1-1-2015

Spillover Effects Of Medicare Advantage Plans: Does The Market Penetration Of Plans Affect Hospital Care Quality?

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SPILLOVER EFFECTS OF MEDICARE ADVANTAGE PLANS: DOES THE MARKET PENETRATION OF PLANS AFFECT HOSPITAL CARE QUALITY?

by

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DISSERTATION

Submitted to the Graduate School

of Wayne State University

Detroit, Michigan

in partial fulfillment of the requirements

for the degree of

DOCTOR OF PHILOSOPHY

2015

MAJOR: ECONOMICS

Approved By:

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Advisor Date

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DEDICATION

To my wife Yingxue and my son Sherman.

ACKNOWLEDGMENTS

I would like to gratefully and sincerely thank Dr. Gail Jensen Summers, my advisor and mentor, for her intellectual guidance, enormous patience, and continuous encouragement throughout the course of this dissertation.

I would like to express my very sincere gratitude to all my committee members, Dr. Li Way Lee, Dr. Xu Lin, and Dr. Wassim Tarraf, for guiding my graduate study and research. My research would not be possible without their kindness and help.

I would also like to thank my parents for their unconditional love and support. It was under their watchful eye that I gained so much drive and an ability to tackle challenges head on.

Finally, and most importantly, I want to thank my wife, Yingxue, for her great patience and sacrifice to take care of me as well as our three-month-old son.

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CHAPTER 1: INTRODUCTION

Medicare is a federal health insurance program created in 1965 for all people age 65 and older, certain younger people with disabilities, and people with end-stage renal disease, regardless of income or medical history. Medicare now covers over 50 million Americans. In 2013, Medicare spending was $585 billion, a 6.17% increase from $551 in 2012 (Congressional Budget Office (CBO), Medicare Baseline May 2013, April 2014), and accounted for 16.7% of total federal spending and 21% of total national health spending. Medicare spending is expected to continue growing due to an aging population and the rising costs of health care per person.

Medicare offers all enrollees a defined benefit with four different parts that help cover specific services. Part A, also called hospital insurance, covers inpatient services provided by hospitals as well as skilled nursing and hospice care, and accounted for 47% of benefit spending in 2013. Part B, also called medical insurance, covers services provided by physicians and other practitioners, hospitals' outpatient departments, and suppliers of medical equipment, and accounted for 42.9% of benefit spending in 2012. Part A and Part B together are called traditional Medicare, which is run by the government. The MMA of 2003 added a voluntary prescription drug benefit beginning in 2006 under Part D, and 10.6% of Medicare spending now goes toward the Part D drug benefit. Last but not least is Medicare Part C, also called the Medicare Advantage Plan, offered by private companies that contract with Medicare to provide all Part A and Part B benefits, as well as prescription drug coverage.

The Medicare program currently provides two distinct choices to beneficiaries: a government-run traditional Medicare (TM) plan, sometimes called Medicare fee-for-service, and a private health plan known as Medicare Advantage (MA). Medicare Advantage plans originated with the 1982 Tax Equity and Fiscal Responsibility Act (TEFRA) as managed health care. The first MA plan was available to Medicare beneficiaries in 1985. Since then, MA plan enrollment has grown rapidly, leading to higher penetration rate and more competition among health care providers. This program has gone by several names over the past 30 years. It was first introduced as Part C (compared to Part A and Part B in Medicare). Then the Balanced Budget Act (BBA) of 1997 renamed it "Medicare+Choice." Next the Medicare Modernization Act (MMA) of 2003 renamed it "Medicare Advantage (MA)." Currently, MA includes health maintenance organization (HMOs) plans, local preferred provider organization (LPPOs) plans, regional preferred provider organization (RPPOs) plans, private fee-for-service (PFFS) plans, special needs plans (SNPS), and several other plans. The HMO plans, PPO plans and SNP plans are together called Medicare Advantage Coordinated Care Plans (CCPs), because they all offer health care through an established provider network approved by the Centers for Medicare and Medicaid Services (CMS).

Improving hospital quality has always been an important goal for policy makers. As a rapidly growing and relatively new program, the quality of MA plans as compared to traditional Medicare program has been studied by many health economists in recent years. Studies not only measured the quality of the MA plan itself, but also how the development of the MA program affects patients under traditional Medicare and even with private insurance. Patients covered by MA plans and TM plans are treated in the same hospitals, using the same medical equipment, and by the same physicians. Thus to accurately evaluate the rapidly expanding MA enrollment, we should not only measure the quality of hospital care received by MA enrollees, but also the quality of hospital care received by patients under TM plans.

This dissertation evaluates some of the indirect effects, known as "spillover effects," of the expansion of MA plans on the quality of care delivered to those who remain with traditional fee-for-service (FFS) Medicare. More specifically, I examine the spillover effects related to how the expansion of managed care changes the characteristics and delivery of hospital care, e.g., the quality of care received, by those traditional FFS beneficiaries, while keeping all other variables constant (Chernew et al., 2008). Most previous studies have examined the spillover effect based on the cost of care, and it is widely accepted that higher managed care penetration can lead to less Medicare expenditure. Little is known, however, about the effect of the expansion of managed care on the quality of hospital care received by traditional Medicare beneficiaries.

Though lower health care expenditure is one goal of Medicare reforms, researchers and policy makers worry about whether reducing medical expenditures will reduce the quality of health care. Reduction in spending for patients may be the result of reducing services. If those services were necessary for good health, the quality of care will decline. Alternatively, the quality of care might rise in low expenditure areas if the spending reductions result from reducing unnecessary or inappropriate services. It is urgently important to determine whether spillover effects are related to quality, and if so, how.

In recent years, the government has been revising the policies related to MA plans, especially to the program's structure and plan payment methods, not only to improve the availability of private plans, ease of plan enrollment, and reducing unnecessary expenditures, but also to improve the quality of health care. For example, the Centers for Medicare & Medicaid Services (CMS) has been trying to adopt a different payment approach for managed care to reduce Medicare expenditures, as well as encourage more enrollments. CMS is also paying more attention to care quality by rewarding hospitals that deliver higher quality and higher value health care. As part of the Affordable Care Act (ACA), CMS also began in October 2012 to penalize hospitals with excess readmissions (as measured by dividing a hospital's number of "predicted" 30-day readmissions for heart attack, heart failure, and pneumonia by the number "expected," based on an average hospital with similar patients). Thus it is extremely important to evaluate the direct and indirect impact of the expansion of MA plans on the quality of hospital care, in order to design a more efficient MA program.

Considering that reducing readmission can simultaneously improve quality and reduce cost, I will use the readmission rate as the measurement of quality. Some readmissions may be unavoidable because of patient- and community-level factors outside the hospital's control. However some readmissions could be avoided by the use of more advanced equipment and more experienced physicians, or by coordinating timely follow-up care. Those preventable readmissions may result from a medical error or adverse event during hospitalization, or the lack of efficient follow-up care or accurate communication following treatments. Readmission rate is thus a logical indicator to measure the quality of hospitals.

This study will address the need for more empirical evidence on quality performance in relation to the MA plans' penetration during the period of 2006 to 2009. Specifically, I examine whether there is a spillover effect from the penetration of Coordinated Care Plans (CCPs) on the traditional fee-for-service sector, by using the 30-day readmission rate as the hospital quality indicator. Because managed care penetration is potentially endogenous, I use county-level payment rates from CMS to managed care plans as instruments. Using recent data, I found a substantial spillover effect from the expansion of managed care plans that will increase the quality of inpatient care received by traditional fee-for-service Medicare beneficiaries.

In this paper, section 2 provides background on the development of Medicare Advantage plans. Section 3 is a brief review of prior studies of the spillover effect of managed care. In section 4, I develop an econometric model to determine the relationship between quality and MA penetration. In section 5, I introduce the data resource and explain the model, and also develop my hypotheses on the relationship between MA plans' penetration, as well as the competition and quality of traditional FFS. Section 6 presents the empirical analysis and solves related issues. Section 7 is the conclusions.

CHAPTER 2: INSTITUTIONAL BACKGROUND

In 1965, Congress created Medicare to provide health insurance to people age 65 and older, regardless of income or medical history. Since then, the Centers for Medicare & Medicaid Services (CMS) administer Medicare, and has contracted with private insurance companies to behave like intermediaries between the government and medical providers. Since the 1970s, Medicare beneficiaries have had the option to enroll in private health plans (at first, only health maintenance organizations [HMOs]), as an alternative to the federally administered traditional Medicare program. Traditional Medicare has lower administrative costs and offers enrollees an unconstrained choice of health care providers, but it lacks incentives to coordinate care and encourage providers to provide higher quality care (e.g., lower readmission rate and mortality rate) (MedPAC, 2014).

The MA program was introduced in the hope that managed care in Medicare could be more efficient with lower cost and higher quality, considering the success of managed care in the commercial insurance market. To attract more enrollees while reducing costs (which has been proved to be hard to arrive), MA payment policy has evolved since the program first originated with the TEFRA 1982. The average MA payment increased from $250 in 1990 to more than $800 in 2014, and could be as high as $1,500 around 2010 (see Figure 1). This payment increase during the last three decades not only relates to increasing health care costs, but is closely related to CMS payment policies, because CMS wants to use MA payment structure and program parameters as an efficient tool to directly affect MA plans and enrollees and may indirectly affect the entire health care system. Much of the rationale for the current MA program is based on the premise that MA plans can provide care of higher quality and lower costs than the TM system, and that this efficiency will enable more generous benefits at a lower premium, which can finally reduce government deficit at healthcare spending.

Prior to the passage of the 1997 Balanced Budget Act, Medicare used formal risk adjustment, setting a per-member per-month payment for each beneficiary. MA plans were paid by a capitation set at 95 percent of expected Fee-for-Service (FFS) spending in the beneficiaries' county, for the purpose of reducing cost compared to TM plans. However, this 5% lower payment than FFS did not save the government money. Instead, the government lost money due to adverse selection: the plans attracted enrollees who were considerably healthier than the average Medicare enrollee (Nicholas, 2009; CMS 1999). Despite paying plans only 95 percent of the beneficiary's expected costs, adverse selection in Part C resulted in an estimated 5 to 7 percent overpayment (CMS 1999).

To reduce overpayments to Medicare Advantage plans, increase choices available to Medicare beneficiaries, and address perceived regional inequities caused by payment rates, the Congress passed the Balanced Budget Act of 1997 (BBA) and introduced a new payment regime. The BBA broke the direct link between the growth in county fee-for-service spending and Medicare managed care payment, and the plans were paid the highest of three annual rates per beneficiary per month: (1) a minimum floor payment that began at $367 in1998 and was to be adjusted annually (floor rate was increased by its estimate of the current year's national growth rate of Medicare fee-for-service spending, minus a statutory reduction of 0.5 percentage point through 2002); (2) a 2 percent increase from the county's prior year rate; or (3) a blend of county-specific and national average rates, if a so-called budget-neutrality condition was met (MedPAC 1999; Nicholas, 2009; McGuire et al., 2013). The blended payment for a county is a weighted average of the adjusted updated local rates and the input price adjusted national rate.

To satisfy the budget neutrality condition in a particular year, the Health Care Financing Administration (HCFA, now called CMS) compared the projected total Medicare+Choice spending, if county rates were based on the highest of the floor, minimum update, or blended rates, with the payment based on local rates only. This requires that total Medicare+Choice spending, including blended payments, equals what would be paid if only local rates had been used. If projected total spending was not equal to projected spending based on local rates, HCFA would multiply the blended amounts by a factor to satisfy the budget neutrality condition. The blended rate was designed to reduce the variation in payments across the country by lowering the highest rates and increasing the lowest rates.

During this period, Medicare continued to lose money on those beneficiaries who enrolled in MA plans. On the one hand, for those non-floor counties that do not apply floor payment, the 2 percent cap on payment increases effectively decreased Part C reimbursement. On the other hand, Medicare paid more for Part C enrollees in any floor county. Because the growth in spending in the FFS Medicare program over that period was higher than 2 percent, more counties were considered as floor counties. In 1998, when there was one national floor, only 12 percent of beneficiaries lived in floor counties. While in 2001, after the introduction of a higher urban floor for counties within Metropolitan Statistical Areas (MSAs) with at least 250,000 people, 46 percent of Medicare beneficiaries lived in floor counties. This updated floor payment rule increased the health plans' overpayment. What was worse, to keep hospitals and doctors in their networks, the plans had to pay market rates. As a result, those counties that applied the 2 percent cap reduced the number of plans. The MC program was thus not successful in expanding plan option choice to Medicare beneficiaries in general, and the BBA was not successful in bringing new choices to areas that had lacked Medicare risk plans.

To solve the problem of decreasing plan participation and declining enrollment in MA plans, the Republican-led congress passed the 2003 Medicare Modernization and Improvement Act (MMA), effective March 2004, to increase payments across all areas. Under MMA, Medicare calculated a benchmark based on the highest of four amounts: (1) an urban or rural floor payment; (2) 100 percent of risk-adjusted traditional Medicare FFS spending in the county (calculated using a five-year moving average lagged three years); (3) a minimum update over the prior year rate of 2 percent or traditional Medicare's national expenditure growth rate, whichever was greater; or (4) a blended payment rate update (McGuire et al., 2013).

Since 2006, the MMA started a bidding process for plan payment. Private plans submit bids indicating the per capita payment for which they are willing to offer Part A and Part B coverage to Medicare beneficiaries. Plan payment rates are determined by the MA plan "bid" and the "benchmark" in the payment area. Benchmark, which is the maximum amount of Medicare payment set by law for an MA plan to provide Part A and Part B benefits, varies depending on the counties the plans serve and where they draw their enrollment. Counties called "floor" counties are given higher benchmarks to increase plan availability and have benchmarks that average 120 percent of FFS spending. For non-floor counties, benchmarks are set at an average 112 percent of FFS spending (Medicare Payment Advisory Commission 2009).

There are two payment floors: a general floor applicable to all counties, and a higher "urban" floor, which applies to counties in metropolitan areas with more than 250,000 residents. If a plan's bid was greater than the county-level benchmark, enrollees were required to pay a monthly premium which equals the difference between the benchmark and the bid price. If the bid was lower, 75 percent of the difference was to be returned to enrollees in the form of supplemental benefits, the other 25 percent was returned to the Medicare program (McGuire et al.,2013; KFF, 2012). Because benchmarks are often set above the cost for Medicare to provide benefits to similar beneficiaries in the FFS program, MA payment rates usually exceed FFS spending. The Medicare Payment Advisory Commission (MedPAC) reports that, on average (weighted by plan enrollment by county to estimate overall averages and average by plan type), 2010 MA benchmarks will be 117 percent of spending in Medicare's traditional FFS programs, bids will be 104 percent of FFS spending, and payments will be 113 percent of FFS spending.

In response to the MA payment levels being significantly above traditional Medicare, the 2010 health reform, known as the Patient Protection and Affordable Care Act (PPACA), gradually phases down Medicare plan payments to bring them closer to the average costs of Medicare beneficiaries. Plan payment rates are still determined by the MA plan bid and the payment area's benchmark. Under PPACA, MA benchmarks for 2011 were frozen at 2010 levels for each county. Beginning in 2012, benchmarks began to transition to a system in which each county's benchmark will be a certain percentage in 2017. Specifically, for counties in the quartile with the lowest FFS costs, benchmarks will be 115 percent of fee-for-service costs per enrollee. For counties in the quartile with the highest FFS costs, benchmarks will be 95 percent of fee-for-service costs per enrollee (MedPAC 2011). The transition from old benchmarks will be complete by 2017, at which time the average base payment will be about 101.5 percent of FFS.

Along with the different payment policies to MA plans, enrollment in Medicare Advantage plans is closely related to the size of the payment. Total MA enrollment has expanded rapidly over the past three decades (see Figure 2). At the 1985 launch of the Medicare HMO program, only 2% of beneficiaries enrolled, but the number enrolled in MA plans increased steadily until the M+C program was adopted as part of the BBA of 1997. After 1997, growth in enrollment in managed care plans slowed to a maximum 6.3

million enrollees in 1999. Enrollment continued to decline by about 27% by 2003 when new Medicare policies came into effective to encourage more participation in MA plans. These policies boosted federal funding to stabilize and expand the program, and in 2006 introduced Medicare drug benefits and authorized regional MA plans. Since then, MA plans have become more attractive because of the convenience of a single plan covering all Medicare benefits, a cap on out-of-pocket spending, and an effective information campaign. In 2013, 14.5 million, or 28 percent, of Medicare beneficiaries enrolled in a Medicare Advantage plan, an increase of about 1 million over 2012 enrollments. This number is projected to increase slowly to 25 million beneficiaries by 2024 (CBO, April 2014).

Since 2006, MA enrollment has doubled (see Figure 3), and plans project overall enrollment growth in 2014 of 3 to 5 percent (MedPAC 2014). In recent years, the share of enrollees under HMO plans has increased slowly, while the number of Medicare Advantage enrollees in both local and regional PPOs has grown rapidly, and enrollees in PFFS plans first increased rapidly then rapidly shrinking after 2010. In 2013, enrollment in HMO plans increased by 10%, to nearly 10 million enrollees, enrollment in local PPO plans grew about 11% to 3.3 million enrollees, and enrollment in regional PPO plans increase by 16% to 1.1 million enrollees. This strong growing trend does not apply to PFFS in recent years. With fewer limitations than other MA plans impose on doctors and hospitals (such as no network restrictions), PFFS was extremely attractive to beneficiaries, especially among Medicare recipients who travel frequently. However since 2011, PFFS plans have generally been required to establish networks, a change that makes PFFS less attractive to Medicare beneficiaries and led to a sharp decline in PFFS enrollment.

Differences in the enrollment and growth trends of the four most popular MA plans result from different regulations and requirements by CMS. HMO enrollees must generally get non-emergency care and services from doctors or hospitals in the plan's network, and they require a referral from their primary care doctor to see a specialist. If they are treated out-of-network, they must pay all or most of the costs.

To reduce the restrictions patients must meet for HMO plans and make health care more convenient, PFFS and local PPO were authorized in the BBA 1997, while regional PPO was added into the MA family in MMA 2003 and was first available to enrollees in 2006. Compared to HMOs, PPO plans are more flexible; no primary care physician is required. Out-of-network services, however, are charged at a higher out-of-pocket cost than in-network services. PFFS did not require a provider network, so beneficiaries are free to choose any doctor, but Medicare providers may refuse to treat them, constraining beneficiary access to services. The Medicare Improvements for Patients and Providers Act of 2008 (MIPPA), required as of 2011 that all employer-sponsored PFFS plans have a network of contracted providers for enrollees in each county of operation, while allowed enrollees to ask other providers if they will accept PFFS payment.

The expansion of enrollment in MA plans provides the incentive to encourage insurance companies and managed care plans to contract with CMS to offer Medicare Advantage plans in specific geographic areas (see Figure 4). As of February 2014, there were 571 MA contracts, including 556 local Coordinated Care Plans (CCPs, including HMO, local PPO and SNPs or Special Needs Plans) contracts, and 12 PFFS contracts. The increase in the number of contracts in recent years increases the overall plan availability. Since 2006, virtually all Medicare beneficiaries have had access to at least one Medicare Advantage plan (see Figure 5). In 2014, 95 percent of beneficiaries had access to network-based local CCPs, 71 percent had access to a regional PPO, and only 53 percent had access to a PFFS plan. From 2007 to 2010, all beneficiaries, whether in rural or urban areas, had access to at least one PFFS plan. This declined to 63 percent in 2011 when the network building requirement was applied, and continued to decrease between 2013 and 2014, from 59 to 53 percent of beneficiaries.

Generally, HMOs, local PPOs and regional PPOs are classified as coordinated care plans (CCPs) because they all include a network of providers contracted to deliver the benefit package approved by CMS to ensure all requirements are met, including access, availability, and quality. PFFS plans are not classified as CCPs because originally they did not have provider networks. In this research, I divide Medicare Advantage plans into two parts: CCPs that require a network of providers, and PFFS that do not require a network. The spillover effect of the expansion of CCPs and PFFS will be evaluated in the following sections.

CHAPTER 3: LITERATURE REVIEW

In this section, I first review the mechanisms through which spillovers may be occurring, and then review the existing literature examining the spillover effects of the expansion of managed care on the quality of patients enrolled in traditional FFS plans. Lastly, I will review the limitations of present literature and the contribution of my dissertation.

3.1 Mechanisms of Spillover Effects

Some researchers point out that the expansion of managed care plans may negatively impact the care of traditional FFS enrollees through the following mechanisms:

First, greater managed care market share may make it more difficult to access hospital care due to high demand and short-run inelastic supply. An unsatisfactory performance on process-of-care measures, which record the percentage of patients who receive appropriate care for specific conditions, is usually considered an indicator of low quality hospital care. Litaker et al. (2003), in a 1998 cross-sectional survey of households, found that individuals residing in areas with more managed care were 28% more likely to report problems obtaining care than those living elsewhere.

Second, spillover effects may occur through a negative impact on the investment in infrastructures, such as the density of hospitals, beds or available services over time, and the adoption of advanced medical technology. HMO providers are often assumed to have highly elastic demand, so high managed care penetration will force managed care providers to compete with each other, which makes HMO plans successful in negotiating lower prices with providers (Baker and Phibbs, 2002). Furthermore, lower prices require managed care providers to reduce cost, most likely by reducing the number of specialists, and thereby the number of specialists' services provided (Baker 2001; Heidenreich et al. 2002); by encouraging more conservative practice patterns (Baker 2001); or by slowing the timing of adopting more advanced but costly technologies (Culter and Sheiner 1998; Baker 2001). Because hospitals' resources are shared by all patients, both managed care beneficiaries and traditional FFS enrollees, fewer advanced technologies not only affects the quality of managed care plans, but also patients under traditional FFS plans.

For example, Chernew (1995) used Standard Metropolitan Statistical Area (SMSA) data from 1982 and 1987, and showed that a 10 percent increase in the non-IPA HMO penetration rate leads to a 4.8 percent to 5.6 percent drop in beds per capita. Baker and Wheeler (1998) find that high HMO market share is associated with low levels of MRI availability, by using data from a nationwide census of 3,705 MRI sites conducted by Technology Marketing Group (TMG) in late 1994 and early 1995. Mas and Seinfeld (2008) reveiwed annual data from 5,390 U.S. hospitals from 1982-95 regarding the adoption of 13 different technologies, and found that managed care has a negative effect on hospitals' acquisition for each of the 13 medical technologies.

Third, higher managed care penetration may discourage high quality hospitals from entering the Medicare market. Gold, Hurley, Lake, et al. (1995) surveyed 138 managed care plans by telephone, found a careful selection of physicians by all plans, and concluded that managed care plans have complex systems for selecting, paying, and monitoring their physicians. Based on this conclusion, Mukamel, et al. (2001) deduced that as managed care takes more market share, plans have the power to place financial and administrative burdens on providers, which may lead high-quality providers to find it less profitable to stay in the FFS market because of lower market share, or accept HMO beneficiaries because of lower prices reimbursements. High-quality providers may thus leave such a managed-care dominated market, and their selective exit would affect the quality of medical care of both managed care and traditional Medicare patients.

On the other hand, as most recent researchers have found, a higher managed care penetration rate is more likely to have a positive spillover effect on the quality of health care received by fee-for-service patients through the practice patterns mechanism. Managed care can influence physicians' practice patterns, because of different payment methods from traditional Medicare patients. As practice patterns changes, they are likely to apply to across all patients, even if the changes are responses to managed care incentives. For example, as Glied and Zivin (2002) pointed out by using the data from the 1993-1996 National Ambulatory Medical Care Survey (NAMCS), more than 25 percent of traditional FFS patients were treated by physicians with more than 20% of patients covered by Medicare HMO plans. Similarly, the average Medicare HMO patient visited a physician whose patient panel was over one-fourth traditional FFS. With proper regression models, they concluded that physicians who treat mostly HMO patients appear to adopt an equivalent practice style along most measurable dimensions (like duration of visit, number of tests and medications ordered, and scheduling of return visits).

Spillovers may also occur in the opposite way through the adoption of technology. Increased HMO penetration will increase the insurer's ability to obtain better quality information about providers for its enrollees. In another paper, Glied (2000) pointed out that managed care plans must have the capacity to collect and transfer administrative data within an internal market. This information collection capacity gives hospitals the incentive to increase quality in order to attract customers. Baker and Phibbs (2002) analyzed hospital development of neonatal intensive care units (NICUs) using data from the American Hospital Association surveys 1980 to 1996 (except 1981 when no survey was conducted), and concluded that higher HMO market share will lead to slower adoption of mid-level care units, but not affect the adoption of the most advanced high-level units. More patients will benefit from advanced technology equipment because they do not have the choice but to use more expensive but more effective technology.

3.2 Managed Care Penetration Affects the Traditional FFS Sector

A large amount of empirical literature seeks to test the relative performance of MA and TM, considering the fast growth of MA plans in recent years. The most recent study supports the hypothesis that MA plans have been outperforming TM plans. Because Medicare beneficiaries, whether enrolled in MA plans or TM plans, will share the same hospitals and be treated by the same doctors, the question remains whether the higher quality of MA will spill over into the traditional Medicare sector. The spillover effect from MA plans has been widely studied since the first HMO plan became available in 1985. It was an especially hot topic in the 1990's, when the government decided to continue supporting Medicare Advantage plans, leading to an expansion of MA plans. There are essentially two approaches to measure this spillover effect: expenditure and quality.

3.2.1 Spillover Effect on System-Wide Expenditures

Much literature examines the spillovers between managed care plans (mostly HMOs) and "system-wide expenditures," (expenditures in all sectors of the health care system, including Medicare and non-Medicare (Baker 1997). The evidence for managed care penetration affecting system-wide expenditures is consistent; most studies conclude that increased HMO penetration is associated with decreased overall hospital spending. Little or no evidence suggests that more enrollments in managed care increase spending (Baker 2003). Gaskin and Hadley (1997) researched all nonfederal hospitals in the 84 largest MSAs in the country from 1985-1993, and found that hospitals in areas with high rates of HMO penetration had a slower rate of expense growth (8.3%) than hospitals in low penetration areas (11.2%).

3.2.2 Spillover Effect on Medicare-Specific Expenditures

Meanwhile, a number of studies examine evidence of the spillover effects of HMO penetration on Medicare-specific expenditures, mostly the expenditure of traditional FFS beneficiaries. Baker (1997) analyzed 1986-1990 county- and MSA- (metropolitan statistical area) level data, and found that Medicare FFS expenditure has a concave relationship with managed care market share, reaching a maximum at HMO market share between 0% and 10% and decreasing thereafter. Another study by Baker (1999) found an increase in HMO market share from 10 to 20% will decrease Medicare FFS expenditures of Part A by 2% and Part B by 1.5%. Using data from the annual Cost and Use files of the Medicare Current Beneficiary Survey (MCBS) for 1994–2001, Chernew, DeCicca and Town (2008) conducted instrumental variable models to correct for the endogeneity of HMO penetration changes across counties, and found that a 1% point increase in county-level Medicare HMO penetration is associated with a nearly 1% reduction in individual-level annual spending by fee-for-service enrollees.

As it becomes widely accepted that higher managed care penetration can lead to lower Medicare expenditure, both researchers and policy makers are concerned that reduced medical expenditures will reduce the quality of health care. Because Medicare's prices are set administratively, reductions in spending on patients must result from a decrease in services. If reduced services are necessary, quality of care will decline. Alternatively, quality of care might improve in low expenditure areas if reduced spending results from reductions in unnecessary or inappropriate services. Thus it is important and urgent to determine the spillover effect, not only by measuring expenditures, but also by measuring quality.

3.2.3 Spillover Effect on System-Wide Quality

To resolve this issue and fill the knowledge gap, the spillover effect of the expansion of managed care on the quality of health care has been extensively discussed in recent years. Unlike measuring expenditures, measuring quality in the health care sector is extremely difficult, mainly because quality has numerous dimensions. No single variable can capture all the factors to measure the quality of each hospital.

Instead, three criteria have been used by previous researchers to measure quality (Sari, 2002): (1) input quality as measured by the number of specialists, adoption of specific technologies like MRI, and hospital staffing levels (Kaestner and Guardado, 2008); (2) process quality as measured by number of tests performed, access to care, admissions for conditions that could be prevented through timely and effective treatment (Nicholas, 2009), and length of visit times with physicians (Decker 2007); and (3) outcome quality as measured by effectiveness of care, patients' satisfaction with care (Hellinger, 1998; Shen and Zuckerman, 2005; Brunt and Jensen, 2012), readmission rates, and mortality rates (Mukamel et al., 2001).

Some literature tests the impact of managed care penetration on system-wide quality, but conclusions about the effect of managed care penetration on the quality of care in the early literature are mixed. Blendon et al. (1998) found in 1997 survey data that 45 percent of Americans believe managed care decreased the quality of care they received. Mobley and Magnussen (2002) examined how managed care penetration affected hospital efficiency by using excess staffing in California hospitals in 1995 as the quality indicator, but they did not find a significant relationship between managed care penetration and nurse staffing ratios. Using national birth certificate data for 1996, Hueston and Sutton (2000) found HMO penetration was unlikely to influence national cesarean section rates.

Escarce et al. (2006) used six medical conditions as quality indicators in California, New York, and Wisconsin from 1994 to 1999, and found that higher HMO penetration was associated with lower mortality rates in California but higher mortality rates in New York. Baker and McClellan (2001) analyzed a cohort of newly diagnosed cancer patients in 1992–94 (derived from Medicare claims files), and concluded that managed care is associated with increased diagnosis rates, which could indicate better screening and better preventive care, usually indicators of higher quality.

3.2.4 Spillover Effect on the Quality of Medicare

Due to limited data, only a small amount of literature provides evidence that managed care can influence the care provided to individuals in fee-for-service plans through a spillover mechanism. Mukamel et al. (2001) used 1990 data from 1,927 hospitals in 134 metropolitan statistical areas (MSAs) with five or more acute-care hospitals to investigate the associations between HMO market penetration, HMO competition, and the quality of care received by Medicare fee-for-service patients. In their study, risk-adjusted expected mortality rates are used to measure the quality of each hospital's service. They claim that HMO penetration is negatively associated with 30-day post-admission mortality rate.

Heidenreich et al. (2002) examined the care of 112,900 fee-for-service Medicare beneficiaries admitted with an acute myocardial infarction from February 1994 through July 1995 to determine the relationship between managed care market share and the use of recommended therapies for those beneficiaries with acute myocardial infarction. Their results showed that patients with traditional fee-for-service care, living in areas with high managed care market share, were more likely to be treated with beta-blockers and aspirin, which commonly considered as appropriate treatment, than those who were residing in areas with low managed care market share. Meanwhile, Meara et al. (2004) studied how managed care market share affects the proportion of fee-for-service Medicare beneficiaries admitted for acute myocardial infarction (AMI), using a sample of 206,450 Medicare beneficiaries included in the Cooperative Cardiovascular Project (CCP). They used logistic regression to examine the association between managed care market share and the use of angiography and concluded that an increased market share of managed care at the county level is negatively related to the use of coronary angiography in AMI patients enrolled in traditional Medicare plans.

Dowd et al. (2011) used sample selection methods that correct for observed covariates and found that HMO enrollees have lower mortality than beneficiaries in traditional fee-for-service Medicare. By studying the use of services and quality of care for beneficiaries in 2009, Afendulis, Chernew and Kessler (2013) also found that the expansion of MA plans can reduce beneficiaries' rates of hospitalization and mortality. In another paper, Baicker, Chernew and Robbins (2013) used changes of the MA payment policy to isolate exogenous increase in MA enrollment and trace out the effects of greater managed care penetration on hospital utilization and spending, and they found that great managed care penetration is not associated with fewer hospitalizations, but is associated with lower costs and shorter stays per hospitalization.

Meanwhile, Keating et al. (2005) studied a sample population diagnosed with breast or colorectal cancer during 1993-1999, using fixed effects regression analysis to evaluate whether county-level increases in the market share of managed care over time are related to the quality of cancer care, as measured by several quality indicators. They concluded that an increase in the market share of managed care has limited or no effect on the quality of care received by patients in the fee-for-service sector.

3.3 Research Gaps and Contributions

Despite the fact that great attentions have been paid by more and more economists in this area, the existing literature on managed care suffers from several limitations. First, due to data availability, most of the previous literature relied on data before MMA 2003. Payment methods have changed significantly since MMA, however, so results from the outdated data may no longer be referential. Conclusions based on this limited data may lead to inaccurate or incorrect recommendations to current Medicare policies.

Second, most studies included only information about HMOs. Even though HMOs take the largest share (65%) of Medicare enrollees, regression results from HMO penetration may not be generalizable to all managed care (Mukamel et al., 2001). As mentioned earlier, the number of Medicare Advantage enrollees in both local and regional PPOs has grown rapidly in recent years. Because different plan types within managed care organizations have different arrangements with physicians and hospitals, leading to different incentives and responses, the result may be different outputs for managed care enrollees and traditional fee-for-service enrollees.

Third, most previous research has been unable to address the adverse selection problem that arises because the health of persons who choose an HMO may differ systematically from those who do not choose an HMO. Some economists have demonstrated that persons who have formed strong relationship with their physicians, usually less healthy enrollees who need to visit physicians frequently, are less likely to join a managed care plan in which they might not be able to keep their current physician (Hellinger 1998). If healthier individuals systematically enroll in Medicare HMO plans, the quality of health care for those remaining in the fee-for-service sector, which is usually measured by patient readmission, in-hospital mortality, post-30-day hospital mortality, and hospital-acquired infections, will be lower in counties with high HMO penetration, even though there is no spillover effect by managed care penetration. Thus, if selection bias is not controlled for, the spillover effect is likely to be underestimated. Evidence from early studies indicated that favorable selection persisted through the late 1980s and early 1990. Riley, et al. used 1994 data from MCBS, and found that HMO respondents were less likely to report fair or poor health after controlling for demographics. Cao and McGuire (2003) found two different effects between FFS plans and MA plans: a positive related spillover effect and negative related selection effect. They used Medicare data for 1996 to estimate the correlation between the HMO market share and the average FFS costs for different health care services, finding that when the HMO market penetration rate is below 15%, the selection effect dominates the spillover effect. The spillover effect starts to dominate the selection effect as the HMO share increases to above 18%.

Other recent studies found that there might not be a selection issue when a proper methodological approach is used. Mello et al. (2003) used 1992–1996 data from MCBS and found no significant association between favorable HMO selection and HMO market penetration. Chernew et al. (2008) also used data from MCBS, and found no systematic evidence of selection effects after estimating models with the largest set of health status controls. Without a consistent conclusion regarding adverse selection, assuming that there is no adverse selection might lead to biased estimators and incorrect conclusions.

Forth, unobserved heterogeneity may also bias the estimation. There may be unobserved, time-varying county level characteristics that are correlated with both managed care penetration and quality of FFS, such as consolidation in the provider market or changes in employer demand (Chernew et al 2008). To correct for this potential bias, an instrumental variables (IV) approach is usually applied. Some authors use county-level payment rates from CMS to HMOs as instruments to identify the effect of county-level Medicare penetration (Town and Liu 2003; Gowrisankaran and Town 2006; Chernew et al. 2008; Nicholas 2009). Since large employers are more likely than small employers to offer their employees a choice of insurance plans, including the choice to enroll in managed care plans, some authors prefer to use a cut-off for firms of 100 or more employees per capita in the HAS as the instrument variable (Bokhari, 2009), or the average number of employees per firm in the corresponding MSA (Mas and Seinfeld, 2008; Baker and Brown, 1997).

This paper contributes to the literature on the spillover effect of managed care penetration in four main ways. First, it examines more recent data than prior studies. This study updates the literature on spillover effect through 2009, whereas most previous studies only looked at the 1990s. Second, by using the MCBS data, it can calculate 30-day readmission rates as the quality measure, which is the same indicator used by CMS to compare the quality of hospitals and determine the payment. Third, the analysis of market penetration is conducted at the county level and focused only on counties located in metro areas, which is a better estimate of the market than using the MSA level or including all counties. Fourth, the data contain information on area characteristics and economic characteristics, such as unemployment rate, which allows careful control of market structure and economic fluctuation.

CHAPTER 4: ECONOMETRIC MODEL

This section develops an econometric model to find the connection between the quality of traditional Medicare and the penetration of Medicare advantage plans.

4.1 Basic Model

The basic model is designed to find the spillover effect of MA expansion on the quality of care patients received under traditional Medicare at the county level. Specifically, the model measures the hospitalization of beneficiary i in hospital k located in county j, as a function of MA penetration in county j, the health and demographic characteristics of beneficiary i, hospital k's characteristics, county j's characteristics and year fixed-effects. The equation looks like:

$$Y_{ijkt} = \alpha_0 + Penetration_{jt}\alpha_1 + X_{it}\alpha_2 + Z_{jt}\alpha_3 + H_{kt}\alpha_4 + year_t\alpha_5 + \varepsilon_{ijkt} \quad (1)$$

where Y_{ijt} is the dependent variable to measure the hospital quality, and in this study it is a binary variable with value 1 if the beneficiary i had a hospital readmission in hospital k in county j in year t, and 0 is there is no readmission; $Penetration_{jt}$ is the MA penetration rate in county j in year t, which equals the number of enrollees over the number of Medicare eligible; X_{it} is a vector of individual characteristics (including age, race and risk, etc.); Z_{jt} is a vector of area time varying characteristics (including measures of area-level population demographics and economic conditions, like median household income, unemployment rate, mortality rate, etc.); H_{kt} is a vector of hospital characteristics (including hospital ownership, teaching status, hospital size, etc.); $year_t$ is a vector to control year effects (my research will cover the period of 2006-2009). My analytic sample is restricted to all MCBS respondents at age 65 and older with traditional Medicare (both Part A and Part B) for the entire year or enrolled in traditional Medicare until death in that year.

This regression model requires careful analysis since the disturbance term ε_{ijkt} in Equation (1) is likely correlated with penetration of county-level Medicare Advantage plans, which will cause the problem of endogeneity. This endogeneity issue was pointed out and tested by health economists in the penetration study of Medicare Advantage plans. There may exist other variables that could be related to both the quality of hospital care and the penetration rates of MA plans, such as the market power and quality of each hospital. It is possible that Medicare Advantage plans tend to enter counties with higher traditional fee-for-service spending because of a higher Medicare payment rate. (As mentioned earlier, the calculation of the MA payment is positively related to traditional FFS spending in recent years.) Counties with higher traditional fee-for-service spending are also more likely to own more advanced medical equipment, hire more experienced physicians, and provide higher quality health care. In this case, the estimation of α_1 is expected to be biased upwards. If the true value of α_1 is negative, the estimation of the marginal effect will be biased toward zero.

This potential bias can be corrected by using the instrumental variables (IV) approach. In a linear model, the two-stage least squares (2SLS) estimator method is the most popular and widely used approach to solve the problem brought by endogenous explanatory variables. In the 2SLS method, the endogenous variables are first regressed on all the exogenous variables including the instruments, and then the predicted value of the endogenous variable is used in place of its actual value in a regression. Since in my model, quality is measured by a binary variable, 2SLS could not be used to estimate the model. In this nonlinear regression model, two estimation methods have been widely used to address endogeneity: two-stage predictor substitution (2SPS), and two-stage residual inclusion (2SRI). (In the following sub-section, the two methods are explained in detail.) Terza et al. (2008) examined the two estimation methods, and concluded that 2SPS is generally an inconsistent procedure, while 2SRI produces consistent estimates of the structural equation parameters. Thus 2SRI will be used in this study to solve the problem of endogeneity.

4.2 Econometric Method

To estimate the spillover effect, I will construct a Probit model with a set of instrumental variables. I define y_i as an observed binary variable: the outcome to be explained. Let x_i be a vector of observed regressors, and β a corresponding coefficient vector, with e an unobserved error. The Probit model can be written as

$$y_i{}^* = \alpha_i + X_i\beta + e_i \qquad y_i = 1[y_i{}^* > 0], \tag{2}$$

where I use the notation 1[.] as the indicator function to define a binary outcome. If some of the explaining variables are endogenous, X_i could be divided into X_i^e, which is a $1 \times N_1$

vectors of endogenous variables and are possibly correlated with e_i, and X_i^o, which is a $1 \times N_2$ vectors of exogenous variables. Then I can rewrite the model as

$$y_i = 1[\alpha + X_i^e \beta_e + X_i^o \beta_o + e_i > 0] \tag{3}$$

$$X_i^e = Z_i \pi_1 + X_i^o \pi_2 + \sigma_\varepsilon \varepsilon_i \tag{4}$$

$$\binom{e_i}{\varepsilon_i} \mid Z_i \sim N\left[0, \begin{pmatrix} 1 & \rho \\ \rho & 1 \end{pmatrix}\right] \tag{5}$$

where Z_i is is a $1 \times K$ vectors of instrumental variables. The instrumental variables must satisfy the following three conditions: (1) they cannot be correlated with the error term ε_i in Equation 4; (2) they must be partially and sufficiently strongly correlated with X_i^e after controlling for all of the other independent variables; and (3) they can neither have a direct influence on y_i nor be correlated with the error term e_i in Equation 3. Further, the Probit model assumes that e_i and ε_i have a joint standard normal distribution. If $\rho \neq 0$, e_i and ε_i are correlated, which can prove that X_e is endogenous or misspecified, and it is correlated with e_i. In that case, the instrumental variables approach is recommended to run the regression model and get the unbiased estimated parameters. This relationship will be used later to test the endogeneity assumption.

There are two ways the model can be estimated to solve the endogeneity problem. One method is called two-stage predictor substation (2SPS), the other is called two-stage residual inclusion (2SRI). Estimation by 2SPS is a straightforward extension of the popular linear two-stage least squares (2SLS) to nonlinear models from the simple linear model. In the first-stage, obtain consistent estimators of the vector X_i^e by estimating Equation 4 as

$$\widehat{X_i^e} = Z_i\widehat{\pi_1} + X_i^o\widehat{\pi_2} \tag{6}$$

After getting $\widehat{X_i^e}$ in Equation 6, in the second-stage, $\beta = [\beta_e \;\; \beta_o]$ can be estimated in Equation 7 by substituting $X_i^e \; by \; \widehat{X_i^e}$ into Equation 3 using nonlinear least squares methods.

$$y_i = 1\left[\alpha + \widehat{X_i^e}\beta_e + X_i^o\beta_o + e_i > 0\right] \tag{7}$$

With 2SRI methods, the first-stage of 2SRI estimator is identical to that of 2SPS, which is to estimate Equation 6, but the residuals need to be calculated and saved for use in the second stage. The residual is calculated as

$$\widehat{Residuals_i} = \widehat{X_i^e} - (Z_i\widehat{\pi_1} + X_i^o\widehat{\pi_2}\,) \tag{8}$$

In the second-stage of 2SRI the set of variables $Residuals_i$ are added to Equation 3 as additional regressors, i.e., using nonlinear least squares method to estimate $\beta = [\beta_e \;\; \beta_o]$

$$y_i = 1\left[\alpha + X_i^e\beta_e + X_i^o\beta_o + \widehat{Residuals_i}\beta_r + v_i > 0\right] \tag{9}$$

where v_i is the regression error term. The reason estimation bias can be removed with the 2SRI method is because by adding the residual terms into Equation 9, those omitted variables that are both correlated with $y_i \; and \; X_i^e$ are controlled in the regression model by adding the set of variables $Residuals$. Thus, the endogeneity issue of X_i^e would cease to exist, and unbiased estimators can be concluded.

Since the relationship between the quality of beneficiaries under traditional Medicare and penetration of Medicare Advantage plans is the primary focus of this research, it is important to determine how much the penetration of MA plans could affect care quality. However, the values of $\beta = [\beta_e \ \ \beta_o]$ calculated from 2SPS and 2SRI don't imply much beyond the signs of the estimators. Instead, the estimated marginal effects can be a better determinant of the spillover effects.

Under the Probit model specification, the joint normality of e_i and ε_i implies that the conditional distribution of e_i given ε_i is also normal as follows

$$e_i|\ \varepsilon_i \sim N(\rho\varepsilon_i, 1-\rho^2) \tag{10}$$

Therefore, the response probability for y_i can be derived as:

$$P(y_i = 1|X_i) = P({y_i}^* > 0|X_i) = P(\alpha + X_i^e\beta_e + X_i^o\beta_o + e_i > 0|X_i)$$

$$= \mathrm{P}[e_i > -(\alpha + X_i^e\beta_e + X_i^o\beta_o)|X_i]$$

$$= \Phi\left(\frac{\alpha + X_i^e\beta_e + X_i^o\beta_o + \rho\varepsilon_i}{1-\rho^2}\right). \tag{11}$$

If x_i^e is a continuous variable, its partial effect is obtained from the partial derivative:

$$\frac{\partial p(X_i^e)}{\partial x_{ij}^e} = \varphi\left(\frac{\alpha + X_i^e\beta_e + X_i^o\beta_o + \rho\varepsilon_i}{1-\rho^2}\right) * \frac{\beta_{ej}}{1-\rho^2} \qquad (12)$$

Because $\Phi(\cdot)$ is the cumulative distribution function (CDF) of continuous random variables, $\varphi(\cdot)$ is a probability density function. In the Probit model, $\varphi(\cdot) > 0$. Thus, the partial effect always has the same sign as β_{ej} (Wooldridge, 2010).

CHAPTER 5: DATA SOURCE AND DESCRIPTION

The main data source in this study is the Medicare Current Beneficiary Survey (MCBS) for the years 2006 to 2009, a period concurrent with the introduction of Part D and regional PPOs, and before the implementation of the ACA. This was a period of fast growth in MA plans enrollment, and changes in many features of managed care. The MCBS is a continuous, multipurpose survey of a nationally representative sample of aged and disabled Medicare beneficiaries sponsored by the Centers for Medicare & Medicaid Services (CMS). The MCBS uses a rotating panel design. There are four panels active at any given time and each panel has approximately 4,000 sample participants. New panels are introduced each year in the fall round and replace the oldest panel. A key feature of the survey is its longitudinal design. Currently, each sample person is interviewed three times a year over four years. Two data files from the MCBS are released in the annual Access to Care and Cost and Use files. Additional information on the MCBS can be found at the CMS website (www.cms.gov).

Another important data source is CMS research data bank, including county-level payment and enrollment for each plan for 2006-2009. Monthly enrollment data comes from the Monthly MA Enrollment by State/County/Contract data file, which provides the stated information for all organization types except Prescription Drug Plans (PDP) and employer-direct PDP organizations. County-level eligible Medicare beneficiary data is drawn from the MA State/County Penetration data file. County-level payment rates come from the Medicare Advantage Ratebook data file. These data were obtained from the CMS website (www.cms.gov) under the Research, Statistics, Data & Systems section.

The third data source is the AHA (American Hospital Association) Hospital Database, compiled from the AHA Annual Survey of hospitals. It includes each hospital's information in four aspects: organizational structure, facilities and services, total utilization and staffing, and supplemental information. In this study, hospital level information is used from 2006 to 2009, including the locations of hospitals, facilities and services, beds, utilization, and staffing. Further information about the AHA annual survey is available at the AHA website (www.aha.org) and all data is purchased from AHA.

The last data source is the 2012-2013 Area Health Resources Files (AHRF). The AHRF is a family of health data resource products, collected from more than 50 sources, and provides county-level economic and demographic information by year (such as unemployment rate, population density, and median household income), as well as county-level health statistic information (such as the number of specialists, mortality rate and total hospital beds). Further information is available at the Health Resources and Services Administration website (www.ahrf.hrsa.gov).

In this study, all penetration rates, MA payment, and area characteristics variables are measured at the county level, but includes only counties located in metropolitan statistical areas (MSAs). The reasons why I exclude rural counties are because first, many rural counties offer only a limited number of managed care plans or even no MA plans, which can cause results that use all county level measurement to be susceptible and biased; second, most rural counties have small numbers of residents, which leads to a smaller amount of enrollment in MA plans, and insufficient sample size in small counties may lead to inaccurate regression; and third hospital behavior in small counties may differ from hospital behavior in large urban areas, specifically, hospital markets located in counties in metro areas are more likely to be characterized as monopolistically competitive markets, whiles hospital markets in rural counties may resemble oligopoly or monopoly markets.

There are 1101 counties located in metro areas out of a total 3250 counties. As Table 1 shows, more than 90% of all HMO enrollees live in metropolitan areas; about 84% of local PPO enrollees and 76% of regional PPO enrollees come from MSA areas. Thus, the sample of urban counties can represent all counties very well and it is logical to focus this study sample on counties located in urban areas.

Other studies have been based on the MSA level instead of county level, because the MSA level measures a larger and more reasonable market since patients may choose hospitals within the metro area instead of the county either for convenience or quality.

However, there are at least two limitations to choosing MSA as the measurement unit in this research. First, this study will use payments to Medicare Advantage plans from CMS as the instrument variables, but the payments are calculated at county level by CMS. Any method to aggregate the payment to the MSA level may lead to bias. Second, Meara et al. (2004) claimed that there exists considerable heterogeneity in the level of market share of managed care within MSAs, and this may be related to the smaller number of MSAs and the relatively less variation among MSAs (Jiang et al, 2013). Thus, using a county-level measure of market share allows the capture of this variation in the analyses.

The unit of observation is the Medicare beneficiary individual level, and the analytic sample is restricted to MCBS respondents age 65 or older enrolled in traditional Medicare (both Part A and Part B) for the entire year. Individual characteristic and MA market fixed-effects are included to remove bias that might result from time-invariant unobserved heterogeneity across hospitals and counties.

5.1 Dependent Variable

The purpose of this research is to measure how the quality of hospital care received by patients under traditional Medicare plans is affected by the penetration of Medicare Advantage plans. Quality of health care always plays an extremely important role in monitoring health systems and is a critical factor in evaluating and comparing hospitals. This study uses available data to focus on readmissions within 30 days of discharge as an indicator of health care quality. The dependent variable is a binary variable, which equals to 1 if the patient gets readmitted within 30 days after discharge from a hospital. This indicator is particularly related to hospital quality to those of 65 years of age and older. The quality indicator is constructed by using the annual Cost and Use file of the Medicare Current Beneficiary Survey (MCBS) for elderly respondents excluding patients under age 65 years (i.e., those entitled to Medicare because of disability).

The 30-day readmission measures are estimates of unplanned readmission for any cause to any acute care hospital within 30 days of discharge. It is often used to evaluate overall hospital performance since readmission may be caused by errors in hospital or premature discharge prompted by pressure to vacate hospital beds. Both causes can lead to readmission and could be avoided. Patients may be readmitted to the same hospital or to a different hospital for the same condition or for a different reason. Even though readmission for the same condition is a better measurement of the previous hospital care, it can be difficult to restrict the readmissions to the same condition since the new condition may be caused by improper treatment of original condition. This study will thus use same and different condition readmission rates.

Readmission within 30 days was measured, rather than a longer or shorter period, because readmissions over longer periods may be influenced by factors outside hospitals' control, such as other complicating illnesses, patients' own behavior, or care provided to patients after discharge. Readmissions over shorter periods are more likely to be affected by patients' own disease or physicians' advice. To conduct a robust test, this study will also measure 60-day and 90-day readmission rates to test whether the spillover effect is sensitive to the number of days.

Table 2 shows the average 30-day readmission rate is about 22% in this study sample, while the 60-day readmission rate is 29% and the 90-day readmission rate is about 31.8%. The Patient Protection and Affordable Care Act of 2010 required CMS to establish a Hospital Readmissions Reduction Program in Medicare FFS to reduce Inpatient Prospective Payment System (IPPS) payments to hospitals that have excess readmissions. CMS also sponsored the Partnership for Patients in 2011 to reduce readmission rates of traditional FFS Medicare patients by 20% between 2010 and the end of 2013.

5.2 Explanatory Variables

The dependent variables fall into four groups: MA penetration, county characteristics, patient characteristics (including risk adjusters), and hospital characteristics.

5.2.1 Market Penetration of Plans

The first and most interesting group includes the penetration rates of MA plans. In this study, managed care penetration at the county level is the share of the Medicare eligible population in the county enrolled in managed care in a given year. For example, the HMO penetration rate in Wayne County in 2006 is calculated as the number of Medicare beneficiaries enrolled in HMOs in 2006 divided by the Medicare eligible population in Wayne County. CMS has monthly MA enrollment data by state/county/contract from October 2006 available online. Because this research period is from 2006 to 2009, October data is used to represent 2006, and June is used for the remaining years. CMS, however, has the monthly data of eligible beneficiaries only from June 2008 to June 2013, which makes it impossible to calculate the enrollment rates for 2006 and 2007. Fortunately, the growth rate of Medicare eligible enrollees is pretty stable in the last five years. So the average growth rate is used here to calculate backward the Medicare eligible enrollees for the years 2006 and 2007. All data in this group comes from the CMS Medicare Advantage enrollment data.

Table 3 provides summary data regarding the penetration rates of MA plans and the number of counties in the sample that offer at least one MA contract out of 1101 MSA counties. It shows the penetration rate of HMO plans was about 12%, the penetration rate of PFFS was about 6%, and the enrollment rates of Local PPO and regional PPO were relatively small but increased significantly during the four years. The penetration rate of Coordinated Care Plans accounted for about 14%.

5.2.2 County Characteristics

The second group of explanatory variables is county characteristics, including median household income, population density, percent of eligible Medicaid enrollees over 65, three-year mortality rate for people over 65, hospital beds per 1,000 people, poverty rate, percentage of males, and so on. For the data on population density and median household income, this study puts the nature logarithms in as independent variables. All the county characteristic data are from Area Resource File (ARF, 2012-2013 release). During this period, America went through an economic boom brought by housing market, and the Great Recession due to the burst of housing bubble. So the county-level unemployment rate is also included to control for the potential influence of macroeconomic fluctuation. Table 4 reports summary statistics for all county-level variables used in the Probit model to control for the county fixed effect.

5.2.3 Patient Characteristics

The third group of variables is patient characteristics, including race, age, and risk, where all the data also comes from MCBS. Because different patients have different admission conditions, we need to control for different diagnoses in order to use readmission to measure the quality of inpatient care. The claim files list each patient's first three ICD-9 diagnosis codes. I use the Hierarchical Condition Category (HCC) Model to map each ICD-9 code to 1 of 70 HCCs. HCC coding is a payment model mandated in 1997 by CMS and implemented in 2003 to identify individuals with serious or chronic illness. It assigns a value to each HCC to measure the risk.

For example, for ICD-9 code 174.9 malignant neoplasm of breast (female), the corresponding HCC is 10 with an HCC weight of 0.187. The HCC weight could be used as an accurate value to control for each patient's risk upon admission. So the average value of three recorded ICD-9 diagnosis HCC risk weights can be calculated for each patient. Table 5 gives the patient characteristic summary that lists all the variables used to control patient-level fixed effect. It shows the risk index ranges from 0 to 6.5, with an average of

0.7. The case mix index is also included, which is a relative value assigned to a diagnosis related group (DRG) of patients in a Medicare care environment.

5.2.4 Hospital Characteristics

Hospital characteristics include several variables to control hospital ownership, quality and size of each hospital, in the model. Hospitals are usually categorized as not-for-profit (NFP), for-profit (FP), or government institutions. Type of ownership plays an important role in determining the quality of hospital care. Shen (2002) examined the effect of ownership choice on patient outcomes after the treatment for acute myocardial infarction (AMI), using the data from the American Hospital Association Annual Survey and the Medicare hospital cost reports from 1985 to 1994. She concluded that for-profit and government hospitals have a three to four percent higher incidence of adverse outcomes than not-for-profit hospitals. Table 6 summarizes the hospital information, showing that not-for-profit, private hospitals take the highest percentage at 73 percent

5.2.5 Instrument with Payment Rates

Recent studies point out that managed care penetration in a market is subject to endogeneity concerns, because missing variables may exist that are related to managed care penetration. To address this concern, this study uses data on payment from CMS to each MA plan in each county from 2006 to 2009. Beginning in 2006, the average monthly payment rate per county was used as the benchmark for plan bids. Table 7 shows the variation in MA payment between the four types of plans over the four years. Payment rates for all four plan types increased.

To prepare the entire data for regression, the data had to be merged. All the data from CMS and ARF comes with Federal Information Processing Standards (FIPS) and SSA county codes, so the penetration and competition data with area characteristics data can be merged using either FIPS or SSA. For Medicare quality and patient characteristics from MCBS data bank, the Medicare claim files for MCBS include inpatients' hospital information, and CMS has a general hospital information file with each hospital's location and hospital owner. The MCBS data with CMS data can thus be merged using the county name. All data merging work is accomplished by using SAS 9.3.

CHAPTER 6: EMPIRICAL ANALYSIS AND RELATED ISSUES

In this section, the empirical models will be estimated using two different methods: 1) the simple Probit model without instrumental variables; 2) the Probit model with instruments using the two-stage residual inclusion (2SRI) method. The rationale for including the simple Probit model is to provide a basis for evaluating the extent to which the results are sensitive to the assumption that the penetration of Medicare Advantage plans are exogenous independent variables.

6.1 Endogeneity Tests

Recent research found that the penetration of county-level Medicare Advantage plans are endogenous, because there may exist unobserved time-varying county-level variables that are correlated with both the penetration of MA plans and the quality of traditional Medicare (Chernew et. al, 2008; Baicker et. al, 2013). Thus, it is necessary to test the endogeneity assumption before running the model, in order to get unbiased and efficient estimators.

The exogeneity test in the 2SRI model arises from the second stage equation. In the second stage, the residuals from the auxiliary regressions are included as substituted for the unobserved variables. The most straightforward method to test exogeneity of the penetration rate can be constructed from the following null and alternative hypotheses: $H_0: \beta_r = 0$ and $H_1: \beta_r \neq 0$ where β_r is the parameter estimate on $Residuals_i$ from Equation 9. If the test statistic (in this case, the F test) is significantly different from zero, then we can reject H_0 and the assumption of exogeneity of the penetration rate of the four MA plans included in my model.

Table 8 shows the results of endogeneity tests. β_{r1} is the coefficient of residual for running the first stage regression of CCPs penetration rate, and β_{r2} is the coefficient of residual for running the first stage regression of PFFS penetration rate. The regression result rejects the hypothesis that the penetration rates of either CCPs are exogenous at the 1% level. Thus, I assert that the exogeneity test results indicate that the penetration rate of the MA plans appear to be endogenous in the regression model. Then the new challenge in accounting for this endogeneity is to find a set of good instrumental variables for the Probit model.

To correct the potential bias coming from endogeneity, instrumental variables (IV) are used to substitute the penetration of the Medicare Advantage plans. Chernew et al. (2008) used county-level payment rate from CMS to Medicare Advantage plans to identify the effect of the penetration of county-level Medicare Advantage plans. In order to satisfy the three conditions of good instrumental variables listed earlier, these payment rates should be correlated with county-level penetration, but not correlated with the quality of traditional Medicare.

The assumption of the correlations between county-level penetration rates of MA plans and payment rates is reasonable. As Chernew et al. (2008) mentioned, increasing the payments will increase the profitability of the marginal enrollee, which will increase profit incentives for more insurance companies to enter the MA market and offer more generous plans to increase enrollment.

Next the county-level payment rates are tested to insure they are not related to the quality of traditional Medicare. As reviewed in Chapter 2, since 2003, Medicare has paid the highest of (1) an urban or rural floor payment; (2) 100 percent of risk-adjusted traditional Medicare FFS spending in the county (calculated using a five-year moving average lagged three years); (3) a minimum update over the prior year rate of 2 percent or traditional Medicare's national expenditure growth rate, whichever was greater; or (4) a blended payment rate update. Beginning in 2006, Medicare started a bidding process for plan payments. The bids are compared to benchmark amounts set by the highest payment to the previous four choices. If a plan's bid is higher than the benchmark, the payment equals the benchmark. If the bid is lower than the benchmark, the plan and Medicare split the difference between the bid and the benchmark. Thus, it is reasonable to assume that county-level payment rates are not correlated with quality indicators used in this research.

While the assumption that county-level payment rates are good instrumental variables, the following conditions still need to be tested: 1) the instrumental variables are not significantly related with the explained variables; 2) the payment rates are not "weak" instruments. Empirically, the first condition can be test by adding the vector of payments in to Equation 1, as to the Equation (13). Then the coefficient vector θ is tested.

The regression result shows that the null hypothesis of 0 at the 5% level cannot be rejected. Then the first condition is test: the instrumental variables are not significantly related to the explained variables

$$Y_{ijkt} = \alpha_0 + Penetration_{jt}\alpha_1 + Payment_i\theta + X_{it}\alpha_2 + Z_{jt}\alpha_3 + H_{kt}\alpha_4 + year_t\alpha_5 + \varepsilon_{ijkt} \quad (13)$$

The strength of the instrumental set, as listed in the second condition, is tested by a standard F-test. All of three F-statistics (penetration rates of HMO, CCP and PFFS) are greater than 66, and a standard rule-of-thumb is that this F-statistic be greater than 10. Thus, the hypothesis that the instrumental variables are unrelated to county-level Medicare Advantage plans can be strongly rejected. Then the second condition is tested: the payment rates are not weak instruments. Thus the instruments used in this paper satisfy the two conditions.

6.2 First Stage Results

Table 9 shows the results of the first stage estimation where observations are constructed at the county level, instead of individual patient level as used in the second stage regression. Instrumental variables must be tested in the county level, because there is a significant variation in MA enrollment by state and county, ranging from 49 percent in Minnesota to less than 1 percent in Alaska. Thus, different counties will have different numbers of patients, and a model conducted at the individual level will lead to over-sampling for counties with more Medicare beneficiaries and under-sampling for counties with fewer Medicare beneficiaries. The penetration rates of HMO, PFFS and CCP are tested, because HMO and CCP are used in the second stage to measure the penetration of Medicare Advantage plans, and PFFS is used as a comparison group. All the equations include the county and year fixed effect (as seen in Equation 14).

$$Penetration_{jt} = \alpha_0 + Payment_{jt}\alpha_1 + Z_{jt}\alpha_4 + year_t\alpha_6 + \varepsilon_{ijt} \qquad (14)$$

The results suggest that an increase in payment to HMOs by $100 will increase the penetration rate of HMO by 13.8 percent. All the R^2 value shows that the instruments are not weak.

6.3 Parameter Estimates

Table 10 presents the main results of the paper. Here, 30-day readmission is used as the quality indicator. Model one and Model two use standard Probit models without instruments, and Model three and Model four use Probit models with payment rates as the instrumental variables. To make the coefficients more meaningful, all coefficients are presented by explaining and measuring the marginal effect of each variable.

In the Probit models, as presented in the first two columns, the estimated coefficients on either Medicare HMO or CCPs are larger (but smaller in absolute value) than the IV estimates in the last two columns. This result supports the endogeneity assumption that Medicare Advantage plan might enter into markets with relatively high cost growth in expenditures.

The first and the most important part of the results in Table 10 show that the expansion of MA plans (either HMO plans or CCP plans) has a significant negative effect on the probability of readmission. Specifically, the result in Model three shows that a 1 percent higher HMO penetration rate will lead to 1.5 percent lower readmission rate. Results in Model four show that a 1% increase in CCP is related to a 1.265 percent lower readmission rate. The market share of PFFS has a negative but not significant effect on the probability of readmission.

The second part of the regression table presents the results of patient characteristics. For the age of patient variable, the controlling group is ages higher than 84. It shows that the younger group has a lower, but not significant, probability of readmission. Another interesting variable is self-assessment of health condition. The control group is in bad health. It shows that the better health condition group has a lower rate of readmission, and the results are significant. Compared to patients in bad health, patients reporting excellent health have 8.75 percent lower 30-day readmission rate. The last important and strongly significant variables are risk index and DRG weight. The risk is calculated from the diagnosis code for each patient. Higher risk is related with higher probability of readmission; if the patient's risk increases by 1 percent, the probability of readmission will increase by 3 percent.

The third part of the result shows the year fixed effect. Compared to 2006, the three following years have higher readmission rates, and the years of 2008 and 2009 are significantly higher than 2006. In other words, hospital care quality had been getting worse over this four-year period.

The next section describes how county characteristics affect hospital quality. Counties with low population density and high household income tend to have higher hospital care quality. In addition, compared to counties in the Eastern U.S., counties located in the West have lower hospital care quality.

Last but not least is the influence of hospital characteristics. As mentioned before, the type of hospital ownership plays an important role in determining the quality of hospital care. As shown in table 10, compared with non-profit, private hospitals, patients discharged from government-owned hospitals have 2.69 perecent lower probability of readmission.

6.4 Alternative Indicators of Quality Measurement

In this section, alternative dependent variables are used to measure the quality, such as the 60-day readmission rate and 90-day readmission rate. The results in table 11 show that a 1 percent higher CCP share can decrease the 60-day readmission rate by 1.08 percent, and can decrease the 90-day readmission rate by 1.16 percent. Thus, the results are robust and it is safe to conclude that the expansion of MA plans could positively affect health care quality, using readmission rate as the quality indicator.

6.5 Chronic Conditions

Most previous research measures quality by considering one specific disease to control for the complexity of assessing a variety of different diseases. In this section, the sample is restricted to patients who report having one of four chronic conditions, including hypertension, cancer, stroke and diabetes. The regression results in table 12 show that a 1 percent increase in CCP plan penetration rate can reduce the 30-day readmission rate by 0.99 percent for patients with hypertension; by 3.11 percent for patients with cancer; and by 1.38 percent for patients with stroke. However, for patients with diabetes, even though the quality is negatively related to the expansion rate, the relationship is not significant 10 percent.

6.6 Selection Effect Test

The measurement of spillover effects may be affected by selection bias, meaning the choice between traditional Medicare and Medicare Advantage plans is not random. A common concern is whether relatively healthier beneficiaries are more likely to choose fee-for-service Medicare. If so, the quality for those remaining in the fee-for-service will decrease, since healthier enrollees who were previously enrolled in fee-for-service plans may switch to MA plans and enrollees under worse health condition who were previously enrolled in MA plans may switch to fee-for-service plans. The existence of possible selection bias could definitely affect the spillover effect measured in this paper.

Fortunately, since patient characteristic information is available in the MCBS data, patient characteristics variables are included in my model to control patient's fixed effect. Thus, there is no selection bias concern in this research. Out of interest, though, I tested the compositional change by regressing the Medicare Advantage plans penetration and various demographic and health-related variables in this section. As Chernew, et. al., (2008) did, I replacedthe dependent variable with age and health-rated measures to see whether the penetration rates are related to patient characteristics (see Equation 15). In my main model, I have dozens of variables about patient characteristics. To simplify the analysis, focused on cancer, risk, DRG weight, stroke and diabetes as the dependent variables.

$$X_{it} = \alpha_0 + Penetration_{jt}\alpha_1 + Z_{jt}\alpha_2 + H_{kt}\alpha_3 + year_t\alpha_3 + \varepsilon_{ijt} \qquad (15)$$

The results in table 13 show that none of the coefficients of either CCP share or PFFS share are significant. Thus, there exists no systematic evidence of selection bias in the model, which is the same conclusion as Chernew et. al., (2008).

6.7 Explanation of the Findings

The major purpose of this empirical study is to better understand how the penetration rates of Medicare Advantage plans will spill over into the traditional Medicare sector, considering the rapid growth of MA plans in recent years. Specifically, it investigates whether the expansion of MA plans will affect the quality of health care for patients remaining in the traditional Medicare sector. To answer the question whether government should continue to support the development of MA plans, a Probit model with instrumental variable method is applied to run the regression, and patient characteristics are well controlled to avoid selection bias.

The regression results suggest that the increasing Medicare Advantage penetration can reduce the hospital readmission rate. Using payment rates from CMS to MA plans as instrumental variables, I find that a 1 percent increase in CCP penetration rate will lead to a 1.13 percent reduction of 30-day readmission in the traditional Medicare sector. Because lower readmission is always favored by patients and considered a sign of higher quality care, the expansion of MA plans has a strong and significant positive spillover effect on the quality of hospital care in the traditional Medicare sector. The same conclusions can be reached if considering the expansion of HMO plans, which a 1 percent increase in HMO penetration will lead to a 1.52 percent reduction of 30-day readmission rate for patients with traditional Medicare plan.

Several alternative models are built to test the robustness. First, using alternative indicators of quality (60-day readmission and 90-day readmission), a similar conclusion of the positive spillover effects is reached. Second, many related studies chose to test the spillover effect by limiting the sample to patients with specific diseases. To follow their methods, I conducted a robust test by using four common chronic conditions (hypertension, cancer, stroke and diabetes), and find that the expansion of MA plans has a negative effect on the 30-day readmission rate for patients with one of the four chronic conditions, even though the effects are at different scales. Lastly, this research used MCBS data with detailed patient characteristics to test the selection bias of whether patients enrolled in Medicare Advantage plans are self-selected. Running patient characteristics (especially the risk index) with penetration rates controlling county and hospital fixed effect, resulting in finding that the penetration rate of CCP plans is not related to patient characteristics, which means there is no selection bias.

Since lower readmission rate is always considered an important indicator of higher hospital quality, we can assert that the expansion of Medicare Advantage plans can positively spill over to the traditional Medicare sector. As reviewed in Chapter 3, this significant positive spillover effect may come from either the physician’s practice patterns, or through the adoption of shared advanced technology.

CHAPTER 7: CONCLUSION

Medicare Advantage plan enrollment has expanded rapidly in recent years, and this rapid growth has attracted the attention of policymakers and researchers to test the effectiveness and efficiency of these plans compared to tradition Medicare plans. This paper is designed to address the question of whether increasing MA plan enrollment is associated with the quality of hospital care received by fee-for-service Medicare patients, by constructing the 30-day readmission rate as the quality indicator.

By using the most recent enrollment data and individual MCBS data, this dissertation has found a statistically significant and beneficial relationship between the MA penetration in a county and the rate of readmissions to local hospitals. Specifically, the results show that a 1 percent increase in the Coordinated Care Plan penetration rate can reduce the 30-day readmission rate by 1.13 percent, reduce 60-day readmission rates by 1.08 percent, and reduce the 90-day readmission rate by 1.12 percent. Since lower rates of hospital readmission are widely accepted as an indicator of higher quality, it is safe to conclude that the expansion of Medicare Advantage plans has had a substantial beneficial spillover effect on the quality of inpatient care received by beneficiaries under traditional Medicare. In addition, when the sample is restricted to patients with specific chronic conditions and 60-day and 90-day readmission rates are used as quality indicators, a similar conclusion is reached. Thus, the positive spillover effect is robust. Finally, the selection bias is tested with the individual data from MCBS, and finds no significant selection bias, which is consistent with most recent studies.

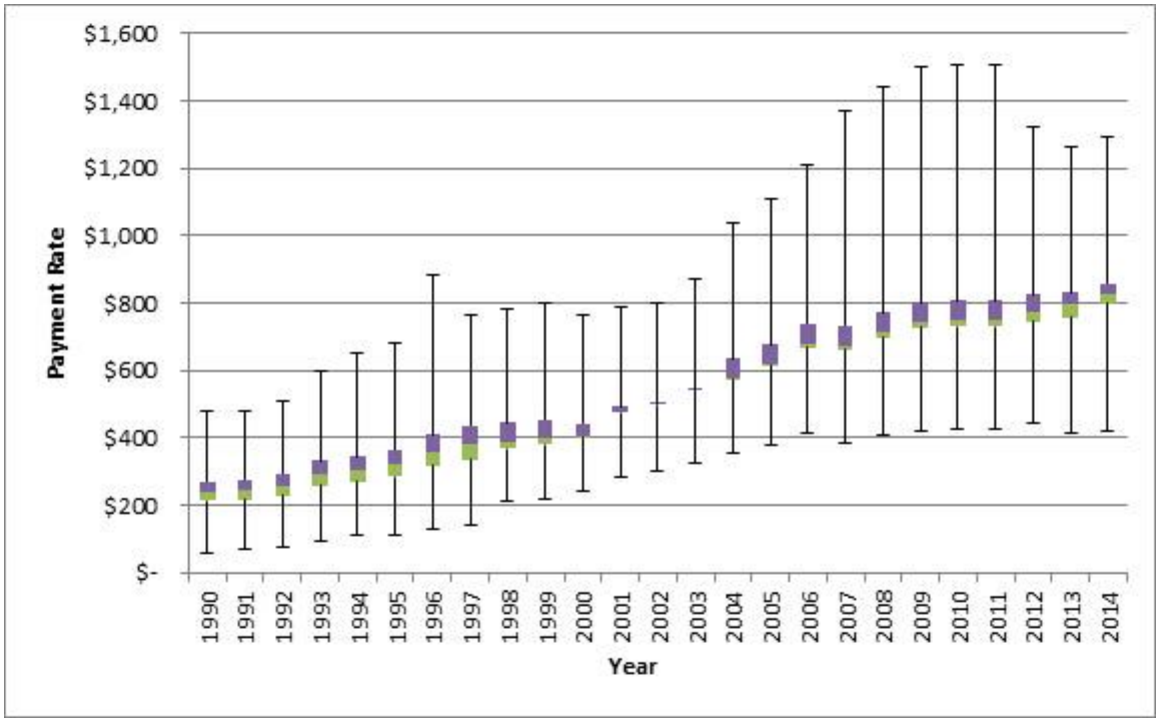
The findings in this paper are consistent with most recent related research on the spillover effects of MA penetration. Baicker et al. (2013), for example, found that greater managed care penetration is associated with lower costs and shorter stays per hospitalization.

The findings in the research presented here provide strong empirical support for the continued development of Medicare Advantage plans. The positive spillover effects from the managed care expansion to improve the quality of fee-for-service beneficiaries can lead to several important policy implications for the Medicare program. When the Medicare Advantage plans are evaluated in the future, the policy makers should not only consider the direct effects on beneficiaries under MA plans, but also the possible spillover effects. According to the results found here, the government should continue to encourage enrollment in Medicare Advantage plans by increasing the payment to MA plans.

There are several limitations in this research. First, as mentioned earlier, quality of care has numerous dimensions. Using readmission rate as the only quality indicator may lead to measurement bias. Future research can focus on other types of utilization and different measures of the quality of care, and test whether the expansion of MA plans will only spill over to sections of the hospital's quality measurements or to overall quality.

Second, the research period for this paper is 2006-2009, which is before the implementation of the Affordable Care Act of 2010. Future work should also seek to evaluate the spillover effect of MA after 2010, when the payments to MA plans are totally different. Finally, future research might investigate whether the expansion of MA plans will affect competition among hospitals, considering that competitiveness could also have a spillover effect on the quality of hospital care.

FIGURE 1 DISTRIBUTION OF MA COUNTY-LEVEL MONTHLY PAYMENT RATES[1]



Note: the payment rate after 2012 is the average value of the program's five-star quality rating. All payment rates are the nominal value, no inflation-adjustment is applied.

SOURCE: CMS, Medicare Advantage (MA) Ratebook files, located online at http://www.cms.gov/Medicare/Health-Plans/MedicareAdvtgSpecRateStats/Ratebooks-and-Supporting-Data.html.

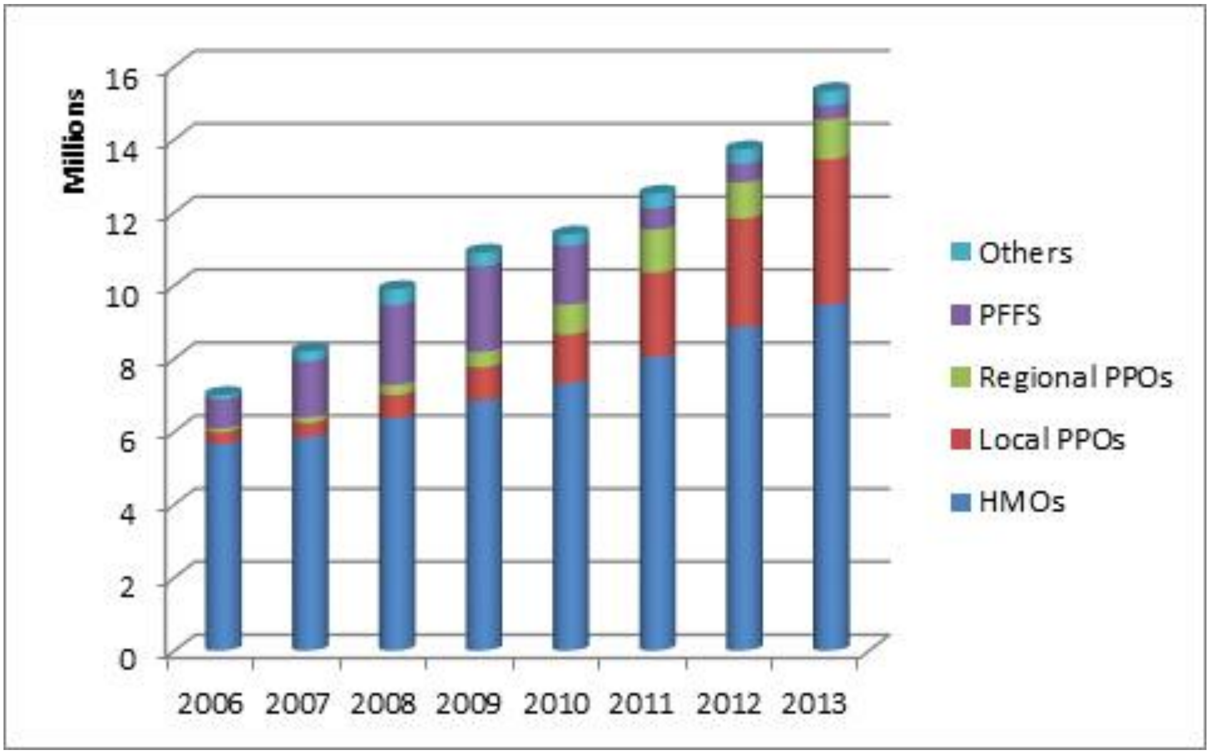
[1] The graph is a boxplot to depict the payment rates in all counties through their quartiles. The green rectangle spans the first quartile to the medium, and the purple rectangle spans the medium to the third quartile. The lower bound describes the minimum payment rate, and the upper bound describes the maximum payment rate.

FIGURE 2 ENROLLMENT (IN MILLIONS) IN MEDICARE ADVANTAGE PLANS, 1985-2003

Note: Data for the number of enrollmees includes local Coordinated Care Plans (risk-based HMOs plus PPOs), Provider Sponsored Organization, private Fee-For-Service (from 2001), regional PPOs (from 2006), and other available MA plans.

SOURCE: CMS, Medicare Advantage Plans Monthly Reports Files and Data, located online at http://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/HealthPlanRepFileData/Monthly.html. All data are from December of the year indicated, except 2007, which is from November.

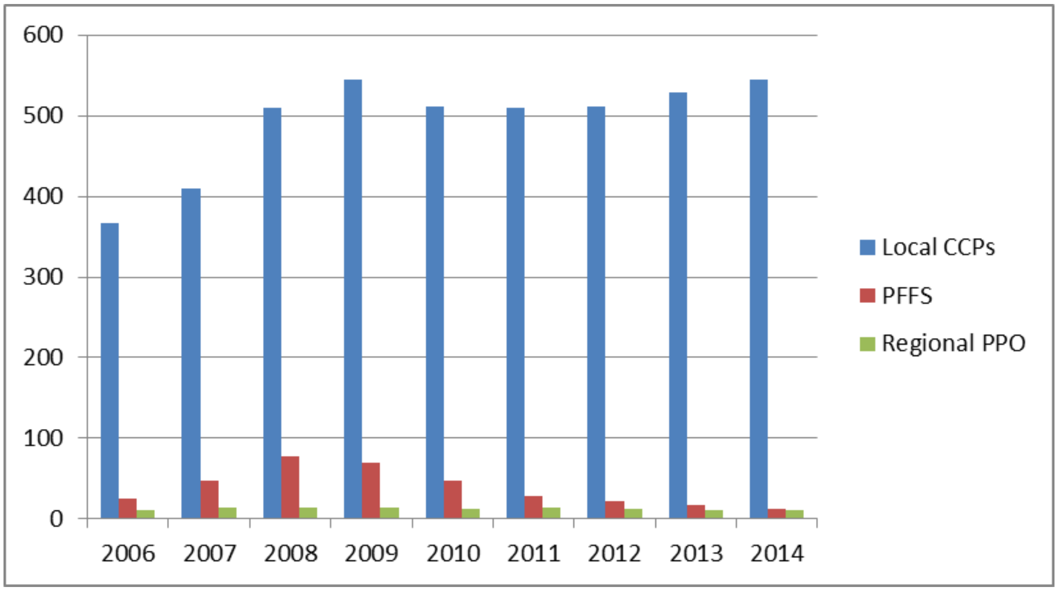
FIGURE 3 ENROLLMENT IN MEDICARE ADVANTAGE PLANS, BY PLAN TYPE, 2006 -2013



Note: "Others" includes cost and demonstration plans.

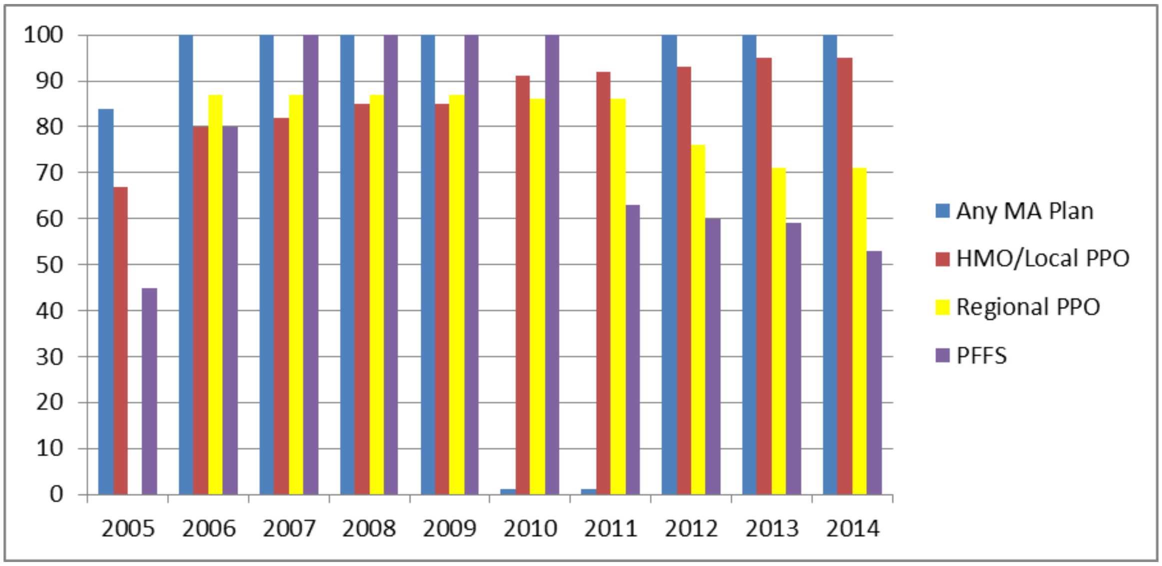
SOURCE: CMS, Medicare Advantage/Part D Contract and Enrollment Data, Monthly Contract and Enrollment Summary Report. All data are from June of the year indicated, except 2006, which is from October, and 2013, which is from May.

FIGURE 4 MONTHLY CONTRACT SUMMARY REPORT



SOURCE: CMS, Medicare Advantage/Part D Contract and Enrollment Data, Monthly Contract and Enrollment Summary Report. All data are from July of the year indicated, except 2008, which is from June, and 2014, which is from February.

FIGURE 5 AVAILABILITY OF MA PLANS AND PLAN TYPES



SOURCE: CMS, Medicare Advantage/Part D Contract and Enrollment Data, Monthly Contract and Enrollment Summary Report. All data are from June of the year indicated, except 2006, which is from October, and 2013, which is from May.

TABLE 1 ENROLLMENT WITHIN MSA AND ALL COUNTIES LEVEL ACROSS PLAN SUMMARY

		2006	2007	2008	2009	Total
HMO	MSA	5155605	5283708	5733023	6171799	22344135
	All	5668255	5849551	6363491	6841016	24722313
	Percent	90.96%	90.33%	90.09%	90.22%	90.38%
Private PFFS	MSA	546444	1071179	1519475	1633770	4770868
	All	810277	1541356	2184014	2351523	6887170
	Percent	67.44%	69.50%	69.57%	69.48%	69.27%
Local PPO	MSA	284335	332775	537102	767148	1921360
	All	325952	388712	640504	926224	2281392
	Percent	87.23%	85.61%	83.86%	82.83%	84.22%
Regional PPO	MSA	73339	120145	207222	304914	705620
	All	87008	148765	274292	415653	925718
	Percent	84.29%	80.76%	75.55%	73.36%	76.22%

Note: percent equals the ratio of enrollment in MSA over the total enrollment.

SOURCE: CMS, Medicare Advantage/Part D Contract and Enrollment Data, Monthly Contract and Enrollment Summary Report. All data are from June of the year indicated, except 2006, which is from October.

TABLE 2 READMISSION RATE SUMMARY

		30-day Readmission rate	60-day Readmission rate	90-day Readmission rate
2006	Mean	0.2302	0.2852	0.3084
	N	1912	1779	1619
2007	Mean	0.2252	0.2955	0.3267
	N	1999	1859	1715
2008	Mean	0.2408	0.3039	0.3285
	N	1874	1755	1581
2009	Mean	0.2152	0.2718	0.3052
	N	1547	1420	1255
Average	Mean	0.2284	0.2900	0.3180
	N	7332	6813	6170

Note: Column "Mean" measures the readmission rate, Column "N" measures the number of observations.

Source: MCBS claims data, 2006-2009.

TABLE 3 MA PENETRATION RATE SUMMARY

		2006	2007	2008	2009	Average
HMO share	Mean	0.1244	0.1148	0.1156	0.1206	0.1187
	N	648	703	777	806	734
PFFS share	Mean	0.0357	0.0530	0.0698	0.0716	0.0580
	N	1001	1075	1086	1085	1062
Local PPO share	Mean	0.0155	0.0176	0.0243	0.0321	0.0234
	N	477	490	591	702	565
Regional PPO share	Mean	0.0040	0.0062	0.0094	0.0129	0.009
	N	387	550	711	854	626

Note: Column “Mean” measures the average penetration rate across counties, Column “N” measures the number of counties that have MA enrollment out of 1101 MSA counties.

Source: CMS data, Medicare Advantage/Part D Contract and Enrollment data, 2006-2009.

mortality_~e	4851	0.0460742	0.0054573	0.033235	0.062451
unemployme~e	4851	5.806164	2.275088	2.3	14
bed_rate	4851	3.759325	1.827867	0	15.8852
lnpop_dens~y	4851	6.801736	1.358753	2.91235	11.1733
lnmedian_i~e	4851	10.83455	0.205482	10.3577	11.4601
per_male	4851	0.4901084	0.0105569	0.465634	0.524712
per_white	4851	0.779139	0.1270935	0.281051	0.968427
per_black	4851	0.154533	0.1256461	0.002864	0.65559
poverty_rate	4851	13.51901	4.32555	4.1	28.9
medicaid_r~e	4851	0.1498616	0.0795238	0.030247	0.429532
midwest	4851	0.2327355	0.4226186	0	1
northeast	4851	0.1894455	0.3919025	0	1
west	4851	0.1480107	0.3551472	0	1
nursing	4851	3.179169	1.087905	0	5.926926
per_under12	4851	0.1990613	0.0248154	0.124691	0.258699
per1519	4851	0.0695888	0.0084634	0.043776	0.091345
per2024	4851	0.069435	0.0144597	0.043085	0.142264
per2544	4851	0.2748526	0.031104	0.191062	0.37928
per4564	4851	0.2550197	0.0226514	0.195628	0.309481

Source: AHRF data, 2006-2009

TABLE 4 PATIENT CHARACTERISTICS SUMMARY

Variable	obs	mean	std	min	max
Age 65-69	4851	0.1245104	0.330197	0	1
Age 70-74	4851	0.1535766	0.3605796	0	1
Age 75-79	4851	0.1781076	0.3826427	0	1
Age 80-84	4851	0.2236652	0.4167432	0	1
Male	4851	0.4197073	0.4935618	0	1
White	4851	0.8499278	0.3571789	0	1
Black	4851	0.1106988	0.3137912	0	1
Obese	4851	0.2510823	0.4336804	0	1
Underweight	4851	0.0486498	0.2151569	0	1
Excellent health condition	4851	0.0414348	0.1993141	0	1
Very good health condition	4851	0.1504844	0.3575825	0	1
Good health condition	4851	0.3073593	0.4614471	0	1
Fair health condition	4851	0.3052979	0.460581	0	1
Smoker	4851	0.0808081	0.2725682	0	1
Hypertension	4851	0.7429396	0.437058	0	1
Myocardial	4851	0.2292311	0.4203815	0	1
Ever told had angina pectoris	4851	0.2174809	0.4125749	0	1
Heart conditions	4851	0.180169	0.3843678	0	1
Stroke	4851	0.1945991	0.3959325	0	1
Cancer	4851	0.2438672	0.4294578	0	1
Diabetes	4851	0.312719	0.4636487	0	1
ADL helpers	4851	0.7730365	0.418912	0	1
Less than high school	4851	0.3230262	0.4676808	0	1
High school	4851	0.280973	0.4495207	0	1
Some college	4851	0.2446918	0.4299486	0	1
College	4851	0.151309	0.3583868	0	1
Married	4851	0.4252731	0.4944353	0	1
Widowed	4851	0.4458874	0.4971144	0	1
Divorced	4851	0.0762729	0.2654617	0	1
Separated	4851	0.0098949	0.0989898	0	1
Number of children living	4851	2.85838	2.46115	0	17
Work	4851	0.0385488	0.1925367	0	1
Distance from hospital	4851	35.99905	188.3992	0	2601.94
Risk index	4851	0.7036217	0.7778851	0	6.525
Case mix index	4851	1.466282	0.4069369	0	2.62649
DRG weights	4851	1.553604	1.899402	0	26.0295

Source: MCBS claim data, 2006-2009.

TABLE 5 HOSPITAL CHARACTERISTICS SUMMARY

Variable	obs	mean	std	min	max
Government owned hospital	4851	0.1207998	0.3259281	0	1
Private hospital-for profit	4851	0.14698	0.3541225	0	1
Private hospital-none profit	4851	0.7322202	0.4428479	0	1
# of staff bed	4851	5.72986	0.7426472	2.079442	7.718241
# of admission	4851	9.608665	0.870272	5.488938	11.53239
Inpatient days (log)	4851	11.23706	0.8514316	6.542472	13.46453
# of employees	4851	7.236669	0.9390539	3.496508	9.77127
Teaching hospitals	4851	0.4627912	0.498665	0	1
# of birth (log)	4851	6.16349	3.085674	0	9.446361
Staffed bassinets	4851	2.639207	1.420773	0	5.003946
Emergency outpatient visits	4851	10.4265	2.016519	0	12.50061
Total outpatient visits	4851	12.04554	1.432899	0	14.84513
# of operating rooms	4851	2.255992	1.226965	0	4.574711
ICU beds	4851	2.505196	1.327045	0	5.278115
Total employee equivalent	4851	7.414616	0.9033796	4.060443	9.706438

Source: AHA survey data, 2006-2009.

TABLE 6 MA PAYMENT RATE SUMMARY

		2006	2007	2008	2009	Mean
HMO	Mean	649.15	687.41	697.37	712.98	687.58
	N	752	762	806	832	788
PFFS	Mean	660.20	691.84	722.66	778.73	714.47
	N	1011	1097	1098	1100	1077
Local PPO	Mean	677.18	717.68	716.99	741.23	716.50
	N	462	486	575	700	556
Regional	Mean	712.79	731.14	751.51	754.13	742.00
PPO	N	385	500	651	865	600

Note: Column "Mean" measures the average payment rate in dollar from CMS across counties, Column "N" measures the number of counties that has payment data for Part C Plans out of 1101 MSA counties.

Source: CMS data, Medicare Advantage Plan payment data items, details for 2006-2009.

TABLE 7 ENDOGENEITY TEST RESULTS

	Value	Standard deviation	P-value
β_{r1}	3.275	1.129	0.004
β_{r2}	3.567	3.032	0.240

Note: β_{r1} is the coefficient of residual from regressing CCP penetration rate on the instrument variables and all exogenous; β_{r2} is the coefficient of residual from regressing PFFS penetration rate on the instrument variables and all exogenous.

I use F-test to test the null hypothesis that both β_{r1} =0 and β_{r2}=0, p-value equals to 0.0033. Thus we can reject the null hypothesis, and, endogeneity does exist.

TABLE 8 FIRST STAGE REGRESSION RESULTS

Independent Variables	CCP Share	HMO Share	PFFS Share
Payment Rates			
Payment to HMO	0.0000163	0.0000138	0.0000544 **
Payment to PFFS	0.0000538	0.0000707	-0.0000105
Payment to Local PPO	-6.95E-06	-0.0000274	-6.19E-06
Payment to Regional PPO	0.0000699 ***	0.0000607 **	1.09E-06
County Characteristic			
Mortality Rate	-2.004243	-1.521831	-1.560804
Unemployment Rate	-0.0090469 **	-0.0093525 **	0.0013839
Bed Rate	-0.0057532	-0.0056966	0.0017704
Population Density (Log)	0.0108253	0.0135145	-0.001064
Median Household Income	-0.3546022 ***	-0.2900124 ***	-0.0661825 **
Percent Of Male	-0.7224788	-0.7317879	-0.7493864
Percent Of White	0.1244474	0.092407	0.057716
Percent Of Black	0.1550378	0.140985	-0.0655995
Poverty Rate	-0.0047092	-0.0033271	-0.0025355
Medicaid Rate	-0.302091 **	-0.2693379 *	0.046946
Midwest	-0.0308311	-0.0242106	0.0289406 ***
Northeast	0.1203201 ***	0.1121536 ***	-0.0367538 ***
West	0.1973037 ***	0.199178 ***	-0.023272 **
# Of Skilled Nursing Facilities	0.0374035 **	0.0368966 ***	-0.0165662 ***
% Of Population Under12	0.41027	0.7150216	-0.0351964
% Of Population 15-19	-0.4082836	-1.6589	2.36565 ***
% Of Population 20-24	0.7603183	1.094993	-0.680421
% Of Population 25-44	0.4600376	0.183801	0.5255639 ***
% Of Population 45-64	1.034376	0.8290734	0.3499746
Hospital Characteristics			
Private Hospital-For Profit	0.0289512	0.0212583	0.0163484 **
Private Hospital-Not For Profit	0.0096118	0.0018352	0.0139672 **
# Of Staff Bed	0.0425783 **	0.0244508	-0.0180613 ***
# Of Admission	0.0077667	0.0119982	-0.0171068 **
Inpatient Days (Log)	-0.0209533	-0.0080241	0.0182294 **
# Of Employees	0.0879277 **	0.0871206 **	-0.0096697
Teaching Hospitals	0.0069533	0.0116155	-0.0014008
# Of Birth (Log)	-0.0027573	-0.0032734	-0.0010881
Staffed Bassinets	0.0002138	0.0006958	0.0017353
Emergency Outpatient Visits	0.0006972	0.0008031	0.002642 **

Total Outpatient Visits	-0.0017373	-0.0021914	0.0003405
# Of Operating Rooms	0.001544	0.0039934	0.002946
ICU Beds	0.0011917 **	-0.0004989	-0.002674
Total Employee Equivalent	-0.1082818 ***	-0.1083846 ***	0.0197868 *
Patient Fixed Effect	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes
R-squared	.6043	.5960	.5320

Note: Dependent variables are CCP market share, HMO market share, and PFFS market share, which range from 0 to 1. The model is clustered by county.

∗ Significant at 10% level.

∗∗ Significant at 5% level.

∗∗∗ Significant at 1% level.

TABLE 9 MAIN REGRESSION RESULTS—30-DAY READMISSION RATE

	Probit Model Without Instruments		Probit Model With Instruments	
Independent Variables	Model 1	Model 2	Model 3	Model 4
Market Penetration				
CCP Share	-0.1784 ***		-1.1324 ***	
HMO Share		-0.1661 **		-1.5158 ***
PFFS Share	-0.0849	-0.0738	-1.1033	-0.8012
Patient Characteristics				
Age 65-69	-0.0283	-0.0288	-0.0277	-0.0321
Age 70-74	0.0149	0.0148	0.0187	0.0195
Age 75-79	-0.0055	-0.0057	0.0045	0.0063
Age 80-84	0.0084	0.0083	0.0104	0.0091
Male	0.0134	0.0132	0.0129	0.0116
White	-0.0131	-0.0128	-0.0164	-0.0231
Black	-0.0318	-0.0312	-0.0524	-0.0642
Obese	0.0244	0.0242	0.0307 **	0.0321 **
Underweight	-0.0022	-0.0018	0.0045	0.006
Excellent Health Condition	-0.0843 **	-0.0845 **	-0.0875 **	-0.0932 **
Very Good Health Condition	-0.0855 ***	-0.0856 ***	-0.0837 ***	-0.0847 ***
Good Health Condition	-0.0161	-0.0163	-0.0165	-0.0196
Fair Health Condition	-0.0382 **	-0.0384 **	-0.0311 *	-0.0302 *
Smoker	0.0326	0.0333	0.0165	0.0171
Hypertension	0.0337 **	0.0335 **	0.0363 **	0.0363 **
Myocardial	-0.0115	-0.0113	-0.0122	-0.0114
Ever Told Had Angina Pectoris	-0.0036	-0.0039	0.0029	0.0028
Heart Conditions	0.0214	0.0217	0.0181	0.0204
Stroke	-0.026	-0.0256	-0.0224	-0.0183
Cancer	-0.002	-0.0019	-0.0066	-0.0061
Diabetes	0.0089	0.009	0.0075	0.0085
ADL helpers	0.033**	0.0328 *	0.0356 **	0.0348 **
Less Than High School	-0.0076	-0.0075	0.0001	0.0028
High School	-0.0395 *	-0.0396 *	-0.0327	-0.0331
Some College	-0.0003	-0.0003	0.00327	0.0048
Married	0.0474	0.0476	0.0422	0.0359
Widowed	0.0507	0.0507	0.0432	0.0352
Divorced	0.0543	0.0544	0.0532	0.0517
Separated	0.0884	0.088	0.0644	0.0411
Number Of Children Living	0.0007	0.0006	0.0018	0.0017

Work	-0.0659 *	-0.066 *	-0.0674 *	-0.0668 *
Distance From Hospital	-2.06E-05	-2.06E-05	-3.13E-06	5.94E-06
Risk Index	0.0313 ***	0.0313 ***	0.0316 ***	0.0322 ***
Case Mix Index	0.0351	0.0341	0.0452 *	0.0397
DRG Weights	0.0105 ***	0.0106 ***	0.0102 ***	0.0099 ***
Weekday	0.0162	0.0163	0.0133	0.013
Date Factor (Compare To 2006)				
Year 2007	-0.0016	-0.0022	0.0138	0.003
Year 2008	0.031	0.0285	0.0823 ***	0.0685 **
Year 2009	0.0097	0.0055	0.0895 **	0.079 *
County Characteristic				
Mortality Rate	-0.0724	0.0925	-4.6096	-3.8462
Unemployment Rate	-0.0001	-1.29E-05	-0.0048	-0.0096
Bed Rate	0.0005	0.0007	-0.0053	-0.0069
Population Density (Log)	0.024 *	0.0239 *	0.0382 ***	0.0451 ***
Median Household Income	-0.0934	-0.0762	-0.5042 ***	-0.5087 ***
Percent Of Male	-0.919	-0.909	-2.0852	-2.0255
Percent Of White	0.2838	0.2747	0.5427 *	0.555 *
Percent Of Black	0.2467	0.2418	0.4047	0.4863
Poverty Rate	-0.0062	-0.0059	-0.0126 **	-0.0114 **
Medicaid Rate	-0.0292	-0.0132	-0.3284 *	-0.3348 **
Midwest	-0.0006	0.0006	-0.00008	-0.0085
Northeast	0.0058	0.0031	0.0882	0.1275 **
West	0.048	0.0461	0.2098 ***	0.2932 ***
# Of Skilled Nursing Facilities	0.0082	0.0074	0.0389 *	0.0561 **
% Of Population Under12	-0.12	-0.0574	0.044	0.7836
% Of Population 15-19	2.4535	2.1754	5.159	2.1103
% Of Population 20-24	-0.188	-0.1135	-0.135	0.9371
% Of Population 25-44	0.2821	0.214	1.362 *	0.8247
% Of Population 45-64	-0.4563	-0.5111	0.9369	0.8423
Hospital Characteristics				
Government Owned Hospital	-0.0269	-0.0255	-0.0481 *	-0.0351
Private Hospital-For Profit	0.0099	0.0096	0.0346	0.0398
# Of Staff Bed	0.0087	0.0057	0.034	0.031
# Of Admission	-0.0744 **	-0.0735 **	-0.0866 **	-0.0739 **
Inpatient Days (Log)	0.0469	0.0486	0.0518	0.0603
# Of Employees	0.113 *	0.111 *	0.1992 ***	0.2413 ***
Teaching Hospitals	0.0146	0.0154	0.02	0.0316 *
# Of Birth (Log)	0.0046	0.0046	0.0028	0.0024

Staffed Bassinets	-0.0026	-0.0027	-0.0068	-0.0093
Emergency Outpatient Visits	0.0045	0.0045	0.007	0.0066
Total Outpatient Visits	0.0013	0.0013	-0.0002	-0.001
# Of Operating Rooms	0.0127	0.013	0.0182	0.0212 *
ICU Beds	-0.0059	-0.006	-0.0095	-0.0106
Total Employee Equivalent	-0.1414 **	-0.1394 **	-0.2393 ***	-0.297 ***

Note:

1. The dependent variable is a binary variable to measure 30-day readmission: when it equals to one, there is a readmission within 30 days; when it equals to zero, there is no readmission within 30 days.

2. All value in the table measures marginal effect of each explaining variable.

3. The sample size is 4,851, with four-year periods.

∗ Significant at 10% level.

∗∗ Significant at 5% level.

∗∗∗ Significant at 1% level.

TABLE 10 ROBUST TEST

Independent Variables	60-day Readmission Rate	90-day Readmission Rate
CCP share	-1.0786 ***	-1.1157***
PFFS share	-.7910	.2485
Risk Adjusters	Yes	Yes
County FEs	Yes	Yes
Hospital FEs	Yes	Yes
Year FEs	Yes	Yes
Pseudo R2	0.0347	0.037

Note:

1. The two binary variables of 60-day and 90-day readmission rates are used as quality indicators.

2. All value in the table measures marginal effect of each explaining variable.

3. The sample sizes are 4,337 and 3,798, respectively, with four-year periods.

∗ Significant at 10% level.

∗∗ Significant at 5% level.

∗∗∗ Significant at 1% level.

TABLE 11 CHRONIC CONDITIONS

Independent Variables	**Hypertension**	**Cancer**	**Stroke**	**Diabetes**
CCP Share	-.9947 **	-3.1051 ***	-1.3804 *	-.3986
PFFS Share	-.8708	-.713	1.967545	-1.3028
Readmission Rate	26.03%	25.44%	24.15%	27.42%

Note:

1. The dependent variable is a binary variable to measure 30-day readmission: when it equals to one, there is a readmission within 30 days; when it equals to zero, there is no readmission within 30 days.

2. All values in the table measure the marginal effect of each explaining variable.

3. The sample sizes are 3604, 1183, 944 and 1517, respectively, with four-year periods.

∗ Significant at 10% level.

∗∗ Significant at 5% level.

∗∗∗ Significant at 1% level.

TABLE 12 SELECTION BIAS TEST

Dependent Variables	CCP share	PFFS share
Cancer	-.851472 (-2.59)	-.8559415 (-0.96)
Risk	-.0916663 (-0.15)	1.854472 (1.61)
DRG weights	.1811279 (0.12)	.4704402 (0.12)
Stroke	-.190593 (0.62)	1.405834 (1.73)
Diabetes	.2944518 (0.85)	-.8761858 (-0.95)

Note:

1. The dependent variables of Cancer, Stroke, and Diabetes are binary variables, where I use the Probit model to measure the marginal effect. The dependent variables of Risk and DRG weights are continuous variables, where I use the OLS model to estimate the coefficients.

2. The sample size is 4,851, with four-year periods.

3. All value in the parenthesis measures t-statistic.

∗ Significant at 10% level.

∗∗ Significant at 5% level.

∗∗∗ Significant at 1% level.

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ABSTRACT

SPILLOVER EFFECTS OF MEDICARE ADVANTAGE PLANS: DOES THE MARKET PENETRATION OF PLANS AFFECT HOSPITAL CARE QUALITY?

by

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May 2015

Advisor: Dr. Gail Jensen Summers

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Degree: Doctor of Philosophy

The percentage of Medicare beneficiaries enrolled in Medicare Advantage (MA) plans increased from 12 percent in 2003 to 28 percent in 2013 out of the roughly 50 million Medicare enrollees. Although Medicare beneficiaries are increasingly choosing MA plans, little is known about whether and how the market penetration of these plans affect the quality of hospital care provided to Medicare beneficiaries. This issue is extremely important to policy makers when they try to evaluate the importance and effectiveness of current Medicare policy, like the Affordable Care Act. This paper examines the spillover effect on the quality of hospital care under traditional Medicare plans in response to the local market penetration of MA plans, such as MA health maintenance organizations (HMOs), MA preferred provider organizations (PPOs), and MA private fee-for-service (PFFS) plans. Using nationally representative data from the 2006 to 2009 Medicare Current Beneficiary Survey and enrollment data from CMS, this study shows that higher

Medicare Advantage plan penetrations are associated with lower readmission. I conclude that the expansion of Medicare Advantage plans has a positive spillover effect on quality of care received by individuals enrolled in traditional Medicare plans.

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