MEDICARE QUALITY: DIFFERENCES ACROSS THE NATION

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ABSTRACT

Medicare costs are predicted to continue increasing at an unsustainable rate in the future unless the financial structure is changed. The purpose of this study is to holistically examine the delivery of Medicare by studying the number of services, enrollees’ demographics, and reimbursements in the delivery of Medicare across the United States. Specifically, I will investigate how the number of Medicare services differs across the country in relation to Medicare reimbursement rates and the makeup of each county. Cutting the physician reimbursement rates remains an ineffective solution as the demographics of the county causes both the average number of services and the total reimbursement for Medicare to vary nationwide. This paper suggests endogeneity exists when cutting the Medicare reimbursement rate and does not lead to a changed behavior in savings. In essence, if cutting rates merely drives up the number of services and possibly decreases quality, then cost containment is not accomplished and all are worse off.
The research and writing of this thesis is dedicated to everyone who helped along the way especially the support from my parents, Kathy and Jim Moore.

Many thanks,
Christina L. Moore
# Table of Contents

I. Introduction.................................................................................................................. 1  
II. Background and Literature Review ........................................................................... 3  
   A. Medicare History ....................................................................................................... 4  
   B. Medicare Cost Structure ........................................................................................... 6  
   C. Financial Challenges ................................................................................................. 7  
   D. Mandatory Role as Social Insurance....................................................................... 8  
   E. Physician Reimbursement Rates ............................................................................. 9  
   F. Rural vs. Urban ......................................................................................................... 10  
   G. Medicare Efficiency .................................................................................................. 11  
   H. Present Environment ............................................................................................... 11  
   I. Contribution ............................................................................................................. 12  

III. Theoretical Framework ............................................................................................. 13  

IV. Data Section ............................................................................................................... 14  

V. Empirical Models and Results .................................................................................... 16  
   A. Empirical Models ...................................................................................................... 16  
   B. Variables .................................................................................................................. 20  
   C. Results ..................................................................................................................... 28  

VI. Conclusion and Policy Recommendations ............................................................... 39  

VII. Appendix A .............................................................................................................. 43  

VIII. Appendix B ............................................................................................................ 45  

IX. Bibliography .............................................................................................................. 46
LIST OF TABLES

Table 1: Model Summary for Equation 1 ................................................................. 28
Table 2: Model Independent Variable Coefficients for Equation 1 .................... 28
Table 3: Model Summary for Equation 2 ................................................................. 32
Table 4: Model Coefficients for Equation 2 ............................................................. 32
Table 5: Model Summary for Equation 3 ................................................................. 36
Table 6: Model Coefficients for Equation 3 ............................................................. 36
Table 7: Model Summary for Equation 4 ................................................................. 37
Table 8: Model Coefficients for Equation 4 ............................................................. 37
Table 9: Description of Variables .......................................................................... 43-44
Table 10: Descriptive Statistics ............................................................................. 45
I. Introduction

Medicare costs are predicted to continue increasing at an unsustainable rate in the future unless the financial structure is changed. The purpose of this study is to compare how the delivery of Medicare varies across the nation and the role of these variations in driving up the overall cost of Medicare. Specifically, I will investigate how the number of Medicare services differs across the country in relation to Medicare reimbursement rates and the makeup of each county. My hypothesis is that if county estimates of certain measures (percentage of males, certain races, median income, state population, percentage Medicare enrollees in total state population, households with a 65 year old member, percentage of county not considered in poverty, and percentage of county considered urban) are higher, then the average number of Medicare services and reimbursement rate will be lower. The question is not whether the financing of Medicare should be fixed, but rather, where should policymakers be focusing on fixing Medicare’s financial structure. Is the main emphasis on cutting reimbursement rates without considering each county’s characteristics and its current delivery of service effective? Should policymakers study what is driving these differences to address the difference in costs?

Americans have come to depend upon Medicare, but its current financial structure is unsustainable because of the increase in expenditures and decreased number of workers supporting beneficiaries. Health care expenditures can be decreased by reducing the input prices (labor, capital, goods), increasing the product’s efficiency, and decreasing the number of services (Fuchs 2000, p.59). The current emphasis placed on decreasing the input prices, particularly the physician reimbursement rates, neglects to study the effects of decreasing these rates and does not account for differences in the quality of care received.
This study illustrates why the emphasis should be placed on each county’s characteristics and the number of Medicare services delivered as opposed to just the reimbursement rates. The present Medicare financial system utilizes a fee-for-service process, which encourages the offering of more services, and in turn causes total costs to rise (National Research Council and National Academy of Public Administration 2010, p.82). The more services performed, the more fees that are collected. Medicare spending has been rising across the United States with the number of services per enrollee and the health care quality differing by county and state (Fisher, Bynum, and Skinner, 2009). Increased spending on health care does not guarantee a higher quality of health care received. This study will indicate whether there is a significant difference in the average Medicare expenditure and the number of services delivered per Medicare enrollee from the characteristics of counties. I will focus on the relationship between the number of services delivered and the average Medicare expenditure per Medicare enrollee. In essence, if cutting rates merely drives up the number of services and possibly decreases quality, then cost containment is not accomplished and all are worse off.

The paper proceeds as follows. In the next section I examine the background, financial structure and efficiency of Medicare, alongside related literature and theory. In Section III, I create a theoretical model to explain the basic relationship between the county’s characteristics, Medicare expenditures, and the number of services provided. In Section IV, I discuss the data used during the years 2006, 2007, and 2008 to study this research question. In Section V, I demonstrate the empirical equations. I explore how the findings differ in quality and expenditures across the United States by county, and I discuss significant findings. The last section summarizes and concludes with the policy implications of cutting physician
reimbursement rates without considering average number of services per enrollee or average Medicare reimbursement rate.

II. Background and Literature Review

Medicare is the second largest entitlement that covers 95% of the aged population and the disabled receiving Social Security, and continues to grow at an unsustainable rate (Klees, Wolfe, and Curtis 2010, p.21; Rettenmaier and Saving 2007, p.15). In 2008, national health care costs reached $2.3 trillion and are predicted to increase to $4.6 trillion in 2019 (Klees, Wolfe, and Curtis 2010, p.5). Medicare costs are expected to continue increasing in the upcoming years. In 2011, the first of the Baby Boom generation became of eligible Medicare age. Between 2011 and 2020, Medicare is predicted to grow by 3 percent each year on average, or 1.5 million people each year. Prior to 2011, Medicare grew by 1.9 percent or between 0.5-1 million people each year (Feder and Cafarell 2011, p.3). Medicare is an entitlement that Americans depend on (Cassel 2005, p.157). The elderly on average possess only half the income as the rest of the population, but tend to face higher health care costs (Cassel 2005, p.16).

Across the nation the delivery of Medicare differs, raising questions: What factors are leading to differences in care and cost, and what should policymakers focus on to correct the financial structure? A large quantity of research measuring quality focuses on patients’ outcomes; however, for a holistic view of care, the process and expenditures should be considered (Cannon, 2006, p.5-6). On the other hand, the emphasis should not be solely based on spending and physician reimbursement rates, but should also include the quantity of services being offered. While Medicare spending has been rising across the United States, states’ quantity and quality of services differ (Fisher, Bynum, and Skinner, 2009). Increased spending
and a higher number of services on health care do not necessarily lead to improved quality of care. The current Medicare financial system, a fee-for-service process, has the potential to give incentive for providers to offer more services and to raise overall health care costs (National Research Council and National Academy of Public Administration 2010, p.82). Profits for health care entities increase in performing more services, because this behavior allows them to charge additional fees.

To gain further understanding of how the delivery of Medicare differs, I will first explore the history and structure of Medicare, its role as social insurance, current and predicted financial challenges, the effect of changing physician reimbursement rates, the variations between rural and urban areas, and the present environment.

*Medicare History*

Medicare became law on July 30, 1965, through Title XVIII, “Health Insurance for the Aged and Disabled” in the *Social Security Act* (Rettenmaier and Saving 2000, p.28; Klees, Wolfe, and Curtis 2010, p.7). When Medicare started in 1967, it cost $1.3 billion and served 19 million people. At that time, the beneficiaries had not paid into the system, which created the costly “pay as you go” system still in place today (Mayes and Berenson 2006, p.17). By 2006, Medicare costs increased to $425 billion a year with 42 million participants (Mayes and Berenson 2006, p.2). Today, medical expenditures are universally characterized as unsustainable. This problem is not recent, but has been building steadily since the 1970s (Mayes and Berenson 2006, p.13). Before examining the extent of the financial trouble, I will explore the program structure of Medicare.
Medicare is made up of Part A, Hospital Insurance, and Part B, Supplemental Medical Insurance. All employees must pay into Part A; after 40 quarters of employment at the age of 65, employees can be covered by Part A insurance. Part A provides coverage for inpatient hospital services, hospice care, home health care, and services in skilled nursing facilities (O’Sullivan 1999, p.5). Part A is partially financed through the mandatory payroll tax (O’Sullivan 1999, p.6). Part B is voluntary insurance coverage; participants are eligible to enroll in this health care program at age 65 by paying a premium. Part B on average has included 95% of all eligible candidates (Rettenmaier and Saving 2007, p.7). Part B covers physician and surgical services, ambulatory services, durable medical equipment (DME), laboratory services, and other medical services (O’Sullivan 1999, p.5; Moon 2006, p.3). Beneficiaries’ premiums and other federal revenues, such as federal income taxes and Social Security benefits tax, finance Part B (O’Sullivan 1999, p.6).

Beginning in 1997, Medicare Part C formerly known as Medicare+Choice and currently known as Medicare Advantage, was formed to provide more benefits for an additional monthly premium. Instead of the government providing the coverage as Parts A and B do, a private company approved by Medicare will provide the coverage. Part C includes not only Parts A and B, but also has additional coverage such as vision, dental, wellness programs, etc. Part D (discussed below) is also usually included. Part C is run similarly to the traditional private insurance coverage with different out-of-pocket costs and a specific process to receive care; Medicare Parts A and B have set fees (U.S. Health and Human Services 2012).

Congress expanded Medicare again in 2006 to include Part D, a voluntary program that subsidizes the cost of prescription drugs; participants 65 years old and older pay an additional
premium (Rettenmaier and Saving 2007, p.15; Klees, Wolfe, and Curtis 2010, p.11). All parts of Medicare are also available to participants who qualify for Social Security based on disability. Parts A, B, and D are not fully funded, but rather have evolved into a pay-as-you-go system with costs exceeding expenditures.

**Medicare Cost Structure**

Prior to 1983, the government reimbursed hospitals and physicians at varying costs depending on the expenses accrued for each procedure. In 1983, the government implemented a uniform payment system; payments were set by the individual diagnosis related groups for hospital payments (Mayes and Berenson 2006, p.3). Six years later in 1989, Congress decided to enact a similar system for physician payments through the resource-based relative value scale (RBRVS). In 1992, the Medicare fee schedule was implemented. The system allowed comparison of different medical services through a monetary value for physicians’ services (O’Sullivan 1999, p.105). The Centers for Medicare & Medicaid Services (CMS) studied the RBRVS in determining physician fees for Medicare fee-for-service (Cromwell et al., 2010, p.677; Mayes and Berenson 2006, p.3). CMS used a list of codes to explain the Medicare activities physicians provide and then determined the relative value units (RVUs). RVUs account for the amount of work performed by the physician, the cost of the practice itself, and the malpractice costs with the procedure. These prices are adjusted for the geographic variations in the price of needed inputs. This value is then multiplied by the conversion standard dollar amount, which yields the final fee (Berenson 2010; Trude and Ginsburg 2002, p.3). In addition to the fee-for-service, Congress also wanted to gain a better understanding of the growth in
physician expenditures; five-year reviews were mandated by Congress to review Medicare fees (Crowell et al., 2010, p.677). Medicare’s fee-for-service is still used today.

In setting these rates, the federal government gained power over the medical providers. However, the federal government does not control the number of services being provided by physicians (Mayes and Berenson 2006, p. 3-4). The varying number of services being offered across the nation has increased the expenditures of health care costs without always improving the quality of care.

*Financial Challenges*

The present Medicare financial pay-as-you-go system is designed by Congress and lobbying groups, as opposed to health care experts (Cassel 2005, p.7). This fee-for-service process has rewarded physicians through additional revenue by increasing the number of services performed which raises health care costs (National Research Council and National Academy of Public Administration 2010, p.82). Financial analysis has raised concern that the focus in containing costs emphasized adequately pricing procedures as opposed to the number of procedures being performed (Berenson 2010).

Costs have also grown since Medicare was first enacted as mortality has dropped and medical technology has improved (Rettenmaier and Saving 2007, p.156; National Research Council and National Academy of Public Administration 2010, p.81). The number of Medicare enrollees has increased as life expectancy in the United States has risen from 47 to 77 years since 1900 (Cassel 2005, p.2). The decrease in mortality means enrollees are in the program longer, accruing additional costs (Rettenmaier and Saving 2007, p.7). However, the costs associated with longer participation have been increasing at a startling rate. Per-beneficiary costs rose from
$1,793 in 1970 to $8,285 in 2006, after adjusting for inflation (Rettenmaier and Saving 2007, p.8). Medicare costs are not simply increasing due to higher number of services, but also because of the medical innovations. Once a new technology is invented, more patients use it and diseases are detected earlier; however, advanced technology can also indicate false positives, which requires additional testing (Fuchs 2000, p.58). Furthermore, the health care costs endured forced adjustments due to unforeseen health threats such as the outbreak of the H1N1 (Klees, Wolfe, and Curtis 2010, p.5).

Medicare does not cover all health care costs. The remainder must be covered by the individual through supplemental health insurance or personal savings (Moon 2006, p.23). Past methods of controlling costs included decreasing the hospital’s and physician’s reimbursement rates; however, costs then increased for the individual payer through higher rates for hospitals and physicians to make up for their lost revenues (Mayes and Berenson 2006, p.3). More challenges are faced in cutting costs when the benefit of additional tests cannot be directly compared to the cost of the procedure (Fuchs 2000, p.60). There is discussion to move away from basing total reimbursement on the volume of procedures to value-based services, but this idea is still in its preliminary stages (Berenson 2010). However, the extended delay in changing these fees leads to continually increasing expenses (Wilensky 2009, p.653).

*Mandatory Role as Social Insurance*

When Medicare was designed as an entitlement and social insurance, the constraint of resources was not considered (National Research Council and National Academy of Public Administration 2010, p.102). An entitlement mandates that all eligible individuals receive payments (Melnick 2004, p.42). Even beyond the law, as Medicare has been in place for over 40
years, citizens have become dependent on this program, where their security is directly tied to receiving said services (Melnick 2004, p.43; Cassel 2005, p.10). Medicare has developed into “social insurance” as an expected elderly program (Rettenmaier and Saving 2007, p.143). Medicare is in place to spread risk and help pay for medical services (Cassel 2005, p.140). The federal government is the institution which bears the risk and has been able to pool risks successfully (Moon 2006, p.3,26). As this program has evolved, not only do elderly individuals depend on this program, but also entire families to cover these expenses (Cassel 2005, p.1).

**Physician Reimbursement Rates**

One of the most discussed methods of decreasing costs of Medicare is to lower the physician reimbursement rates. Medicare has become a key part of today’s health care market and makes up on average 1/3 of physicians’ revenue (Cassel, 2005, p.117). Between 2000 and 2003, as physician fees decreased further, the number of physicians accepting new Medicare patients decreased from 84.1% in 2000 to 76.1% in 2003 (Mueller et al., 2004, p.1). The rate of doctors who do not accept Medicare patients decreased at a slower rate in rural areas compared to urban areas (Mueller et al., 2004, p.1). A similar effect is expected to take place today if physician reimbursement rates are decreased. In addition to this impact, health care will also be affected as reduced access to care could leave physicians unable to provide needed services, and these effects will be passed onto medical providers, insurance companies, employers, and health care administrators (Klees, Wolfe, and Curtis 2010, p.17; Mayes and Berenson 2006, p.2; Wilensky 2009, p.653). Reducing reimbursement rates could also reduce the quality of care (Brunt and Jensen 2010, p.149).
*Rural vs. Urban*

In studying the quality of Medicare, a critical factor is the location of the beneficiary. The amount states spend per beneficiary varies drastically across the United States. In 1996, $8,414 was spent on average for a beneficiary in Miami compared to $3,341 per beneficiary in Minneapolis (Cassel 2005, p.54). Over time, this difference in spending could lead to an overall additional $50,000 spending in Medicare per beneficiary (Wennberg, Fisher, and Skinner 2002, p.97). The difference in the total costs is attributed to the quantity of health services being provided (Cassel 2005, p.54). The number of services includes hospital and physician visits, diagnostic tests, and minor procedures (Fisher, et al., 2003, p.285). The idea, however, that the more services a patient receives ensures more quality care is untrue. Higher costs have not led to the reception of higher quality care (Cannon 2006, p.1).

The differences in prices have been furthered studied in terms of population density, leading to separating rural and urban areas. Urban areas have more physicians per capita compared to rural areas, influencing the access patients have to medical services (Reschovsky and Staiti 2005, p.1). In one study, rural patients were found to use less medical care and see fewer medical specialists and more general doctors compared to urban areas (Chan, Hart, and Goodman 2006, p.143). Possible reasons include the longer travel distance and time to reach a doctor (Chan, Hart, and Goodman 2006, p.140). Even a distance as small as 20 miles was shown to cause patients to forego medical services (Chan, Hart, and Goodman 2006, p.140). Family practitioner expenditures are lower compared to medical subspecialists (Fisher, et al., 2003, 284).

Since 1992, Medicare payment prices have taken into account the variation of costs in practicing medicine across the country (O’Sullivan 1999, p.106). Concerns in recruiting
Physicians to rural areas include the expected lower salary in rural areas. Physicians are incentivized to practice in rural areas by the *Medicare Modernization Act of 2003*, which gives bonus payments for physicians practicing in certain rural areas and adjusted for geographic location in the Medicare payment fees for physicians (Reschovsky and Staiti 2005, p.1). However, when adjusting for cost of living, the salaries of urban and rural physicians of similar specialties are relatively comparable. Furthermore, urban areas have more physicians per capita compared to rural areas, allowing rural physicians to accept more new Medicare patients compared to urban physicians. (Reschovsky and Staiti 2005, p.3-4).

*Medicare Efficiency*

Medicare’s efficiency is currently limited by poor coordination between providers, lack of preventative care, and doctor’s monetary incentives. Physicians are rewarded for performing multiple procedures instead of using effective practices that would use fewer services (Davis and Guterman 2007, p.449, 452). The number of services provided across the country is found to vary because of different population characteristics, hospital readmission rates, the number of specialists, capacity of hospitals, and physicians’ training and medical school (Davis and Guterman 2007, p. 456). For Medicare to increase efficiency, one study finds the focus should be placed on a coordinated system among providers instead of individual providers (Davis and Guterman 2007, p.462). However, it is important to note that changing Medicare is slowed down by the overall inefficiency of the health care system (Fuchs 2000, p.57).

*Present Environment*

The *Patient Protection and Affordable Care Act* was passed on March 23, 2010, mandating health insurance for all citizens. This measure was supported in the belief that it
would be able to produce cost savings, particularly in Medicare. Savings in Medicare would be guaranteed through the creation of the Independent Payment Advisory Board (IPAB). IPAB will be made up of 15 appointed members who will make recommendations on how to lower Medicare spending when it exceeds the target growth rate. These recommendations will become law unless opposed by a supermajority in Congress. Until 2016, only physician reimbursement rates will be cut as clinical laboratories are off limits until 2016 and hospital rates are off limits until 2020 (Aaron 2011, p.2378).

Contribution

In this paper, I will contribute to the understanding of the delivery of Medicare services across the nation. In approaching the examination of Medicare, I will begin my study with how a county’s make up influences the number of services and different Medicare reimbursement payments per enrollee to gain an understanding of how Medicare differs across the nation through its implementation. Second, in examining current expenditures and total number of services, I will study if these two variables are related and if the higher number of services on average are correlated with a lower reimbursement rates; this finding will provide further understanding to whether uniform cuts to physician reimburse rates are in the best interest of health care costs or quality. I take a new approach of questioning how effective reducing payment rates across the nation would save costs or harm the quality of care provided. I will now proceed to the theoretical model to provide a framework for the empirical models that follow afterwards.
III. Theoretical Framework

In order to study the influencing factors on the total number of Medicare services and average Medicare reimbursement, I have developed a simple theoretical model. This model is:

\[
\text{totservices\_person} = f(C, M, e)
\]

where totservices\_person is the average total Medicare services per person, C represents the county characteristics, M represents the medical expenditures, and e is the random error. Since there is currently no accountability on the number of services physicians can perform (Mayes and Berenson 2006, p. 3-4), my framework provides a model to study what factors affect the variation in the number of services provided.

The total services per person consist of the number of Medicare services a person received in one year. Increasing the number of services per person does not necessarily increase the quality of care being received. Fisher, Bynum, and Skinner have found large variations in the number of procedures performed on Medicare enrollees across the country (2009). Unnecessary services decrease the efficiency of Medicare and increase Medicare costs.

County estimates study the specific population including the gender, race, median income, total state population, percentage Medicare enrollees in total state population, households with a 65 year old member, percentage of poverty, and percentage of county considered urban. As the literature review has found, a critical factor in how Medicare is delivered is the location of the beneficiary. Where a beneficiary resides influences his or her access to care and physicians. For example, an area with a limited number of physicians may have an increase in the number of services because doctors do not have the advanced training or practice in narrowing down the tests that should be performed. More Medicare enrollees in an
area could increase the demand for physicians accepting Medicare patients. Also, more households in an area could increase the effect of changes in Medicare on the county’s population.

Expenditures measure the reimbursement per enrollee by controlling for price, age, sex and race. A weakness of the fee-for-service process is that physicians could increase the number of services per patient to increase their total revenue (National Research Council and National Academy of Public Administration 2010, p.82). Physicians earn less revenue when fewer procedures are performed (Davis and Guterman 2007, p.449, 452). Looking at the various expenditures could narrow down whether rural or urban areas are more likely to perform more services, or if a particular area of Medicare drives up health care costs. Separating the total number of Medicare services allows for a more detailed analysis to see if differences within a specific area of Medicare vary more across the nation. The county’s population could influence which Medicare services are used more (Davis and Guterman 2007, p. 456).

I will now proceed to the estimated empirical model used to test the theoretical framework described above.

**IV. Data Section**

The data used in this research were panel data in long form from the years 2006, 2007, and 2008. Data were derived from the following three primary data sources: the Centers for Medicare & Medicaid Services (CMS), the U.S. Census Bureau, and the Dartmouth Atlas of Health Care. The level of measurement was at the state level for the CMS and county level for the U.S. Census Bureau and the Dartmouth Atlas of Health Care datasets. I used state abbreviations and county identification to match the counties to states. This long panel resulted
in 2,203 observations. The descriptive statistics were located in the Appendix B, Table 10. The locations of these datasets are found in the Appendix A, Table 9.

The Centers for Medicare & Medicaid Services (CMS) data was produced annually by the CMS Center for Strategic Planning, which described various health care expenditures across the United States broken down by state. I downloaded each table individually from the Medicare and Medicaid Statistical Supplement section of CMS website for each year 2006, 2007, and 2008. The specific table numbers are found in the Appendix A in Table 9. Only the data for each state were compiled; I removed the specific data for regions and the national level.

The American Community Survey was produced annually by the U.S. Census Bureau and compiled demographic information at the county level. The information was collected to determine the distribution of state and federal funding. I downloaded each table at the county level with the following variables: B19013 Median Household Income, B01001 Sex by Age, B02001 Race, B17001 Poverty Status, and B11007 Household by Presence of People 65 years and older. I repeated this process for all three years. I then compiled this information into one Excel sheet. As described in the next section, I manipulated the data to convert total measures into percentages to make them easier to compare across counties and states. The American Community Survey was limited in providing only a third of the counties the Dartmouth Atlas of Health Care provides. The American Community Survey did allow the entire dataset to be downloaded for a fee.

The 2000 U.S. Census was produced by the U.S. Census Bureau. The demographic information was collected every ten years to determine the distribution of state and federal funding. I downloaded the number of rural and urban residents and the total population at the
county level. I compiled this information into one Excel sheet and manipulated the data to percentages to make them easier to compare across counties and states.

The Dartmouth Atlas of Health Care data was produced by the Dartmouth Atlas Project. This dataset studied specific medical resources used across the United States to inform health care policy analysts and other policymakers. This dataset was downloaded at the county level under the section, “selected Medicare reimbursement measures.” Additional levels of measurement choices included state, hospital service areas, and hospital referral regions. All reimbursements were adjusted by inflation using the GDP Deflator for personal consumption expenditures. The inflation statistic was determined by the Bureau of Economic Analysis which used the year 2005 as the base year. The following inflation measures were in parentheses after each year, 2006, (1.02723), 2007 (1.05499), and 2008 (1.08943).

Further detail about each variable is available in the empirical models below. I believe this dataset was compiled with best available data sources and will improve the quality of data available in the research. The dataset will allow for consistent estimation in the models presented in the next section.

V. Empirical Models and Results

A. Empirical Models

I propose the following four equations:

\[ (1) \text{ totservices}_{person_i} = \beta_0 + \beta_1 \times \text{malper}_{i} + \beta_2 \times \text{medianincome}_{i} + \beta_3 \times \text{blackper}_{i} + \beta_4 \times \text{asianper}_{i} + \beta_5 \times \text{otherper}_{i} + \beta_6 \times \text{urbper}_{i} + \beta_7 \times \text{households\\_with65+}_{i} + \beta_8 \times \text{pop000s}_{i} + e_i \]

\[ (2) \text{ totnareim}_{enrollee_i} = \beta_0 + \beta_1 \times \text{malper}_{i} + \beta_2 \times \text{medianincome}_{i} + \beta_3 \times \text{blackper}_{i} + \beta_4 \times \text{asianper}_{i} + \beta_5 \times \text{otherper}_{i} + \beta_6 \times \text{enrollees\\_percentage}_{i} + \beta_7 \times \text{pop000s}_{i} + \beta_8 \times \text{povper}_{i} + e_i \]
(3) $totservices_{person_i} = \beta_0 + \beta_1 \times malperc_i + \beta_2 \times medianincome_i + \beta_3 \times blackper_i + \beta_4 \times asianper_i + \beta_5 \times otherper_i + \beta_6 \times urbperci + \beta_7 \times households_{with65} + \beta_8 \times pop000_{si} + \beta_9 \times totmcare_{reimb_enrollee} + e_i$

(4) $totmcare_{reimb_enrollee_i} = \beta_0 + \beta_1 \times malperc_i + \beta_2 \times medianincome_i + \beta_3 \times blackper_i + \beta_4 \times asianper_i + \beta_5 \times otherper_i + \beta_6 \times enrollees_{percentage} + \beta_7 \times pop000_{si} + \beta_8 \times povper_i + \beta_9 \times totservices_{person} + e_i$

Where (with expected signs in parentheses):

- $totservices_{person}$ is the average number of Medicare services per enrollee (dependent variable); (+ as independent variable);
- $totmcare_{reimb_enrollee}$ is the average total Medicare reimbursement per enrollee by county (dependent variable) (+ as independent variable);
- $malperc$ is the percentage of males of the total county population (-);
- $medianincome$ is the median income of the county (+);
- $povper$ is the percentage of poverty within the county (+);
- $urbperc$ is the percentage of the county’s urban population (-);
- $households_{with65}$ is the number of households with a 65 years old or older resident in each county (+);
- $race$ is the percentage of a particular race in the county:
  - $blackper$ is the percentage of the county’s population that identifies as black/African American (-);
  - $asianper$ is the percentage of the county’s population that identifies as Asians (-);
  - $otherper$ is the percentage of the county’s population that identifies as all other races including Indian, Pacific American, two races and races classified as other (-);
  - $whiteper$ is the percentage of the county’s population that identifies as white and is used as the base category (+);
- $pop000s$ is the state’s population in the thousands (-);
- $enrollees_{percent}$ is the percentage of Medicare enrollees in the state’s population (-);
- $e$ is the random error;

and the subscript $i$ denotes panel observations from 1 to 2,203.

To explore the variation in the delivery of Medicare, I use the total services per person ($totservices_{person}$) as the dependent variable in the first and third equation and total Medicare reimbursement per enrollee ($totmcare_{reimb_enrollee}$) as the dependent variable in the second and fourth equation. I estimated all equations using Ordinary Least Squares combining the data from the years 2006, 2007, and 2008. These equations differed only in the independent variables.
used. The same independent variables in both equations used the percentage of males in each county (\textit{malperc}), the median income of each county (\textit{medianincome}), state population measured in the thousands (\textit{pop00s}), and the race categories: the percentage of the county’s population that identify as white (\textit{whiteper}), the percentage of the county’s population that identify as black or African Americans (\textit{blackper}), the percentage of the county’s population that identify as Asian (\textit{asianper}), the percentage of the county’s population that identify as Indian, Pacific American, two races, and all other races (\textit{otherper}). The first equation also includes the percentage of urban population within the county (\textit{urbper}) and the number of households with a 65 year old or older resident (\textit{households_with65}). The second equation includes the percentage of Medicare enrollees within the state (\textit{enrollees_percentage}) and the percentage of poverty within the county (\textit{povper}). The third equation builds on the first equation, and also adds in total Medicare reimbursement per enrollee (\textit{totmcare_reimb_enrollee}) as an independent variable. The fourth equation builds on the second equation and adds in the total services per person (\textit{totservices_person}) as an independent variable.

These variables demonstrate how the quality of Medicare can vary according to the location of the enrollee. I examine the county demographics to explore how the location influences the number of services each enrollee receives. The policy variables I use examine the reimbursement rates and the number of services received in each of the areas in Medicare. Please see the Appendix A, Table 9 for a description of the variables studied and Appendix B, Table 10 for the descriptive statistics of each variable.

I include the demographic variables to control for the differences in each county. To understand each county further in-depth I include the population in addition to the location of
each enrollee. I study the population through the following variables: the percentage of males in
the county (malperc), percentage of race in each county (blackper, asianper, otherper, whiteper),
the median income of the county (medianincome), the total population of the state (pop000s),
the Medicare enrollees percentage in the total state population (enrollees_percentage),
the percentage of households with at least one person 65 years and older (percentage_household_w65),
the percentage of poverty within the county (povper), and the percentage of county considered urban (urbperc).
Living in an urban area has been found to increase the access to physicians and services as a greater physician per capita ratio is found in urban areas (Reschovsky and Staiti 2005, p.3-4).

My policy variables of interest examine the reimbursement per enrollee and the number
of services per Medicare category. I examine each reimbursement to see if the total
reimbursement rate varied across the country. All reimbursements are adjusted for price, age,
sex and race as explained in footnote 3, above. The total Medicare reimbursement is studied for
each enrollee (totmcare_reimb_enrollee) and the average number of Medicare services per
enrollee (totservices_person) is measured by state.

One limitation I found is how the data are measured annually and not all of the data are at
the county level. The data are collected by year and do not break down their measurements by
quarters preventing further study to examining what event could influence a specific change for
that variable. In general the data from the year 2008 could be particularly affected as a recession
began for the U.S. economy that could have influence the use of Medicare. Medicare enrollment
could have increased causing the number of services and reimbursements to rise as people were
being forced to retire early and leave employer’s health care. Available data are limited in that
some variables are measured at the state level. This measurement characteristic caused the findings to be on the state level and more generalized, as opposed to the county level.

In trying to measure the demographics, collinearity could exist due to a few of the variables measuring very similar scenarios such as the median income (medianincome) and percentage of poverty (povperc). I specifically include both to see further how income was influenced and how spread out the income was in each county. Furthermore, I am unable to measure unobserved characteristics of counties such as the motivation for healthiness within the county’s population. These unobserved characteristics could influence the explanatory variables and cause a bias in my estimated coefficients.

Previous health insurance and records are not provided to offer possible explanation as to why the number of services increased. These data do not take into account the supplemental insurance used beyond Medicare which could reduce the number of tests run through Medicare and costs in the delivery of Medicare as they would be covered by a private insurance. Also these data do not account for prior health insurance respondents had before Medicare which could influence the number of tests used and in general the healthiness of a patient in having preventative care before becoming eligible for Medicare.

Despite these limitations, the ordinary least squares is useful in providing insight into the delivery of Medicare.

**B. Variables**

Each variable, unless noted, is compiled for the years 2006, 2007, and 2008. The variables are defined as follows:
Dependent Variables

1. **totservices_person**: Using the Center for Medicare & Medicaid Services (CMS) data, the average number of Medicare services per enrollee is measured by state each year. These data are annually produced by the CMS Center for Strategic Planning measuring the entire U.S. population and characteristics of the Medicare population. This variable is intended as a measure of the delivery of Medicare as the number of average services varies greatly across the country.

2. **totmcare_reimb_enrollee**: Using data from the Dartmouth Atlas of Health Care, which is conducted by the Dartmouth Atlas Project and measures medical resources by counties across the country, the average total Medicare reimbursement each year is used. This measurement is adjusted for price, age, sex, and race. It is intended to measure the total sum of Medicare spending each year by county and illustrate the variation in spending across the country.
Independent Variables: each prediction is for both dependent variables listed above.

1. **malperc**: Using data from the American Community Survey (ACS), which is an annual survey that randomly contacts 3 million households to compile statistics by the U.S. Census Bureau on various demographic variables, the total male population is divided by the total population. This division results in the percent of males in each county which can range from 0-1, with 1 meaning the county’s population is all males. All counties have a mix of both genders. I believe a percentage is a better measure to compare across counties. This variable is intended to measure the relationship of gender to the total number of services and Medicare reimbursement per enrollee. I predict a significant and negative coefficient which will indicate an increase in males in the county will result in a lower number of services and lower reimbursement. An insignificant coefficient will indicate gender does not affect the average Medicare total services per person in the first equation or the total Medicare reimbursement per enrollee in the second equation.

2. **medianincome**: Using the ACS data, I took the reported median income for each county. The income accounts for the previous 12 months of income earned and is adjusted each year for inflation. I use the median as a measure to show the midpoint of the county’s income. I had decided to use the median measure as opposed to an average as averages could become misconstrued with extreme incomes that are very high or very low. I predict a significant and positive coefficient on this variable, which will indicate the higher the income, the higher the number of the average Medicare total services per person and higher total Medicare reimbursement per enrollee. A significant and negative coefficient will indicate the opposite with a higher median income will cause a lower
number of services and lower reimbursement. An insignificant coefficient will indicate
the median income does not affect the dependent variables. A possible interpretation of
this result could result in showing how socioeconomic statuses affect in the delivery of
Medicare.

3. **povper:** Using ACS data, I took the total population in poverty and divided by the total
population in the second equation. This division results in the percent of poverty within
each county which can range from 0-1, with 1 meaning the entire county is in poverty.
All counties have a mix of populations with poverty and not in poverty. A percentage is
used to better compare across counties. This variable is intended to measure the
relationship of income to the total number of services and Medicare reimbursement per
enrollee. This variable went further in-depth than the median income variable into the
socioeconomic status of the county by illustrating the extent of poverty within each
county. I predict a significant and positive coefficient which indicates the more poverty
within the county will result in higher reimbursements. An insignificant coefficient will
indicate that the socioeconomic factor of income does not affect the total Medicare
reimbursement per enrollee in the second equation. The result could support conducting
further research into how the possible cost savings in health care in addressing poverty.

4. **urbperc:** Using the 2000 U.S. Census data, which includes data from across the United
States with a 67% response rate, I use the total urban population of each county and
divide it by the total population of the county. This division results in the percentage of
urban population in each county compared to the rural population of the county. The
percent can range from 0-1, with 1 meaning the entire county population is urban. There
are counties that were all rural, all urban, and a mix. I predict a significant and negative coefficient which will indicate the higher the percentage of urban population, the lower the number of average Medicare total services per person. An insignificant coefficient will indicate the breakdown between urban and rural does not affect the dependent variable. This result could indicate future study in how the spreading out of population affects the delivery of Medicare in terms of the number of tests and total reimbursements.

5. **households_with65**: Using the ACS data, I use the number of households with a 65 year old or older resident in each county. An individual can enroll in Medicare starting at the age of 65 or if the individual receives Social Security disability benefits. I predict a significant and positive coefficient, which will indicate the higher the number of households with a 65 year old or older resident will increase the number of average Medicare total services per person and the total Medicare reimbursement per enrollee. I believe this relationship will be positive as more households will be directly affected by Medicare services which could cause a higher number of services and an increase the reimbursement for Medicare. An insignificant coefficient will indicate the presence of 65 year olds or older in households does not affect the delivery of Medicare. This result could indicate how the age of population affects the delivery of Medicare.

6. **Race**: Using ACS, I took the total population for each race and divide by the total population. This division results in the percentage of each race in each county which can range from 0-1, with 1 meaning the county’s population is all of one race. All counties have a mix of races. I believe a percentage is a better measure to compare across counties. This variable is used to measure the percentage of different races in each
county measured in the following categories **whiteper** (percentage of respondents that identify as white), **blackper** (percentage of respondents that identify as black or African Americans), **asianper** (percentage of respondents that identify as Asian), and **otherper** (percentage of respondents that identify as Indian, Pacific America, two races or as other race). I made the **otherper** category as a combination of the percentages for Indian, Pacific Americans, two races and other as the first three categories were relatively small. The **whiteper** is the base category in all of the equations to compare the percentage of other races to it. This variable is intended to measure the relationship of race to the total number of services and Medicare reimbursement per enrollee. A significant and negative coefficient on all of the races besides white will indicate a lower number of services and lower reimbursement was found in that county. An insignificant coefficient will indicate race does not affect the average Medicare total services per person in the first equation or the total Medicare reimbursement per enrollee in the second equation. I predict a negative coefficient will result on all races except for the base category (**whiteper**). This result could point to further research as to what is driving the difference in the number of tests and higher reimbursement rates based on race.

7. **pop000s**: Using the Center for Medicare & Medicaid Services (CMS) data, I measure the total population for each state in the thousands. These data are produced by the CMS Center for Strategic Planning each year measuring the entire U.S. population and characteristics of the Medicare population. I use this variable to see if the size of the state’s population influences the delivery of Medicare delivery. I predict a significant and negative coefficient which indicates the larger the state population will result in a lower
number of services and lower reimbursement. An insignificant coefficient will indicate population does not affect the average Medicare total services per person in the first equation or the total Medicare reimbursement per enrollee in the second equation. If size of the state’s population is found to be significant with larger states using a lower average number of Medicare services, it might be appropriate to recommend additional training for less populated states.

8. **enrollees_percent** Using the Center for Medicare & Medicaid Services (CMS) data, I took the total number of Medicare enrollees in each state and divide by the total state population for the second equation. This division results in the percentage of Medicare enrollees within each state which can range from 0-1, with 1 meaning the entire county is Medicare enrollees. All counties have a mix of populations with Medicare enrollees and those not enrolled in Medicare. I use a percentage to provide an easier comparison among states. This variable is used to see if the size of the state’s Medicare enrollee population influences the delivery of Medicare delivery. I predict a significant and negative coefficient which indicates a larger Medicare enrollee population will result in a higher reimbursement. An insignificant coefficient will indicate that the percentage of Medicare enrollees does not have an effect on the dependent variable. One possible interpretation of the result could be that in populations with fewer Medicare enrollees health care providers have less practice treating Medicare patients; health care providers in these areas might need additional training in choosing fewer and more appropriate tests to run.
9. **totservices_person:** As explained above, using CMS annual data, the average number of Medicare services per enrollee is measured by state each year. These data are produced by the CMS Center for Strategic Planning measuring the entire U.S. population and characteristics of the Medicare population. This variable is intended as a measure of the delivery of Medicare as the number of average services varies greatly across the country. I predict a significant and positive coefficient which indicates the more services used will result in a higher reimbursement. An insignificant coefficient will indicate that the number of Medicare services does not have an effect on the dependent variable. This result could show how the number of services affects the reimbursement levels.

10. **totmcare_reimb_enrollee:** As mentioned above, these data come from the Dartmouth Atlas of Health Care, and measure medical resources by counties across the country in the form of the average total Medicare reimbursement each year is used. It is intended to measure the total sum of Medicare spending each year by county and illustrate the variation in spending across the country. I predict a significant and positive coefficient which indicates higher reimbursement rates will result in a higher number of Medicare services used. An insignificant coefficient will indicate that the Medicare reimbursement rate does not have an effect on the dependent variable. This result could provide an indication of the effect of higher or lower reimbursement rates.

11. **totservices_person** and **totmcare_reimb_enrollee:** If the coefficients are significant for both of these variables as independent variables in equations 3 and 4, then this result suggests endogeniety. This relationship would suggest that cutting reimbursement rates increases the number of services and a reduction in cost is not occurring. Rather
decreasing the Medicare reimbursement could increase the number of Medicare services in the third equation. In the fourth equation, I predict that increasing the number of Medicare services will increase the Medicare reimbursement; thus increasing total costs.

C. Results

The results from estimating the equations detailed above are summarized by the following statistics:

<table>
<thead>
<tr>
<th>Table 1: Model Summary for Equation 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-Squared</td>
</tr>
<tr>
<td>F-Statistic (8, 2194)</td>
</tr>
<tr>
<td>Root Means Square Error</td>
</tr>
<tr>
<td>Observations</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 2: Model Independent Variable Coefficients for Equation 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
</tr>
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<td>(Constant)</td>
</tr>
<tr>
<td>malperc</td>
</tr>
<tr>
<td>medianincome</td>
</tr>
<tr>
<td>blackper</td>
</tr>
<tr>
<td>asianper</td>
</tr>
<tr>
<td>otherper</td>
</tr>
<tr>
<td>urb_perc</td>
</tr>
<tr>
<td>households_with65</td>
</tr>
<tr>
<td>pop000s</td>
</tr>
</tbody>
</table>

**All variables and the regression as a whole, are statistically significant at the alpha level .01 and 99% level of confidence.

In general, through this equation I measure the delivery of Medicare through the average number of Medicare tests and the effect of demographic variables. The equation has a high F-statistic of 158.49 indicating a strong statistical significance and an R-squared measure of 0.4333
indicating approximately 43% of the variation is explained through this equation. The magnitude of the coefficients represents the effect of each variable. The first equation is statistically significant at all conventional levels. The results above are interpreted as follows:

The first equation finds the percent of males (malperc) to have a statistically significant and negative coefficient. If the percent of males within the population increases by one percent, the number of total Medicare services is predicted to decrease by 0.63. This finding supports my original prediction that the more males in the population would lead to a decrease in the number of Medicare services. The t-statistic is relatively strong at -4.30 indicating a strong statistical significance. This finding indicates that populations with more women tend to receive more Medicare services than men. This finding aligns with the Centers for Disease Control and Prevention which reported that women are approximately 33% more likely to visit the doctor and have annual exams as compared to men (Centers for Disease Control and Prevention “New Study,” 2001).

The median income (medianincome) coefficient is statistically significant, but has a smaller magnitude of effect. As the median income increases by $1.00, the number of total Medicare services is predicted to increase by 0.00001. If the median income increases by $10,000, the number of Medicare services is predicted to increase by 0.1. This finding aligns with my original estimate and indicates higher incomes levels have more Medicare services than lower income levels. This finding could be partly explained as higher income levels could have increased access to more and better physicians and hospitals which can perform more Medicare services.
The race variables are all statistically significant, but vary in magnitude. If the percentage of those identifying as black (blackper) increases by 1 percent, the number of Medicare services is predicted to increase by 0.14. The highest t-statistic of 12.68 indicates a strong statistical significance. If the percentage of those identifying as Asian (asianper) increases by 1 percent, the number of Medicare services is predicted to decrease by 0.32. This race has a lower t-statistic than the percentage of black population, but still remains strong at -6.44. If the percentage of those identifying as other races (otherper) increases by one percent, the number of Medicare services is predicted to decrease by 0.10. This t-statistic is even lower at -2.97 but still strong. These findings indicate that race does affect the number of Medicare services, but differently than how I originally predicted with the percentage of blacks increasing the number of services when compared to the percentage of whites; I previously predicted the percentage of blacks would decrease the number of services. Blacks have been found to have lower life expectancies, poorer health outcomes, and lack of access to health care (Center for Disease Control and Prevention “Black or African American Populations,” 2001). The finding that Asians have a lower number of Medicare services is surprise as Asians are most at risk for cancer, health disease, strokes, diabetes, and accidents (Office of Minority Health, 2012).

The percentage of the county identified as urban (urb_perc) does not play as strong of an influence as I originally believed. This coefficient is found to be negative and statistically significant. However, if the percentage of urban in the county increases by one percent, the number of services is predicted to decrease only by 0.03. The t-statistic is strong at -3.18 indicating that the spread of where the population resides within the county does affect the total number of Medicare services, but with a small magnitude. As previously mentioned rural areas
have fewer physicians per capita and on average see fewer medical specialists and more general doctors (Reschovsky and Staiti 2005, p.1; Chan, Hart, and Goodman 2006, p.143). This limited population density could help explain my finding: seeing more general practice doctors as opposed to specialists could account for the increased number of services as these doctors’ might feel compelled to order more tests due to a lack of knowledge in particular diagnoses.

The coefficient for households with 65 years old or older resident (households_with65) is found to be positive and statistically significant. It has the lowest t-statistic of the equation at 2.64, but is still statistically significant at all conventional levels. However, the magnitude of the coefficient is very small. If the households with 65 years or older residents variable increases by one household, the average number of services is predicted to increase by 0.00002. However, if the number of household with 65 years or older residents increases by 10,000, the average number of services increases by 0.2. This finding indicates that the presence of an eligible Medicare enrollee increases the number of Medicare services which aligns with my original prediction, but the small magnitude is surprising. More households with a 65 year or older resident could increase the demand for more doctors and more technologies. Having additional technology could allow for the provision of more diverse arrange of services, but the effect would still remain relatively small.

The state population measured in the thousands (pop000s) coefficient is found to be the most statistically significant with a t-statistic of 29.20. If the state population increases by 1,000, the average number of services is predicted to increase by 0.0006. The magnitude of this coefficient is relatively small, but the high t-statistic suggests a strong level of statistical significance. If the state population increases by 100,000, the average number of services
increases by 0.06. As state populations range from approximately 508,798 to 36,553,210 an increase of 100,000 is a better measure of comparison to the change of services. This high significance implies that large states have more Medicare services, which is the opposite of my original prediction. As discussed above with the increase in households, similarly an increase in state populations could allow for more available technology which could increase not only the diversity of services but also the number of services.

Table 3: Model Summary for Equation 2

<p>| | | | | | |</p>
<table>
<thead>
<tr>
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<tbody>
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<tr>
<td>F-Statistic (8, 50)</td>
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<tr>
<td>Root Means Square Error</td>
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<tr>
<td>Observations</td>
<td>2203</td>
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<td></td>
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</tbody>
</table>

Table 4: Model Coefficients for Equation 2

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<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Robust Standard Error of Coefficient</th>
<th>T</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
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<tr>
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<td>pov000s</td>
<td>0.039146</td>
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<td>0.135</td>
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<td>povper*</td>
<td>3864.31</td>
<td>1920.978</td>
<td>2.01</td>
<td>0.050</td>
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</tbody>
</table>

*Variables are statistically significant at the alpha level .05 and 95% level of confidence.
**Variables are statistically significant at the alpha level .01 and 99% level of confidence.
+Standards errors are also clustered at the state level.

Through the second equation I measure the delivery in Medicare through the average total Medicare reimbursement per enrollee. This equation studies how the cost changes across
the country and if similarities in variables are found from the previous equation measuring the number of services. The magnitude of the coefficients represents the effect of each variable. This equation is statistically significant for all variables except for percent of males (\text{malperc}), other races (\text{otherper}), and state population measured in the thousands (\text{pop000s}). The equation has a fairly high F-statistic, indicating statistical significance; and an R-squared measure of 0.1578 indicates approximate 16\% of the variation is explained through this equation. The results above are interpreted as follows:

The socioeconomics variables I use are the median income (\text{medianincome}) and the percentage of poverty within the county (\text{povper}); they are both found to be statistically significant. If the median income increases by $1.00, the Medicare reimbursement increases by $0.03. If the median income increases by $10,000, the Medicare reimbursement increases by $250.00. The t-statistic of 4.75 indicates a strong statistical significance. Interestingly, if the percentage of poverty increases by one percent, the Medicare reimbursement increases by $38.64. A t-statistic of 2.01 indicates statistical significance. While I predicted both median income and percentage of poverty to increase the Medicare reimbursement, these variables could be considered to go in opposite directions. An increase in poverty could indicate that more Medicare insurance will be used once participants are eligible for the program compared to not having health insurance before or having weak health insurance. It is interesting to note if participants were in poverty, they would in many cases, have had access to Medicaid and possibly could have received health insurance prior to Medicare. Possible negative effects are mitigated for the very poor from prior enrollment in Medicaid; this access to health care could offset the effect of poverty. However, I cannot study this as the data do not distinguish Medicare
participants by prior Medicaid enrollment. An increase in the median income could increase the reimbursement by using more Medicare services by going to the doctor more or having access to newer Medicare procedures.

The \textit{asianper} and \textit{blackper} variables are statistically significant, but vary in magnitude. These variables follow a similar pattern as the first equation with only the percent of blacks in the population increasing the Medicare reimbursements and being found statistically significant. Those who identified as Asians have the biggest difference in magnitude compared to those who identified as white. If the percentage of those identifying as Asian (\textit{asianper}) increases by one percent, the average Medicare reimbursement decreases by $8,595.30. However, if the percentage of those identifying as black population (\textit{blackper}) increases by one percent, the Medicare reimbursement increases by $2,161.99. The t-statistic of 2.76 indicates statistical significance. The other races (\textit{otherper}) variable is not found to be statistically significant. These findings for those identifying as Asian (\textit{asianper}) and those identifying as black population (\textit{blackper}) align with those in the first equation and indicate that race does play a role in the amount of Medicare reimbursements. The higher percentage of blacks in a county increases the average Medicare reimbursement just as they increased the average number of Medicare services; similarly, the higher percentage of Asians in a county decreases the average Medicare reimbursement just as this decreases the average number of Medicare services.

The coefficient of the percentage of Medicare enrollees in the state’s population (\textit{enrollees\_percent}) is positive and statistically significant with a t-statistic of 2.05. If the percentage of Medicare enrollees increases by one percent, the Medicare reimbursement is predicted to increase by $1.44. This finding is opposite of my prediction, but the magnitude of
this coefficient is relatively small as the percent of enrollees only ranges from approximate 7.8% to 20.3%. Even a 10 percent increase of Medicare enrollees is only predicted to increase the Medicare reimbursement by $14.40. As mentioned in the first equation, a higher number of Medicare enrollees could cause more technology to enter a particular market. Advances in medical technology have been found to be a driving factor in increasing health care costs (Kaiser Family Foundation, 2007).

The percent of males (malperc) and the state population measured in the thousands (pop000s) are not statistically significant. This finding about gender contrasted with my original prediction that the more males in the population would decrease Medicare reimbursement. The statistical insignificance of the state population does not support the finding from the first equation that more Medicare services are used by larger states. This variable does not have an effect even though small states might not have as much access to advanced medical technology which is more expensive (Kaiser Family Foundation 2007). Having less available technology could have decreased the average Medicare reimbursement.
Table 5: Model Summary for Equation 3

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
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<td>R-Squared</td>
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<td>F-Statistic (9, 2193)</td>
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<td>Root Means Square Error</td>
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<tr>
<td>Observations</td>
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Table 6: Model Coefficients for Equation 3

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<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Robust Standard Error of Coefficient</th>
<th>T</th>
<th>Significant</th>
</tr>
</thead>
<tbody>
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<td>0.000</td>
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<td>blackper**</td>
<td>10.07406</td>
<td>0.9839002</td>
<td>10.24</td>
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<tr>
<td>asianper*</td>
<td>-10.78449</td>
<td>4.261011</td>
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<td>0.011</td>
</tr>
<tr>
<td>otherper*</td>
<td>-6.954215</td>
<td>3.35149</td>
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</tr>
<tr>
<td>urb_perc**</td>
<td>-2.410711</td>
<td>0.8645507</td>
<td>-2.79</td>
<td>0.005</td>
</tr>
<tr>
<td>households_with65</td>
<td>0.00000327</td>
<td>0.00000513</td>
<td>0.64</td>
<td>0.524</td>
</tr>
<tr>
<td>pop000s**</td>
<td>0.0005837</td>
<td>0.0000191</td>
<td>30.52</td>
<td>0.000</td>
</tr>
<tr>
<td>tomtcare_reimb_enrollee</td>
<td>0.0022004</td>
<td>0.000112</td>
<td>19.65</td>
<td>0.000</td>
</tr>
</tbody>
</table>

*Variables are statistically significant at the alpha level .05 and 95% level of confidence.

**Variables are statistically significant at the alpha level .01 and 99% level of confidence.
Table 7: Model Summary for Equation 4

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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<tbody>
<tr>
<td>R-Squared</td>
<td>0.2718</td>
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<tr>
<td>F-Statistic (9, 50)</td>
<td>13.56**</td>
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<tr>
<td>Root Means Square Error</td>
<td>1072</td>
</tr>
<tr>
<td>Observations</td>
<td>2203</td>
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</tbody>
</table>

Table 8: Model Coefficients for Equation 4

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Robust Standard Error of Coefficient*</th>
<th>T</th>
<th>Significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>4808.623</td>
<td>2254.272</td>
<td>2.13</td>
<td>0.038</td>
</tr>
<tr>
<td>malperc</td>
<td>-4002.154</td>
<td>3807.321</td>
<td>-1.05</td>
<td>0.298</td>
</tr>
<tr>
<td>medianincome**</td>
<td>0.0150943</td>
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<td>2.72</td>
<td>0.009</td>
</tr>
<tr>
<td>blackper</td>
<td>967.3669</td>
<td>744.3257</td>
<td>1.30</td>
<td>0.200</td>
</tr>
<tr>
<td>asianper**</td>
<td>-6295.663</td>
<td>1895.357</td>
<td>-3.32</td>
<td>0.002</td>
</tr>
<tr>
<td>otherper</td>
<td>43.04575</td>
<td>1729.66</td>
<td>0.02</td>
<td>0.980</td>
</tr>
<tr>
<td>enrollees_percent</td>
<td>46.53213</td>
<td>70.59595</td>
<td>0.66</td>
<td>0.513</td>
</tr>
<tr>
<td>povper</td>
<td>-0.0131133</td>
<td>0.0185704</td>
<td>-0.71</td>
<td>0.483</td>
</tr>
<tr>
<td>povper*</td>
<td>3332.881</td>
<td>1674.16</td>
<td>1.99</td>
<td>0.052</td>
</tr>
<tr>
<td>totservices_person**</td>
<td>70.93885</td>
<td>19.06687</td>
<td>3.72</td>
<td>0.001</td>
</tr>
</tbody>
</table>

*Variables are statistically significant at the alpha level .05 and 95% level of confidence.
**Variables are statistically significant at the alpha level .01 and 99% level of confidence.
*Standards errors are also clustered at the state level.

In both equations three and four, the addition of the former dependent variable, the average total Medicare reimbursement per enrollee by county (totmcare_reimb_enrollee) [t=19.65] and the average total Medicare services per person (totservices_person) [t=3.72], respectively, to each equation the variables are found to be highly statistically significant suggesting an endogenous relationship between these two variables. This is not causation or a pure effect, but it does indicate the possibility that behavior in response to cuts in reimbursement rates is not changing as hoped for and reducing total cost. Increasing the Medicare reimbursement in the third equation predicts a higher number of Medicare services; similarly, in
the fourth equation increasing the number of Medicare services predicts a higher reimbursement rate. This change cannot conclusively state, but can logically suggest, that the cutting of reimbursement rates can actually lead doctors to perform more services, and thus to raise overall Medicare costs. Another noticeable difference is the statistical insignificance of the number of households with a 65 year old or older resident (households_with65) variable in equation three, and the percentage of the county’s population that identifies as black population (blackper) all other races including Indian, Pacific American, two races and races classified as other (otherper), and state population in the thousands (pop000s) in equation four. It is unclear to how adding in one additional variable to each equation could change the variable’s significance.

Equations three and four are relatively similar to equations one and two, respectively, with a few exceptions. In equation three, the state population in the thousands (pop000s) is statistically significant, but the magnitude is relatively smaller. However in this equation, if the state population increases by 1,000, the Medicare reimbursement will decrease by $0.01. In equation two, if the state population increases by 1,000, the Medicare reimbursement will increase by $0.04. This brings into the question whether the previous findings that larger state populations will spend more in Medicare reimbursements; the opposite could in fact be true. In equation four, the percent of poverty (povper) is statistically significant with a larger magnitude. If the percentage of poverty increases by one percent, the Medicare reimbursement is predicted to increase by $33.33. In equation two, if the percentage of poverty increases by one percent, the Medicare reimbursement is predicted to increase by $38.64.
VI. Conclusion and Policy Recommendations

My original purpose in this research was to study the relationship between the number of services, enrollees’ demographics, and reimbursements in the delivery of Medicare across the United States. To establish a holistic study of the Medicare process, I compiled datasets to create interactions of reimbursements, the number of services, and county characteristics. My purpose was to answer the research question: where should policymakers focus to fix the financial structure? Based on my findings, I recommend that policymakers look toward improving Medicare efficiency and reducing long term health care costs. Cutting the physician reimbursement rates remains an ineffective solution as individual counties’ demographics influences the average number of services and the total reimbursement for Medicare to varying degrees.

As demonstrated in the last two equations, endogeneity suggests that cutting the Medicare reimbursement rate does not lead to a changed behavior in savings. If cuts in reimbursement rates continue, a possible effect could include either no change in savings or a decrease in the number of doctors who accept Medicare patients. Fewer doctors could choose to accept Medicare patients as the expenses of performing tests may be too large as compared to the reimbursement rates. Another possibility is that doctors could adjust the number of services to maintain total revenue at the end; if reimbursement rates are decreased, doctors perform more services to make up the difference.

My model illustrates the need for a more personalized method of correcting costs in Medicare beyond reduced physician reimbursement rates. I used the total number of services and Medicare reimbursements as my dependent variables to determine how the location
influenced the number of tests delivered and the total reimbursement. I found that state 
population, race, gender, income level, and percent of Medicare enrollees affected the total 
services per Medicare enrollee and the Medicare reimbursement fee. Simply cutting a 
reimbursement rate does not address why in one county the average number of services is 34, 
while another county performs more than twice the number of services at 73. These differences 
in the number of services are influencing the increase in Medicare reimbursements, as the 
average Medicare reimbursements range from $4,961.23 to $16,763.87. Just as the Census and 
American Community Survey statistics determine funding for the state and local programs, these 
demographic characteristics should be considered for physician reimbursements until an 
additional study is conducted to determine why these differences remain.

Possible alternatives to cutting said rates include bundled payments and studying 
practices that perform fewer numbers of services and lower Medicare reimbursements. Bundled 
payments require physicians to collaborate. An episode of care is paid for instead of the 
individual services. However, it remains unclear as to whether this suggested alternative would 
reduce health costs, and how this change would impact the quality of care. A second alternative 
is to study physicians with the highest and lowest number of services and reimbursements in an 
effort to identify disparities. If additional training or heightened communication is needed 
among doctors, this change could be implemented.

These findings are particularly relevant to the current implementation of the Patient 
Protection and Affordable Care Act (PPACA) which attempts not only to extend insurance 
across the country, but also to move toward sustainable spending rates. Currently the Supreme 
Court is holding hearings for the National Federation of Independent Businesses (NFIB) v.
Sebelius to determine the constitutionality of PPACA. The arguments raised in challenging the legislation include the inability to lower costs as predicted by the original proposal. If PPACA is upheld, then the provisions within the law including the Independent Payment Advisory Board (IPAB) will be implemented. IPAB is limited only to cutting physician reimbursement rates and therefore will fail to address the disparity issue of the varying numbers of Medicare services conducted and the average reimbursement according to what I found in this paper.

In reflecting on my research, the specific cause of increasing the health care costs is still unclear if doctors are ordering the unnecessary tests or if technological advances are driving these additional costs. I recommend that my research be taken further in studying the variations among doctors through an instrumental variable approach. The datasets I had available to me did not offer an appropriate instrumental variable.

I also recommend this research be conducted over a longer period extended beyond 2008 to 2009 and 2010; 2008 was the beginning of an economic recession, which could have affected the data. Similarly, as the discussion of the federal deficit has remained at the forefront, 2009 and 2010 represented the two slowest spending rates in the past 51 years, with the costs of health care in 2009 at 3.8 percent and in 2010 only increasing by 0.1 percent to 3.9 percent (Centers for Medicare & Medicaid Services, 2011). Further study could determine if spending is slowing as more Americans have become aware of the unsustainable growth rates of health care.

Americans depend upon the Medicare entitlement, but its current financial structure is unsustainable. Challenging the status quo must continue as the federal budget cannot handle these rising costs. At the same time, it is obviously undesirable for the quality of health care to decrease, which adds to the complexity of identifying a solution. Ideally, changes in the
Medicare financial structure will go beyond temporary measures and establish long-term improvements for the presently flawed program. The efficiency of Medicare will not be addressed by solely cutting reimbursement rates without a sincere examination of Medicare’s delivery.
VII. Appendix A

Table 9: Description of Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>Level of Measurement</th>
<th>Data Source</th>
</tr>
</thead>
</table>

Table continues onto next page.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>Level of Measurement</th>
<th>Data Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>urb_perc</td>
<td>Percent of the county’s urban population according</td>
<td>County</td>
<td>U.S. Census Bureau. 2000 Census. <a href="http://www.census.gov/">http://www.census.gov/</a></td>
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</table>
VIII. Appendix B

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Minimum</th>
<th>Maximum</th>
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</thead>
<tbody>
<tr>
<td>totservices_person</td>
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<td>53.73</td>
<td>8.27</td>
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<tr>
<td>tomtcare_reim_b_enrollee</td>
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<tr>
<td>enrollees_percent</td>
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<td>7.82</td>
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<td>malperc</td>
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<td>0.05</td>
<td>.018</td>
<td>0.44</td>
</tr>
</tbody>
</table>
VIV. Bibliography


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The U.S. Census Bureau defines the Baby Boom generation as those who were born between 1946 and 1964 (U.S. Census Bureau).

A quarter is defined by three months in a year. A minimum earning of $1,130 must be taken in for each quarter. Typically quarters are determined by the earnings of one year and dividing by the minimum earning of $1,130 to determine the number of quarters of work. Up to four quarters can be earned each year.

Parts C and D are not included in the data used in this paper.

This measurement was adjusted for price, age, sex, and race by using actual Medicare claims. Price adjustments were made for the differences across regions in the amount the Centers for Medicare & Medicaid Services (CMS) reimburses health care providers for Medicare services. Differences in reimbursement rates that result from Medicare-specific provisions such as hospitals with medical and surgical residency training programs, and disproportionate share hospitals (DSH) payments were also removed. DSH payments provide higher compensation for hospitals with a greater percentage of low-income patients.

An instrumental variable is an ideal approach to endogeneity, but the data sets lack an appropriate instrumental variable.