospital Ownership				
Non-For-Profit	73.1%	(0.444)		
For-Profit	12.4%	(0.330)		
Government	14.5%	(0.352)		
Market Competition				
HHI	0.952	(0.145)	0.959	(0.134)
Change of HHI	-0.007	(0.084)		
Observations	3,696			

Note: There are totally 928 unique hospital IDs in the sample, among which 421 hospital IDs have five-year continues observations, 245 IDs have four-year observation, 135 IDs have three-year, 79 IDs have two-year and 48 IDs have one-year observations. There are 683 hospital observations in 1998, 788 in year 1999, 802 in year 2000, 715 in year 2001 and 708 in year 2002.

Table 5-2: The Impact of BBA on Change of Private Price during 1998-2002 (Basic Model)

Dep. Var. : change of private price (base year = 1996)

	(1)	(2)	(3)	(4)
BBA Financial Impact (price)	-0.778***		-0.711**	
	[-5.166]		[-2.564]	
BBA Financial Impact (price) * Bargaining Power			-0.584	
			[-1.249]	
BBA Financial Impact (Revenue)		-2.779***		-1.592***
		[-5.545]		[-2.672]
BBA Financial Impact (Revenue)* Bargaining Power				-3.458***
				[-2.815]
Bargain Power(private vs. Medicare)			-1,131.016***	-968.622***
			[-4.214]	[-3.343]
System Membership	-33.127	-47.781	-44.400	-46.704
	[-0.488]	[-0.702]	[-0.657]	[-0.687]
Network	-105.496	-120.172*	-108.906*	-119.884*
	[-1.606]	[-1.824]	[-1.668]	[-1.823]
Centralized system	65.081	85.575	84.727	90.144
	[0.871]	[1.153]	[1.139]	[1.212]
Accredited	43.714	51.384	21.225	30.129
	[0.386]	[0.448]	[0.180]	[0.256]
Urban	-208.059**	-164.801**	-97.458	-106.549
	[-2.546]	[-2.047]	[-1.158]	[-1.268]
Tacmi_1996	84.246	-13.662	125.987	126.586
	[0.349]	[-0.055]	[0.505]	[0.501]
NFP	2.924	-34.746	-42.536	-44.631
	[0.027]	[-0.321]	[-0.393]	[-0.413]
Gov	75.114	85.749	61.260	79.326
	[0.538]	[0.614]	[0.440]	[0.568]
Teaching	69.898	105.247	91.585	116.943
	[0.766]	[1.162]	[0.988]	[1.259]
Ocupancy_96	267.537	263.006	288.701	278.015
	[1.063]	[1.049]	[1.157]	[1.108]
Bedsize group 2 (100<299)	-14.115	4.258	22.563	20.354
	[-0.162]	[0.049]	[0.258]	[0.233]
Bedsize group 3 (300<)	-154.994	-99.313	-83.039	-82.131
	[-1.174]	[-0.755]	[-0.632]	[-0.621]
HHI_1996	571.820**	542.870**	532.711**	545.747**
	[2.283]	[2.134]	[2.098]	[2.143]
Change of HHI	1,027.406***	921.634**	900.560**	891.882**
	[2.814]	[2.480]	[2.396]	[2.400]
Observations	3,696	3,696	3,696	3,696
R-squared	0.189	0.195	0.204	0.200

Note: Standard errors are clustered by hospital. Robust t-statistics are reported in brackets. All regressions include year and county fixed effects. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 5-3: The Impact of BBA on Change of Private Price Using Annual Subsample during 1998-2002

Dep. Var. : change of private price (base year = 1996)

Panel A

	1998	1999	2000	2001	2002
	(1)	(2)	(3)	(4)	(5)
BBA Financial Impact					
(Revenue)	-5.873**	-2.768*	-1.477	-0.621	-0.950
	[-2.308]	[-1.684]	[-1.105]	[-0.550]	[-1.115]
BBA Financial Impact					
(Revenue)* Bargaining Power	-6.318	-0.780	-8.554***	-3.900	-2.263
	[-1.122]	[-0.201]	[-2.664]	[-1.449]	[-1.122]
debt ratio_1996	-252.332	157.256	4.425	-296.515	-93.565
	[-1.195]	[0.800]	[0.022]	[-1.506]	[-0.440]
Bargain Power					
(private vs. Medicare)	-553.656	-439.705	-1,726.048**	-1,103.075	-1,066.544*
	[-1.083]	[-0.643]	[-2.479]	[-1.515]	[-1.679]
Observations	683	788	802	715	708
R-squared	0.284	0.227	0.210	0.215	0.269
Marginal Effect of cost shifting	258%	121%	45%		

Panel B

	1998	1999	2000	2001	2002
	(1)	(2)	(3)	(4)	(5)
BBA Financial Impact (price)	-2.319*	-0.921	-0.707	-0.084	-0.537
	[-1.714]	[-1.416]	[-1.204]	[-0.165]	[-1.392]
BBA Financial Impact (price) *					
Bargaining Power	-1.607	-0.851	-2.084*	-1.780*	-0.020
	[-0.657]	[-0.715]	[-1.890]	[-1.850]	[-0.028]
Debt Ratio,1996	-290.794	129.434	-57.883	-350.421*	-120.211
	[-1.382]	[0.660]	[-0.292]	[-1.746]	[-0.560]
Bargain Power					
(private vs. Medicare)	-1,020.460*	-1,208.044**	-1,898.340***	-1,626.472***	-953.413*
	[-1.893]	[-2.419]	[-3.339]	[-2.790]	[-1.802]
Observations	683	788	802	715	708
R-squared	0.289	0.232	0.220	0.223	0.269

Note: All regressions include the same variables as in Table 5-2. Standard errors are clustered by hospital. Robust t-statistics are reported in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table 5-4: The Impact of BBA during 1998-2002 (Controlling For Financial Distress)

Dep. Var.: change of private price (base year = 1996)

	Debt Ratio 1996		current ratio 1996	
	(1)	(2)	(3)	(4)
BBA Financial Impact (price)	-0.675**		-0.683**	
	[-2.443]		[-2.461]	
BBA Financial Impact (price) * Bargaining Power	-0.679		-0.651	
	[-1.455]		[-1.389]	
BBA Financial Impact (Revenue)		-1.502**		-1.521**
		[-2.534]		[-2.558]
BBA Financial Impact (Revenue)* Bargaining Power		-3.644***		-3.625***
		[-2.989]		[-2.970]
Bargain Power (private vs. Medicare)	-1,207.954***	-1,055.576***	-1,196.125***	-1,046.810***
	[-4.648]	[-3.758]	[-4.578]	[-3.714]
Debt Ratio,1996	**-104.578**	**-68.395**		
	[-0.783]	**[-0.517]**		
Current ratio, 1996			**32.029**	**31.920**
			[1.609]	**[1.602]**
System Membership	-50.074	-52.751	-47.559	-50.404
	[-0.745]	[-0.780]	[-0.710]	[-0.748]
Network	-108.179*	-119.011*	-111.954*	-123.095*
	[-1.656]	[-1.809]	[-1.716]	[-1.873]
Centralized system	92.271	97.077	97.157	103.019
	[1.232]	[1.296]	[1.293]	[1.371]
Accredited	9.720	20.386	6.644	15.169
	[0.083]	[0.174]	[0.056]	[0.129]
Tacmi_1996	71.850	77.949	73.353	71.751
	[0.286]	[0.306]	[0.294]	[0.283]
NFP	-51.649	-50.445	-42.079	-44.320
	[-0.471]	[-0.461]	[-0.391]	[-0.412]
Gov	59.786	87.238	72.273	92.403
	[0.427]	[0.622]	[0.526]	[0.670]
Teaching	93.760	120.520	92.737	118.952
	[1.009]	[1.295]	[0.998]	[1.278]
Ocupancy_96	293.914	271.296	303.428	289.956
	[1.167]	[1.071]	[1.220]	[1.159]
Bedsize group 2 (100<299)	12.534	11.323	20.356	17.721
	[0.142]	[0.129]	[0.233]	[0.202]
Bedsize group 3 (300<)	-94.711	-92.879	-84.713	-84.548
	[-0.717]	[-0.698]	[-0.641]	[-0.635]
HHI_1996	544.628**	561.584**	555.519**	570.459**
	[2.157]	[2.214]	[2.194]	[2.247]
Change of HHI	884.117**	876.911**	830.966**	821.279**
	[2.334]	[2.343]	[2.176]	[2.175]
Observations	3,696	3,696	3,696	3,696
R-squared	0.203	0.199	0.205	0.201

Note: Standard errors are clustered by hospital. Robust t-statistics are reported in brackets. All regressions include year and county fixed effects. *** p<0.01, ** p<0.05, * p<0.1.

Table 5-5: Cost Shifting by Financial Distress Level

Panel A: Financial distress measured by debt ratio

	1st quartile	2nd quartile	3rd quartile	4th quartile
BBA Financial Impact (Revenue)	-2.746	-1.108	-0.210	-1.927
	[-1.650]	[-0.868]	[-0.203]	[-1.572]
BBA Financial Impact (Revenue)* Bargaining Power	-0.135	-0.296	**-6.114****	**-3.858***
	[-0.049]	[-0.110]	[-2.101]	[-1.674]
Bargain Power (private vs. Medicare)	-1,131.322**	-711.024	-1,071.879	-936.437
	[-2.239]	[-1.054]	[-1.364]	[-1.614]
debt ratio_1996	-253.206	3,156.127*	-2,259.798	700.907**
	[-0.234]	[1.680]	[-1.495]	[2.380]
Observations	927	925	923	921
R-squared	0.440	0.356	0.344	0.363
Marginal Effect of cost shifting			41%	36%

Panel B: Financial distress measured by current ratio

	1st quartile	2nd quartile	3rd quartile	4th quartile
BBA Financial Impact (Revenue)	-1.427	-0.756	-0.234	-2.108
	[-1.171]	[-0.704]	[-0.221]	[-1.397]
BBA Financial Impact (Revenue)* Bargaining Power	-3.427*	-4.128*	-5.283**	-0.489
	[-1.726]	[-1.673]	[-2.327]	[-0.173]
current ratio_1996	-456.932	-1,216.252**	-2,699.268***	-886.451
	[-0.890]	[-2.031]	[-5.716]	[-1.264]
Bargain Power (private vs. Medicare)	-171.093	-589.952	126.006	23.566
	[-0.804]	[-1.496]	[0.492]	[0.738]
Observations	924	928	923	921
R-squared	0.316	0.430	0.426	0.379

Note: Standard errors are clustered by hospital. Robust t-statistics are reported in brackets. All regressions include year and county fixed effects. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 5-6: Cost Shifting by Financial Distress (Interaction Effect)

	(1) Debt Ratio 1996	(2) Current Ratio 1996
BBA Financial Impact (Revenue)* Bargaining Power* Debt Ratio	-4.988**	
	[-2.189]	
BBA Financial Impact (Revenue)* Bargaining Power* Current Ratio		0.792**
		[2.048]
BBA Financial Impact (Revenue)	-1.549***	-1.635***
	[-2.632]	[-2.765]
BBA Financial Impact (Revenue)* Bargaining Power	-0.506	-5.042***
	[-0.283]	[-3.381]
Bargain Power (private vs. Medicare)	-906.755***	-909.237***
	[-3.167]	[-3.159]
Debt Ratio,1996	-169.106	
	[-1.167]	
Current ratio, 1996		44.017**
		[2.170]
Totlevrg_96	-169.106	
	[-1.167]	
Curratio_96		44.017**
		[2.170]
HHI_96	539.473**	559.314**
	[2.146]	[2.218]
Ch_HHI	880.280**	873.813**
	[2.354]	[2.332]
yr2	22.598	12.418
	[0.399]	[0.219]
yr3	107.268	91.561
	[1.437]	[1.219]
yr4	225.793**	208.498**
	[2.485]	[2.285]
yr5	565.089***	544.879***
	[5.495]	[5.283]
Observations	3,696	3,696
R-squared	0.202	0.204

Note: Standard errors are clustered by hospital. Robust t-statistics are reported in brackets. All regressions include year and county fixed effects. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Chapter 6 The Impact of the BBA of 1997 on Health Outcomes

6.1 Introduction

Most previous research uses the mortality of AMI patients to measure the impact of BBA on health outcomes. However, there are some potential problems in using the mortality of AMI patients to identify changes in health outcomes. First, there is selection bias in using mortality to measure hospital quality (Gowrisankaran 1998, Geweke *et al* 2003). Most statistics models assume random assignment of patients. However, patients or their physicians are likely to choose hospitals based on the factors such as location, convenience, and severity of illness. For instance, patients with high unobserved severity of illness select high quality hospitals; consequently observed mortality rates for high quality hospitals are higher. Geweke *et al* (2003) stresses that the problems remain even after controlling the observed measures of severity of illness. Second, the mortality of AMI is biased by "Window Dressing" effect. Because the mortality of AMI is an established indicator of the quality of health care and has received a lot of attentions from the public, hospitals may focus their resources on maintaining the quality of care for AMI patients, despite of reducing the service quality in other areas. Third, the quality of care measured by mortality rate does not capture the changes in the quality of life or in the quality that has not led to any changes in mortality. The effects of deteriorated service quality may vary from discomfort and extended length of stay to prolonged or permanent disability and death. However, the mortality rate captures only the death in severe cases.

I use the hospital-acquired infection (HAI) rate to identify the changes in health service quality. The HAI is an infection that a patient contracts while hospitalized. I select the HAI rate to measure the hospital service quality for the following reasons. First, HAIs are a significant cause of morbidity and mortality in the United States. According to the Centers for Disease Control and Prevention (DCP)'s estimation, each year in the United States there are 1.7 million healthcare-associated infections, which cause about 99,000 deaths and additional healthcare cost from $35.7 to $45 billion annually (Klevens *et al* 2002). Now HAI has been treated as a priority within the health service.[26] Second, HAI rate is regarded as a comprehensive index of health service quality. To prevent infection, hospitals are required to ensure systematical adoption of policy and procedures that reduce risk and enhance patient safety. Further, mandatory reporting of HAI rates was not enforced until 2005. The Deficit Reduction Act (DRA) of 2005 instructed the Centers for Medicare & Medicaid Services (CMS) to identify at least two hospital-acquired conditions, which would be subject to performance-based payment. On the state level, Pennsylvania was one of the first states to mandate hospital-acquired infection reporting and began to release public reports on HAI data since 2005. Therefore, unlike the mortality of AMI patients, the HAI rates among hospitals in Pennsylvania during 1998-2002 are not subject to the "Window Dressing" effects.

I use the occurrence rate of sepsis and pneumonia associated with invasive surgical procedures as a proxy of the HAI rate in this study. HAIs are often poorly identified in administrative records because based on diagnosis codes it is hard to distinguish HAIs from community acquired infection. Hospital acquired pneumonia is a serious infection that can set in if a disease-causing microbe gets into the lungs -- in some cases when a dirty ventilator tube is used. It occurs more often in patients who are using a respirator machine (also called a ventilator) to help them breathe and affects approximately 250,000 US hospitalizations each

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[26] http://www.cdc.gov/HAI/prevent/prevention.html

year.[27] Sepsis is a severe illness in which the bloodstream is overwhelmed by bacteria. In most cases Sepsis results from infections such as primary bloodstream infections and surgical site infections. Sepsis affects 750 000 US hospitalizations yearly and approximately half of these cases may be hospital acquired (Eber *et al* 2010). Studies have shown that sepsis and pneumonia can reliably identify HAIs in administrative records (Martin *et al* 2003, Aronsky *et al* 2005). I narrow down to invasive surgical procedure only because these cases were unlikely to result from preexisting community acquired infection (Eber *et al* 2010). Further, surgical infection prevention is one important indicator of health care quality and patient safety. In 2004 the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) listed surgical infection prevention as one of the five major conditions to be disclosed publicly.[28] The Centers for Medicare & Medicaid Services (CMS) in 2007 selected surgical site infection as one of the two hospital-acquired infections[29] that are subject to performance-based payment.

I categorize hospitals in Pennsylvania into three groups based on the level of financial impacts by the BBA of 1997. I continue to use the exogenous variable, BBA Financial Impact Index constructed in Chapter 5 to measure the financial stress due to the BBA of 1997 (Seshamani, Schwartz & Volpp 2006, Wu & Shen 2011). This method is better than the one using operating margin or changes in net patient revenues (Bazzoli *et al* 2007, 2008) because

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[27] http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001201/.

[28] In 2004, the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) launched Quality Check (www.qualitycheck.org) to publicly report hospital-specific information about clinical performance in patient care for five major conditions: acute myocardial infarction, heart failure, pneumonia, pregnancy and related conditions, and surgical infection prevention.

[29] The other hospital-acquired infection is catheter associated urinary tract infection.

hospitals may change their behaviors to increase revenue and offset the expected loss due to exogenous financial shock, while the BBA Financial Impact Index as discussed in Chapter 5 is an exogenous measurement of financial shock and is not affected by the changes in hospital practices. I used an average of BBA revenue impact during 1998 to 2002 to categorize hospitals into high-impact group (in the top quartile), middle-impact group (in the 2nd and 3rd quartile) and low-impact group (in the 4th quartile of BBA impact).

6.2 Dataset

I use the National Healthcare Safety Network list of operative procedures associated with substantial risk of infection to identify invasive surgical cases. I select the patients as those who had a DRG code indicating orthopedic or general surgical procedures, including Circulatory system, Neurosurgery, Orthopedic surgery, Endocrine system, Gastrointestinal system, Genitourinary system, Reproductive system, Respiratory system, Skin and soft tissue and Hemic and lymphatic system. Among the selected patients, I identify those who developed pneumonia or sepsis or both by checking the non-primary diagnosis codes.

I use PHC4 inpatient data during 1994 to 2002. I include data from 1994 to 1996 as the base years before the enactment of the BBA of 1997. I include data up to 2002 for two reasons. The first reason is that 2002 is the last year when some of the BBA's policies are still effective. Another reason is that new legal requirement regarding healthcare quality enacted after 2003. Since 2003, CMS has required hospitals to publicly report on performance measures endorsed by the National Quality Forum (NQF) and Hospital Quality Alliance (HQA) in order to obtain their full Medicare annual payment update. Especially, Act 14 of 2003 in Pennsylvania requires hospitals to collect, analyze and report HAI rates.

From PHC4 data of nine-year period, I initially identified from 196 general hospitals totally 2,498,311 surgical events, among which 25,425 cases are with HAIs. The average HAI rate during the study period is about 1.02%. About 80% of the infection cases are sepsis infections. I then aggregate the patient level data into hospital level and obtain hospital characteristics information and BBA financial impact information by linking to the BBA impact dataset in this study. I keep hospital observations without missing value. Because I need to use log transformation of the HAI rate, I deleted eight observations from one hospital, which reported zero HAI rate for the whole research period. I eventually have 706 observations at the hospital level during the study period, including in total 89 distinct hospital IDs. Since about half of the observations were dropped when merging with CMS dataset to obtain BBA impact information, I compare the main descriptive statistics of Pennsylvania hospital population with the final sample I have.

6.3 Descriptive Statistics

The basic descriptive statistics of the full sample and subsample are reported in Table 6-1. The dependent variable, the HAI rate and all explanatory variables of the patient and hospitals characteristics, including MediQual Atlas Admission Severity, payer mix of patients and hospital ownership, in the full sample and the subsample, are not statistically significantly different. For this reason the subsample is a valid representative of the full sample, though the size of the subsample is only about half of the full sample. BBA financial impact is reported for the subsample only.

The distribution of the HAI rate in histogram graph is reported in Figure 6-1A. Like most other health outcome variables, the distribution of HAI rate is truncated at zero and highly skewed to the right. For this reason, I take the log of HAI. As shown in Figure 6-1B, the distribution of the log-transformed HAI rate is very close to normal distribution. Therefore it is valid to use the log transformation of HAI rate as the dependent variable of empirical estimation.

6.4 Empirical methodology and models

Basically, I use hospital-year fixed-effect models to examine the BBA's impact on the HAI rates of hospitals. I first start from a model with year and BBA impact group interaction terms, which allow time-varying post-BBA effects. This model also allows a flexible investigation of whether there are any differential trends in the HAI rates between the BBA impact groups in any of the pre-BBA years. This method is similar with those in Acemoglu & Finkelstein (2008) and Seshamani, Zhu & Volpp (2006).

$$Log(HAI_{it}) = \alpha_i + \lambda X'_{it} + \Sigma_{t>1994}\, \beta_{1\_t}\, (Year_t{*}High\_Impact_i) + \Sigma_{t>1994}\, \beta_{2\_t}\, (Year_t{*}Mid\_Impact_i) + Hospital_i + Year_t + \mu_{it} \qquad (6.1)$$

where i indexes hospital, and t indexes year. $Hospital_i$ includes hospital fixed effect, while $Year_t$ captures the year fixed effects. X' is a sector of hospital characteristics. The dummy variable High-Impact indicates a hospital with BBA Impact Index in the top 25 percentile, while Mid-Impact indicating one in the 25^{th} to 75^{th} percentile of BBA Impact Index. The base group is the hospitals in lower than 25 percentile. The coefficients of the interaction terms of year dummy and group dummy capture how the difference between the impact group and the base group changes between the base year of 1994 and a specific year.

Then I investigate whether there is any common trend of the effect of BBA on the changes of HAI rates. I use 'post' to indicate the years after the implementation of BBA and investigate the data using equation (6.2), in which years between 1998 and 2002 are defined as 'post-BBA' period. The interaction between "High-impact" and "post" dummy identifies how the difference of HAI rates between hospitals of high BBA financial impact and of low impact changes during the period before-BBA and after-BBA.

$$Log(HAI_{it}) = \alpha_i + \lambda X'_{it} + \beta_1 (Post*High\_Impact) + \beta_2 (Post*Mid\_Impact) + Hospital_i + Year_t + \mu_{it} \quad (6.2)$$

Considering that my finding in Chapter 5 reports that hospitals actively engaged in cost-shifting during the period of 1998 to 2000, whereas did not significantly shift costs during 2001 to 2002, I further divide the post-BBA years into Short-Run-post BBA (1998-2000) and Long-Run-post BBA (2001-2002). The estimation equation is specified as below.

$$Log(HAI_{it}) = \alpha_i + \lambda X'_{it} + \beta_1 (SR\_post*High\_Impact) + \beta_2 (LR\_post*High\_Impact) + \beta_3 (SR\_Post*Middle\_Impact) + \beta_4 (LR\_Post*Middle\_Impact) + Hospital_i + Year_t + \mu_{it} \quad (6.3)$$

Estimations (6.1) - (6.3) are the Difference-In-Difference models in essence. I did not include the main effect of period dummies and impact group dummies because the BBA impacts on HAI rates are identified by comparing changes in HAI rates across periods and across the BBA impact groups. The main effects of period dummies and impact group dummies do not vary over time for each hospital.

In all estimations, the aggregated hospital level outcome measure is the log of HAI rate, using the surgical site sepsis and pneumonia rate as the proxy. Among the control variables on the right-hand side of the estimation equation, I use MediQual Atlas Admission Severity aggregated on hospital level to control for the patient severity in a specific hospital. MediQual Atlas Admission Severity is a score of 0 to 4. It measures the risk of in-hospital mortality based on 250 key clinical indicators upon admission, such as blood pressure, serum sodium, and hematocrit. Because it is more likely for sicker patients to have HAI during their hospitalization, this admission-based severity index enables to compare risk adjusted outcomes.

I include the length of stay to control for the unobservable patient severity, or underlying patient risks. The potential endogeneity between the HAI and the length of stay in hospitals is widely recognized in literature. While the risk of acquiring an infection increases with the length of hospital stay (Graves *et al* 2007, Delgado-Rodriguez *et al* 1990, Glynn *et al* 1997), the length of stay is further extended upon the occurrence of negative event HAI.

With the endogenous problem, the estimated coefficient of length of stay is upward biased. Given the possibility of bias, in this study I include the length of stay for the following reasons. First, the time dependent feature is an important feature of HAI (De Angelis *et al* 2010). Risk of occurrence of HAI is increased every day when a patient stays longer in the hospital. The longer a patient is hospitalized, the higher the probability of using invasive medical devices, that lead to higher HAI. Second, the endogenous problem of the length of stay is not a major concern in this case. While length of stay for patients undergoing elective surgery varied according to the presence of HAI, the length of stay for patients with underlying medical illness or trauma is largely decided by the underlying severity of illness and patient characteristics (Olaechea *et al* 2003). They also found that the effect of extra Intensive Care Unit infection did not contribute significantly when stays are longer than 21 days.

I control payer mix by including the percentage of Medicare, Medicaid or private-insurance patients. I also include the gender, age, race to control for patient characteristics. Among the hospital characteristics, I control hospital size by including bed-size group dummy variables. I also include occupancy rates to control for actual use of beds. I control the hospital ownership by using a dummy for non-for-profit, where the base group is for-profit hospitals.[30] I include dummies for teaching status, accreditation, and membership of hospital system or network, as well as urban or rural location. Hospital market competition is measured by Herfindahl-Hirschman Index (HHI), which is calculated by using hospitals' bed number on actual zip code level. Additionally, I include eight Facility Region dummies to control for area fixed effects. The Facility Region is based on the Facility Region Code assigned by PHC4 and there are totally nine Facility Regions in Pennsylvania.

6.5 Results

Figure 6-2 shows the simple time-series average of HAI rates in hospitals with high BBA impact and those with low impact measured in terms of Medicare price change or Medicare revenue change. The top two graphs shows the trends of changes in HAI rates and log HAI rates when the impact measured by BBA price bite. There is no clear pattern for the changes between the high and low impact groups when the impact is measure by BBA price bite. The two graphs in the middle panel show the trends of changes in HAI rates and log HAI rates when the impact is measured by BBA revenue shock. The HAI rate in the High Impact group is on average higher than that in the Low Impact group. It appears that the HAI rates in both High and Low Impact groups lowered during 1998 and 1999. However, the rate in the High Impact group began to pick up again after 2000 while that in the Low Impact group showed a trend of going down.

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[30] The government hospitals in the full sample were dropped after merging with BBA financial impact data. In my final sample, there is no government hospital left.

The two graphs on the bottom level of Figure 6-2 show the trends of HAI rates between the financially distressed hospital (debt-ratio in the top quartile) and non-distressed hospitals (debt-ratio in the lowest quartile). In the graphs the HAI rate in distressed hospitals appears to remain on the high level after 1998 while the HAI rates in non-distressed hospitals tend to decrease, suggesting that the health outcomes in financially distressed hospitals may be subject to the financial impact by the BBA.

However, the time-series trend is only suggestive, because it does not control other changes in the hospital sector or general factors in the economy. I formally control the hospital characteristics in regression models and exploit the variation of HAI rates across hospitals due to the impact of BBA.

Table 6-2A reports the estimation of equation (6.1). I use years 1994, 1996 and 1998, respectively, as the base year in Columns (1) to (3), respectively. Table 6-2B reports the coefficients of the control variables. Except for the coefficient of (High impact * 1996) relative to 1994 being significant at the 10% level, none of the coefficients of (Impact group * year) is significant. Despite of the insignificance of the coefficients, the signs of the coefficients of (High impact * year) are all negative before 2002. However, it becomes positive in 2002. Although this insignificant estimation may only suggest the direction of the coefficients, these results imply that the HAI rates in high impact group might be insignificantly lower than those in the low impact group during the period of 1994 to 2001, however, the HAI rates among the High Impact hospitals becomes higher than those in the Low Impact hospitals in 2002. The estimation in Columns (2) and (3) using 1996 and 1998 as the base year, are insignificant again. However, the coefficients of (High impact * year) in 2002 are positive and much higher than those in previous years.

Table 6-3 reports the estimation of equation (6.2). Coefficients of the interaction term of impact group and post BBA captures the effect of BBA financial impact on HAI rate. Columns (1) and (2) report tests using 1994 as the base year. Columns (3) and (4) report tests using 1996, the year right before the BBA of 1997 as the base year. Because Figure 6-2 shows that the HAI rates in 2000 deviate from the general trend after 1997, Columns (2) and (4) omits the observations from 2000. Results in Table 6-3 shows that none of the coefficients on the BBA impact and their interactions to the post BBA period is statistically significantly different from zero. This implies that there is no statistically significant difference in the HAI rates for all hospitals on average after the implementation of BBA between 1998 and 2002. In other words, the HAI rate trends are statistically the same between pre-BBA and post-BBA periods across the three BBA financial impact categories.

At the same time, given the statistical insignificance of the estimated coefficients, the sign of the coefficients may suggest the change directions of the HAI rates during the post-BBA period on average. All of the coefficients of Mid Impact * post are positive, suggesting that HAI rates in Mid Impact hospital groups are under pressure to compromise the quality. The coefficient of High Impact*post in Column (1) when including all years from 1994 to 2002 is negative, suggesting that the HAI rates in High Impact group may tend to be lower after the implementation of BBA. However, after I exclude the observations from year 2000, the sign becomes positive, though still insignificant. When I use shorter period to examine BBA’s impact during the period of 1996 to 2002, the coefficients are still insignificant, but the signs are all positive and the value of the reported t-statistics increased by two to four times.

Table 6-4 reports the short run and long run effects of BBA on HAI rate of hospital groups. Panel A reports results of estimations using BBA revenue shock to measure BBA's impact and to categorize hospitals, while Panel B reports estimations using BBA price cut per inpatient admission as specification tests. In Panel A, Columns (1) to (3) report estimations using data from 1994 to 2002. Column (1) reports the results of the specification including only hospitals fixed effects, year dummies and the interaction terms of impact groups and Long Run or Short Run terms, without controlling other hospital characteristics. Columns (4) and (5) report the results from the period of 1996 to 2002. Again, Columns (3) and (5) omit the data in year 2000. The results in Table 6-4 show that none of the coefficients of the BBA impact and their interactions to the post BBA period of short run or long run are statistically significantly different from zero. This implies that there is no statistically significant difference in the HAI rates for all hospitals on average after the implementation of BBA in the short run or long run compared to the pre-BBA trend. Again, the HAI rate trends are statistically the same between pre-BBA and short run or long run post-BBA periods across the three BBA financial impact categories.

Though the sign of the interaction term of High Impact and Short Run remains negative when using data from 1994 to 2002, it becomes positive when using data from 1996 to 2002 after omitting year 2000. The signs of the interaction term of High Impact and Long Run are positive in all specifications. The tests in Panel B of Table 6-4 using BBA price cut as BBA impact measurement are consistent with the results using BBA revenue shock as BBA impact measurement.

Table 6-5 reports the estimation of the effects of BBA on HAI rates in financially distressed hospitals. Panel A reports the effects on financially distressed hospitals and Panel B reports the effects on financially distressed hospital receiving high or mid level BBA impacts. Again, the coefficients are insignificant and the values of t-statistics are very low. In other words, after controlling common trends and patient risk factors, the HAI rates in those financially distressed hospitals are not significantly different from those non-distressed hospitals upon the implementation of the BBA of 1997. For the group of hospitals which are financially distressed and receive high or mid level of financial impact from BBA, their HAI rates are not significantly different from other hospitals after controlling common trends and patient risk factors.

6.6 Discussion

The results in this study suggest that after the implementation of the BBA of 1997 there is no significant change in the health outcomes measured by the HAI rate, which is specifically the occurrence rate of sepsis and pneumonia at surgical sites.

Although I find no significant evidence about the association between the health outcome and hospital's cost shifting strategy, the finding in this study suggests that hospitals may experience greater pressure of compromising HAI rate during post-BBA period, and the pressure may be weak during the short run period of 1998 to 2000, but became stronger three years after the implementation of the BBA. Wu & Shen (2011) find that the adverse effect of the BBA of 1997 on AMI mortality only became measurable during the period of 2001 to 2005, about five years later after the policy implementation. Especially, the adverse effect of the BBA of 1997 became significant after 2003, which is the year that was not included in this study.[31] In future research, I will control the HAI reporting factor and extend the study period to 2005.

There is an association between the change of HAI rate and the timing of hospital cost-shifting. It appears that hospitals actively use cost-shifting strategy during the period of 1998-2000 soon after the BBA, the difference of HAI rates between high and low BBA impact groups tend to be smaller. On the other hand, when hospitals' cost-shifting was less possible during the period of 2001 to 2002, it appears that hospitals were facing greater pressure of compromising HAI rates. This implication supports the theory that hospitals use cross-subsidization from private to Medicare patients to maintain medical care quality.

There are several limitations to the analyses of outcome. Because this study sample only includes half of the hospitals in Pennsylvania, I will generalize the finding with caution. Even though the mean and distribution shape of HAI rates in the final sub sample are very similar with those in the full sample, there is no guarantee that the subsample has the same distribution of the population in all respects concerned. If the hospitals which were dropped due to missing value from the sample also experience great difficulty in managing health outcome, the estimated effects of BBA could be biased toward zero.

Another limitation of this study is also related with the relative small sample size of the final sample. Small sample sizes lead to decreased precision, or large sample variance. The

[31] As discussed in the introduction part of this study, I did not include 2003 because Pennsylvania began to establish mandatory HAI reporting policy, which may bring 'Window effect' or 'disclosure effect' to hospital behaviors.

estimated coefficients of BBA's impact on HAI rates have positive signs but are insignificant. While it implies that BBA has no significant impact on the health outcome measured by HAI, insignificance of estimated coefficients could be due to the relatively small sample. Also because of the sample size problem, the observation identified for interaction effects are further restricted to small numbers. For example, there are actually only 23 observations in the category of "distressed hospital with high BBA impact".

Figure 6-1A: Distribution of Hospital Acquired Infection Rate

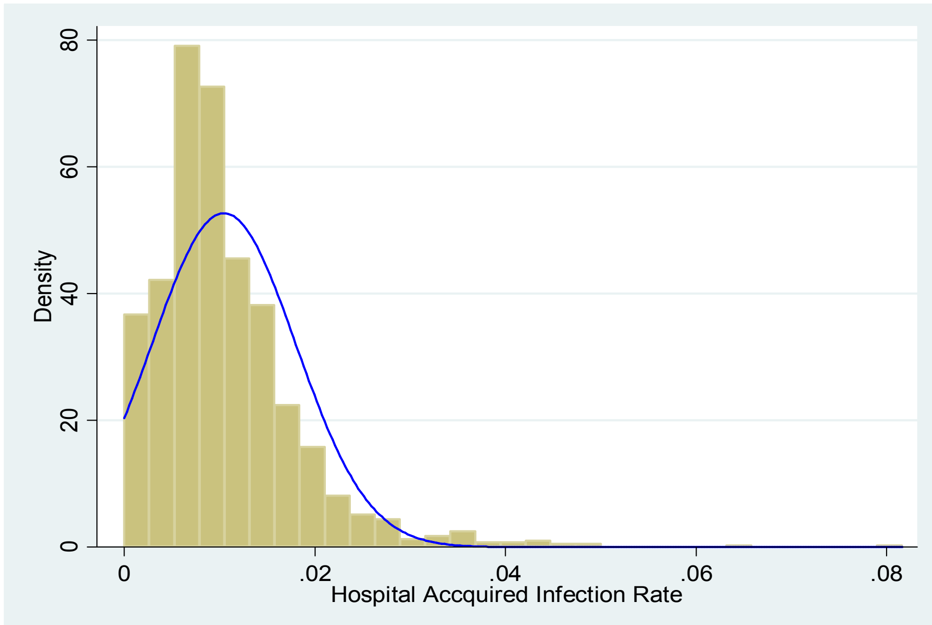

Figure 6-1B: Distribution of log of Hospital Acquired Infection Rate

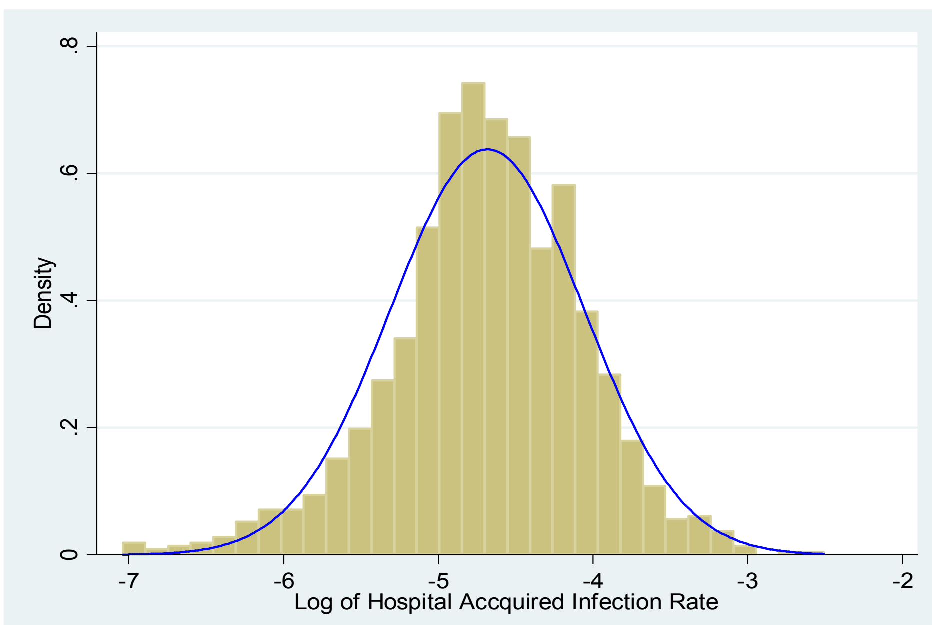

Figure 6-2: Time Series of HAI Rates

Table 6-1: Descriptive Statistics of Patient and Hospital Characteristics

	Full Sample		Subsample	
	Mean	S. D.	Mean	S. D.
Dependent variable				
Hospital Acquired Infection Rate	1.045%	0.76%	1.043%	0.69%
Patient Characteristics				
MediQual Atlas Admission Severity	0.956	0.232	0.943	0.185
Uninsured	1.8%	3.7%	1.7%	4.2%
Medicare share	42.1%	13.5%	43.2%	11.2%
Medicaid Share	9.1%	7.1%	7.8%	5.4%
Private Insurance	41.0%	13.4%	41.3%	12.5%
White	83.3%	26.9%	86.0%	27.1%
Black	6.3%	11.4%	3.4%	6.3%
Female	61.9%	8.9%	62.6%	6.8%
Age	56.6	8.4	57.5	4.6
Length of stay	5.4	1.2	5.2	1.3
Hospital Characteristics				
Non-For-Profit (1=yes)	99.0%	10.2%	98.5%	12.2%
For-Profit (1 = yes)	1.0%	10.2%	1.5%	12.2%
Hospital System Member (1 = yes)	46.5%	49.9%	45.0%	49.8%
Network (1=yes)	28.3%	45.0%	29.0%	45.4%
Bed numbers	216.2	152.6	216.0	147.3
Bedsize group 1 (<100)	18.1%	38.5%	14.6%	35.3%
Bedsize group 2 (100<299)	62.7%	48.4%	66.7%	47.2%
Bedsize group 3 (300<)	19.2%	39.4%	18.7%	39.0%
Having HMO contracts (1 = yes)	75.2%	43.2%	79.0%	40.8%
HHI	0.962	0.129	0.954	0.142
Occupancy rate	56.4%	14.9%	56.5%	14.6%
Urban (1=yes)	77.8%	41.6%	77.9%	41.6%
Accred (1=yes)	89.3%	30.9%	89.5%	30.6%
Teaching (1=yes)	30.1%	45.9%	26.7%	44.3%
Financial Impact				
BBA Impact (price) ($)			-453.9	286.0
BBA Impact (revenue) ($)			-180.0	85.3
Debt ratio			0.489	0.334
Number of hospital observations	1541		727	

Table 6-2A: Changes of Average Difference of HAI Rate between Impact Groups

Dependent Variable = log (HAI rate)

	1994-2002 (1)	1996-2002 (2)	1998-2002 (3)
High Impact*1995	-0.0238		
	[-0.1538]		
High Impact*1996	-0.3266*		
	[-1.7187]		
High Impact*1997	-0.0987	0.1840	
	[-0.3736]	[0.7962]	
High Impact*1998	-0.2112	0.0793	
	[-0.9564]	[0.3753]	
High Impact*1999	-0.1154	0.1469	-0.0299
	[-0.5878]	[0.6981]	[-0.1961]
High Impact*2000	-0.3105	-0.0187	-0.1589
	[-1.2825]	[-0.0771]	[-0.6782]
High Impact*2001	-0.1149	0.1750	0.0515
	[-0.4808]	[0.6800]	[0.2920]
High Impact*2002	0.0597	0.3410	0.2182
	[0.2221]	[1.3099]	[1.1065]
Mid-Impact*1995	0.1180		
	[0.7044]		
Mid- Impact*1996	-0.2875		
	[-1.3601]		
Mid- Impact*1997	0.0228	0.2916	
	[0.0835]	[1.2348]	
Mid- Impact*1998	-0.0414	0.2244	
	[-0.1803]	[1.0591]	
Mid- Impact*1999	-0.0326	0.2219	-0.0843
	[-0.1513]	[1.0963]	[-0.4619]
Mid- Impact*2000	-0.1185	0.1535	-0.1256
	[-0.4851]	[0.6323]	[-0.5293]
Mid- Impact*2001	0.0313	0.2933	0.0054
	[0.1258]	[1.1763]	[0.0272]
Mid- Impact*2002	0.1035	0.3537	0.1074
	[0.3982]	[1.3997]	[0.5927]
Observations	706	554	401
R-squared	0.545	0.606	0.688

All regressions controlled for patient characteristics (gender, age, race, severity, length of stay and payer mix) and hospital characteristics (ownership, teaching status, accreditation, urban, occupancy rate, bedsize, HMO contract status and HHI). The coefficients of controlled variables are reported in Table 6-2b.

All regressions included hospital fixed effects and year fixed effects.

Robust t-statistics in brackets. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 6-2B: Yearly Changes of HAI Rate by Impact Groups (Control Variables)

Dependent Variable = log (HAI rate)

Control Variables	1994-2002	1996-2002	1998-2002
	(1)	(2)	(3)
Medicare share	-0.1542	-0.1680	-0.8010*
	[-0.4357]	[-0.4003]	[-1.7680]
Medicaid Share	0.1154	-0.0754	-2.3744
	[0.1094]	[-0.0655]	[-1.5560]
Black	1.5350	1.1592	0.6927
	[1.3158]	[1.0463]	[0.6779]
Female	1.5896*	2.4430**	1.9987*
	[1.9769]	[2.6143]	[1.7791]
Age	-0.0057	-0.0179	-0.0191
	[-0.2198]	[-0.5805]	[-0.5360]
Length of stay	0.0522	0.0465	0.2819***
	[1.4531]	[1.3170]	[2.6746]
Admission Severity	1.2088*	1.9806***	1.3891*
	[1.9282]	[2.7278]	[1.8006]
Accreditation	-0.0146	-0.1278	-0.1771
	[-0.1075]	[-0.7036]	[-0.7628]
Teaching	-0.0456	-0.1334	-0.1389
	[-0.3742]	[-0.7859]	[-0.6239]
Hospital System Member	-0.0264	0.0196	-0.0334
	[-0.3883]	[0.2762]	[-0.4274]
Network	0.0069	0.0234	0.0953
	[0.1115]	[0.3226]	[0.9687]
Having HMO contracts	0.0429	0.0727	0.0744
	[0.4875]	[0.7709]	[0.6943]
Urban	0.1157	0.0388	-0.1650
	[0.4892]	[0.1353]	[-0.4080]
Non-For-Profit	-0.0290	-0.0467	-0.3170
	[-0.1303]	[-0.1763]	[-1.4739]
Occupancy rate	-0.1508	-0.0076	-0.3655
	[-0.3756]	[-0.0177]	[-0.8369]
Bedsize group 2 (100<299)	0.4087	0.4218	0.3659
	[1.6103]	[1.2649]	[1.4787]
Bedsize group 3 (300<)	0.3185	0.4140	0.4037
	[1.1690]	[1.1758]	[1.4816]
HHI	0.0211	0.1273	-0.1047
	[0.1149]	[0.6272]	[-0.2657]
Observations	706	554	401
R-squared	0.545	0.606	0.688

All regressions included region dummies, hospital fixed effects and year fixed effects.

Robust t-statistics in brackets.

*** p<0.01, ** p<0.05, * p<0.1

Table 6-3: BBA's Impact on HAI Rate

Dependent Variable = log(HAI rate)

VARIABLES	(1) 1994-2002	(2) 1994-2002 omitting 2000	(3) 1996-2002	(4) 1996-2002 omitting 2000
High Impact* post	-0.0279	0.0117	0.0525	0.0825
	[-0.2141]	[0.0853]	[0.3484]	[0.5130]
Mid Impact* post	0.0255	0.0429	0.1027	0.1019
	[0.1890]	[0.3083]	[0.6584]	[0.6213]
Observations	706	633	554	481
R-squared	0.537	0.532	0.600	0.606

Not reported here, but all regressions controlled for patient characteristics (gender, age, race, severity, length of stay and payer mix) and hospital characteristics (ownership, teaching status, accreditation, urban, occupancy rate, bedsize, HMO contract status and HHI).

All regressions included hospital fixed effects and year fixed effects.

Robust t-statistics in brackets.

*** p<0.01, ** p<0.05, * p<0.1

Table 6-4: Short Run and Long Run Effects of BBA on HAI Rate

Dependent Variable = log(HAI rate)

Panel A: Impact groups are based on BBA revenue shock

	(1)	(2)	(3)	(4)	(5)
	1994-2002	1994-2002	1994-2002	1996-2002	1996-2002
VARIABLES	(no control var.)		omit 2000		omit 2000
High Impact * Short Run	-0.0527	-0.0973	-0.0431	-0.0183	0.0237
	[-0.3637]	[-0.7305]	[-0.3026]	[-0.1133]	[0.1365]
Mid Impact *Short Run	0.0462	-0.0246	0.0015	0.0573	0.0665
	[0.3117]	[-0.1735]	[0.0096]	[0.3445]	[0.3756]
High Impact * Long Run	0.0998	0.0858	0.0757	0.1733	0.1540
	[0.5723]	[0.5013]	[0.4375]	[0.9555]	[0.8208]
Mid Impact* Long Run	0.1779	0.1053	0.0912	0.1814	0.1483
	[0.9838]	[0.6215]	[0.5357]	[0.9874]	[0.7851]
Observations	706	706	633	554	481
R-squared	0.538	0.504	0.533	0.602	0.607

Panel B: Impact groups are based on BBA price cut

	(1)	(2)	(3)	(4)
	1994-2002	1994-2002	1996-2002	1996-2002
VARIABLES		omit 2000		omit 2000
High Impact * Short Run	-0.0002	0.0824	-0.0364	0.0441
	[-0.0010]	[0.4694]	[-0.2407]	[0.2462]
Mid Impact *Short Run	-0.0222	0.0860	-0.0413	0.0804
	[-0.1431]	[0.4956]	[-0.2607]	[0.4566]
High Impact * Long Run	-0.1036	-0.0993	0.0013	0.0005
	[-0.5633]	[-0.5282]	[0.0067]	[0.0025]
Mid Impact* Long Run	0.1277	0.1292	0.2324	0.2231
	[0.6781]	[0.6704]	[1.1882]	[1.1070]
Observations	706	633	554	481
R-squared	0.542	0.539	0.605	0.614

Not reported here, but all regressions controlled for patient characteristics (gender, age, race, severity, length of stay and payer mix) and hospital characteristics (ownership, teaching status, accreditation, urban, occupancy rate, bedsize, HMO contract status and HHI).

All regressions included hospital fixed effects and year fixed effects.

Robust t-statistics in brackets

*** p<0.01, ** p<0.05, * p<0.1

Table 6-5: Effects of BBA on HAI Rate by Financial Status and BBA Impact Groups

Dependent Variable = log (HAI rate)

Panel A: Effects on financially distressed hospitals

	(1)	(2)	(3)	(4)	(5)
	1994-2002	1994-2002	1994-2002	1994-2000	1994-2000
VARIABLES		omit1997	omit 1997, 2001		omit1997
Disdressed*Post	0.0966	0.0496	0.0926	0.1561	0.1071
	[0.9566]	[0.4271]	[0.7958]	[1.4961]	[0.9100]
Observations	706	629	542	531	454
R-squared	0.538	0.549	0.560	0.560	0.574

Panel B: Effects by financial status and BBA impact groups

	(1)	(2)	(3)	(4)
VARIABLES	1994-2002	omit 1997 & 2001	1994-2002	omit 1997 & 2001
Distressed*High Impact * post	-0.0628	-0.0268		
	[0.135]	[0.241]		
Distressed*Mid Impact * post	0.0327	0.0432		
	[0.174]	[0.190]		
Distressed*High Impact * early			-0.0211	-0.0328
			[0.101]	[0.177]
Distressed*High Impact * late			-0.1181	0.0004
			[0.238]	[0.416]
Distressed*Mid Impact * early			-0.0255	-0.0354
			[0.173]	[0.181]
Distressed*Mid Impact * late			0.1338	0.1960
			[0.203]	[0.260]
Observations	706	543	706	543
R-squared	0.537	0.541	0.538	0.543

Not reported here, but all regressions controlled for patient characteristics (gender, age, race, severity, length of stay and payer mix) and hospital characteristics (ownership, teaching status, accreditation, urban, occupancy rate, bedsize, HMO contract status and HHI).

All regressions included hospital fixed effects and year fixed effects.

Robust t-statistics in brackets

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Chapter 7 Concluding Remarks

Conclusion

This study analyzed how private prices changed during the period of 1998 to 2002 relative to the base year of 1996 with respect to Medicare payment cut by the BBA of 1997. I found that during the period of 1996 to 2002, hospitals on average were able to shift the expected revenue loss of the BBA to private patients almost on a one-dollar-to-one-dollar basis. However, the hospitals did not shift the expected loss equally every year. It appears that hospitals shifted most cost during the first three years after the implementation of the BBA of 1997.

There is statistically significant evidence that hospitals with financial distress do cost-shifting. These results suggest that underlying hospital financial health status plays important role in cost shifting decision.

I found that the BBA of 1997 had no significant impact on the health outcomes measured by the HAI rate, which is specifically the occurrence rate of sepsis and pneumonia at surgical sites. I found no statistically significant evidence about the association between the health outcomes and hospital's cost shifting strategy. However, the empirical results suggest that hospitals may experience greater pressure of compromising HAI rate during the post-BBA period, and the pressure seems weaker when hospitals were shifting cost, whereas stronger when hospitals did not significantly shift cost.

Limitation

One limitation of the cost shifting in this study is that the price changes do not reflect potential quality changes. Healthcare quality is not directly measured and controlled in the estimation. Facing payment cut by Medicare, hospitals may cut cost by cutting staff numbers and/or adopting new technologies. Hospitals may also shift patients between inpatient and outpatient departments, which are not subject to the impact of the BBA of 1997. In my future research, I will further examine hospitals' cost shifting with the controls of quality measurement, technology changes and labor input of health care givers.

Although I find highly significant evidence of hospital cost shifting in this study, I will further explore to obtain a more feasible estimation of cost shifting effect in future research. I will examine whether there are other time variant confounding factors of private patient price change, which may lead to an overestimated efficient of BBA Financial Impact. I will also try IV method to better address the concern that Medicare price or revenue may be correlated with changes in private price.

Another future research direction of this study is to examine the association between the hospital investment cuts due to the BBA of 1997 and possible negative patient outcomes during longer period. Increased financial pressures might lead to cutbacks in hospital plants and equipment investments as suggested in Bazzoli *et al* (2007). Thus, the negative impacts may show up during even longer period, despite that this study does not find significant negative impacts on the health outcomes.

References

Acemoglu, D. and A. Finkelstein. 2008. "Input and Technology Choices in Regulated Industries: Evidence from the Health Care Sector." *Journal of Political Economy*, 116 (5), 837-880.

Agency for Healthcare Research and Quality, 2002. "AHRQ Quality Indicators–Guide to Inpatient Quality Indicators: Quality of Care in Hospitals-Volume, Mortality, and Utilization".

Aronsky D.; P. J. Haug; C. Lagor and N. C. Dean. 2005. "Accuracy of Administrative Data for Identifying Patients with Pneumonia". *America Journal of Medicine Quarterly*, 20 (6), 319-328.

Bazzoli, G. J.; B. Chan; S. M. Shortell and T. D'Aunno. 2000. "The Financial Performance of Hospitals Belonging to Health Networks and Systems." *Inquiry-the Journal of Health Care Organization Provision and Financing*, 37 (3), 234-52.

Bazzoli, G. J.; H. F. Chen; M. Zhao and R. C. Lindrooth. 2008. "Hospital Financial Condition and the Quality of Patient Care." *Health Economics*, 17 (8), 977-95.

Bazzoli, G. J.; J. P. Clement; R. C. Lindrooth; H. F. Chen; S. K. Aydede; B. I. Braun and J. M. Loeb. 2007. "Hospital Financial Condition and Operational Decisions Related, to the Quality of Hospital Care." *Medical Care Research and Review*, 64 (2), 148-68.

Bazzoli, G. J.; R. C. Lindrooth; R. Hasnain-Wynia and J. Needleman. 2004. "The Balanced Budget Act of 1997 and U.S. Hospital Operations." *Inquiry-the Journal of Health Care Organization Provision and Financing*, 41 (4), 401-17.

Blendon R. J.; M. Brodie; J. M. Benson; D. E. Altman; L. Levitt; T. Hoff and L. Hugick. 1998. "Understanding the Managed Care Backlash." *Health Affairs*, 17 (4), 80-94.

Burgess Jr., J. F.; C. Kathleen and J. Y. Gary. 2005. "The Effect of Network Arrangements on Hospital Pricing Behavior." *Journal of Health Economics*, 24 (2), 391-405.

Carter, G.; J. Newhouse and D. Relles. 1990. "How Much Change in the Case Mix Index is DRG Creep?"*R-3826-HCFA*. Santa Monica, CA: RAND Corporation.

Center on Budget and Policy Priorities. 2010. "Where do Our Federal Tax Dollars Go?" http://www.cbpp.org/files/4-14-08tax.pdf (last access: Aug 23, 2010).

Cutler, D. M. 1998. "Cost Shifting or Cost Cutting? The Incidence of Reductions in Medicare Payments." *Tax Policy and the Economy*, 12, 1-28.

Dafny, L. S. 2009. "Estimation and Identification of Merger Effects: An Application to Hospital Mergers." *Journal of Law and Economics*, 52 (3), 523-550.

Dafny, L. S. 2005. “How do Hospitals Respond to Price Changes?” *American Economic Review*, 95 (5), 1525-47.

Das D. 2009. “Factor Analysis of Financial and Operational Performance Measures of Non-Profit Hospitals.” *Journal of Health Care Finance,* 36 (2), 13-23.

De Angelis, G.; A. Murthy; J. Beyersmann and S. Harbarth. 2010. “Estimating the Impact of Healthcare-Associated Infections on Length of Stay and Costs.” *Clinical Microbiology and Infection*, 16 (12), 1729-1735.

Delgado-Rodriguez, M.; A. Bueno-Cavanillas; R. Lopez-Gigosos R; J. de Dios Luna-Castillo; J. Guillén-Solvas; O. Moreno-Abril; B. Rodriguez-Tunas; A. Cueto-Espinar; R. Rodríguez-Contreras and R. Galvez-Vargas. 1990. “Hospital Stay Length as an Effect Modifier of Other Risk Factors for Nosocomial Infection.” *European Journal of Epidemiology*, 6 (1), 34-39.

Devers, K. J.; L. P. Casalino; L. S. Rudell; J. J. Stoddard; L. R. Brewster and T. K. Lake. 2003. “Hospitals’ Negotiating Leverage with Health Plans: How and Why Has It Changed?” *Health Services Research*, 38, 419-446.

Dranove, D. 1988. “Pricing by Non-Profit Institutions - the Case of Hospital Cost-Shifting.” *Journal of Health Economics*, 7 (1), 47-57.

Dranove, D. and W. White. 1998. “Medicaid-Dependent Hospitals and Their Patients: How Have They Fared?” *Health Services Research,* 33 (2, Part I), 163-184.

Eber, M.; R. Laxminarayan; E. Perencevich and A. Malani. 2010. “Clinical and Economic Outcomes Attributable to Health Care–Associated Sepsis and Pneumonia.” *Archives Internal Medicine*, 170 (4), 347-353.

Ellis, R. P. and T. G. McGuire. 1996. “Hospital Response to Prospective Payment: Moral Hazard, Selection, and Practice-Style Effects.” *Journal of Health Economics*, 15 (3), 257-77.

Friesner, D. and R. Rosenman. 2002. “Cost Shifting Revisited: The Case of Service Intensity.” *Health Care Management Science*, 5 (1), 15-24.

Friesner, D. and R. Rosenman. 2004. “Inpatient-outpatient Cost Shifting in Washington hospitals.” Health Care Management Science, 5 (1), 15-24.

Foster, R. W. 1985. “Cost-Shifting under Cost Reimbursement and Prospective Payment.” *Journal of Health Economics*, 4 (3), 261-71.

Frakt, A. 2011. “How Much do Hospitals Cost Shift? A Review of the Evidence.” HCFE WP# 2011-01.

Fuchs, V. R. 2009. “Cost Shifting Does Not Reduce the Cost of Health Care.” *Jama-Journal of* *the American Medical Association*, 302 (9), 999-1000.

Geweke, J.; G. Gowrisankaran and R. J. Town. 2003. "Bayesian Inference for Hospital Quality in a Selection Model." *Econometrica*, 71 (4), 1215-1238.

Glazer, J. and T. G. McGuire. 1994. "Payer Competition and Cost Shifting in Health Care." *Journal of Economics and Management Strategy, 3* (1), 71-92.

Ginsburg, P. B. 2003. "Can Hospitals and Physicians Shift the Effects of Cuts in Medicare Reimbursement to Private Payers?" *Health Affairs*, 22 (6), W472-W79.

Glazer, J. and T. McGuire. 2002. "Multiple Payers, Commonality and Free-riding in Healthcare: Medicare and Private Payers." *Journal of Health Economics*, 21, 1049-1069.

Gowrinsandaran, G. and R. J. Town. 1999. "Estimating the Quality of Care in Hospitals Using Instrumental Variables." *Journal of Health Economics*, 18 (6), 747-767.

Graves, N.; D. Weinhold; E. Tong; F. A. Birrell; S. R. Doidge; P. Ramritu; K. A. Halton; D. Lairson and M. Whitby. 2007. "The Effect of Healthcare-Acquired Infection on Length of Hospital Stay and Cost." *Infection Control and Hospital Epidemiology*, 28 (3), 280-292.

Griliches, Z. and J. Hausman. 1986. "Errors in Variables in Panel Data." *Journal of Econometrics*, 31, 93-118.

Hariri, S.; K. J. Bozic; C. Lavernia; A. Prestipino and H. E. Rubash. 2007. "Medicare Physician Reimbursement: Past, Present, and Future." *The Journal of Bone & Joint Surgery*, 89, 2536-46.

Hay, J. W. 1983. "The Impact of Public Health Care Financing Policies on Private-sector Hospital Costs." *Journal of Health Politics, Policy and Law*, 7, 945-952.

Havighurst, D. 2001. "The Backlash Against Managed Health Care: Hard Politics Make Bad Policy." *Indian Law Review*, 34, 2.

Healthreform.gov. "Lower Premiums, Stronger Businesses: How Health Insurance Reform Will Bring Down Costs for Small Businesses." At http://www.healthreform.gov/reports/smallbusiness2/smallbusiness2.pdf, last access on July 20, 2011.

Heiber-White, J. 1997. "Medicare Reforms Cut Hospital Payments, Add PSO Option". *Health Progress,* (November-December), 10-16.

Jensen, G. A.; M. A. Morrisey; S. Gaffney and D. K. Liston. 1997. "The New Dominance of Managed Care: Insurance Trends in the 1990s." *Health Affairs*, 16 (1), 125-136.

Klevens, R. M.; J. R. Edwards; C. L. Richards Jr.; T. C. Horan; R. P. Gaynes; D. A. Pollock and D. M. Cardo. 2007. "Estimating Health Care-Associated Infections and Deaths in U.S. Hospitals, 2002." *Public Health Reports*, 122 (2), 160-166.

Lee, J. S.; R. A. Berenson; R. Mayes and A. K. Gauthier. 2003. "Medicare Payment Policy: Does Cost Shifting Matter?" *Health Affairs*, 22 (6), W480-W88.

Leslie, D. L. and R. Rosenheck. 1999. "Shifting to Outpatient Care? Mental Health Care Use and Cost under Private Insurance." *American Journal of Psychiatry*, 156 (8), 1250-57.

Levit, K.; C. Smith; C. Cowan; A. Sensenig and A. Catlin. 2004. "Health Spending Rebound Continues in 2002". *Health Affairs, 23* (1), 147-159.

Ma, C. A. and T. G. **McGuire.** 1993. "Paying for Joint Costs in Health Care." *Journal of Economics and Management Strategy, 2* (1), 71-95.

Martin, G. S.; D. M. Mannino; S. Eaton and M. Moss. 2003. "The Epidemiology of Sepsis in the United States from 1979 through 2000." *New England Journal of Medicine*, 348 (16), 1546-1554.

Mechanic, D. 2004. "The Rise and Fall of Managed Care." *Journal of Health and Social Behavior, Extra Issue: Health and Health Care in the United States: Origins and Dynamics*, 45, 76-86.

McKinnish, T. 2000. "Model Sensitivity in Panel Data Analysis: Some Caveats About the Interpretation of Fixed Effects and Difference Estimators", unpublished work in progress, http://stripe.colorado.edu/~mckinnis/fe053100.pdf.

Morrisey, M. A. 1994. "Cost Shifting in Health Care: Separating Evidence from Rhetoric?" Washington: The AEI Press.

Morrisey, M. A. 2003. "Cost Shifting: New Myths, Old Confusion, and Enduring Reality." *Health Affairs*, 22 (6), W489-W91.

Newhouse, J. P. 2002. "Medicare Policy, in J Frankel and P. Orszaq (Eds.)", *American Economic Policy in the 1990s*. The MIT Press.

Olaechea, P. M.; M.-A. Ulibarrena; F. Alvarez-Lerma; J. Insausti; M. Palomar and M.-A. De la Cal. 2003. "Factors Related to Hospital Stay Among Patients With Nosocomial Infection Acquired in the Intensive Care Unit." *Infection Control and Hospital Epidemiology*, 24 (3), 207-213.

Research Data Assistance Center. 2006. "Calculating hospital specific DRG payments" http://www.resdac.umn.edu/tools/TBs/TN-004_CalculatingHospitalDRG_508.pdf (last access: July. 10, 2011).

Russell, L. B. and C. L. Manning. 1989. "The Effect of Prospective Payment on Medicare Expenditures." *The New England Journal of Medicine*, 320 (7), 439-44.

Seshamani, M.; J. Zhu and K. Volpp. 2006. "Did Postoperative Mortality Increase after the Implementation of the Medicare Balanced Budget Act?" *Medical Care*, 44 (6), 527-533.

Seshamani, M.; J. Sanford Schwartz and K. Volpp. 2006. "The Effect of Cuts in Medicare Reimbursement on Hospital Mortality." *Health Service Research*, 41 (3, Part 1), 683-700.

Shen, Y. C. 2003. "The Effect of Financial Pressure on the Quality of Care in Hospitals." *Journal of Health Economics*, 22 (2), 243-69.

Sloan F. A. and E. Becker. 1984. "Cross-Subsidies and Payment for Hospital Care", *Journal of Health Politics, Policy and Law*, 8 (4), 660-85.

U. S. Department of Health & Human Services, Office of Inspector, General Office of Evaluation and Inspections. 2001. "Medicare Hospital Prospective Payment System". http://oig.hhs. gov/oei/reports/oei-09-00-00200.pdf (last access: Aug. 13, 2010).

Volpp, K. G.; R. T. Konetzka; J. Zhu; L. Parson and E. Peterson. 2005. "Effect of Cuts in Medicare Reimbursement on Process and Outcome of Care for Acute Myocardial Infarction Patients". *Circulation*, 112, 2268-2275.

Wu, V. Y. and Y.-C. Shen. 2011. "The Long-term Impact of Medicare Payment Reductions on Patient Outcomes", NBER Working Paper 16859, http://www.nber.org/papers/w16859.

Wu, V. Y. 2010. "Hospital Cost Shifting Revisited: New Evidence from the Balanced Budget Act of 1997." *International Journal of Health Care Finance & Economics*, 10 (1), 61-83.

____. 2009. "Managed Care's Price Bargaining with Hospitals." *Journal of Health Economics*, 28 (2), 350-60.

Zuckerman, S. 1987. "Commercial Insurers and All-Payer Regulation - Evidence on Hospitals Responses to Financial Need." *Journal of Health Economics*, 6 (3), 165-87.

Zwanziger, J. and A. Bamezai. 2006. "Evidence of Cost Shifting in California Hospitals." *Health Affairs*, 25 (1), 197-203.

Zwanziger, J.; G. A. Melnick and A. Bamezai. 2000. "Can Cost Shifting Continue in a Price Competitive Environment?" *Health Economics*, 9 (3), 211-25.

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Jing Hua Zhang, "The Problems in Chinese Financial Institution System" (Chinese), *Sichuan International Finance* (Chengdu, China), October 1994; 11-12. (Reprinted in *China Economics Document Bank, Finance Volume,* Article No: J27-1572, published by Central Compilation & Translation Press (Beijing, China), 1995.)

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