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Determinants of Employment Growth in the Healthcare Sector



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by

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Submitted to The Department of Economics

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I hereby recognize and pledge to fulfill my responsibilities as defined in the Honor Code and to maintain the integrity of both myself and the College as a whole.

Trevor Colvin

Cover Image Source: http://blog.accredited-online-colleges.com/wp-content/uploads/2012/01/Medical-Administrative-iS-300x207.jpg

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Abstract

Healthcare is among the largest components of personal consumption and government expenditure in the United States today. This indicates that the demand for healthcare has increased greatly over the years. As a result, healthcare firms need to hire qualified employees to keep up with demand. This study examines the determinants of employment growth in the healthcare sector. Attention is given as to how healthcare employment growth has evolved over time in relation to business cycle phases, as defined by the National Bureau of Economic Research (NBER). This study also highlights various aspects of the healthcare system by investigating previous researchers' works. The economic theory of cost minimization subject to producing a desired level of output is thoroughly discussed, since healthcare firms are constantly trying to cut costs while providing excellent care. A multiple regression analysis on the effects that various independent variables, derived from theory, have on healthcare employment growth is also conducted in this study. Findings include that 1) a major structural change occurred in 1990, which is explained by the growth rate of employment in the healthcare sector, 2) employment in the healthcare sector is likely to continue to grow, but not at the rates seen from 1968 to 1990, and 3) contractions have a negative impact on healthcare employment; however, this effect is not as recognizable in comparison to other recession prone sectors.

United States Employment Growth in the Healthcare Sector

1.0: Introduction

The healthcare sector has grown tremendously in size and importance over the years. It is a crucial industry in the United States economy and a constant topic of discussion among economists, politicians, and the general public. The purpose of this study is to examine the determinants of employment growth in the healthcare sector from 1968 to the present. Attention is given to how healthcare employment growth has evolved over time in relation to business cycle phases, as defined by the National Bureau of Economic Research (NBER).

This chapter identifies how the healthcare sector has evolved into a significant industry in the United States in terms of employment and output. It is comprised of six sections. The first provides a complete definition of employment used by economists and the government. The second explains how employment is an essential variable for the economy. The third provides data and references to the sources used for the data that underlie all of the figures in this chapter. The fourth provides visual data for total civilian employment in comparison to employment in the healthcare sector. The fifth compares healthcare employment growth in relation to real GDP growth through figures. The sixth looks at the value added of the sector in comparison to total value added.

Prior to identifying the official terms used to define employment, it is important to understand various characteristics of the United States healthcare system. Some of these important features are noted in the article "An Overview of the Healthcare System" by Michael Shenk. The author sets out to achieve three objectives. The first is to explain how "employment in healthcare has been remarkably resilient over the past three recessions" (p. 20). This indicates that employment in the healthcare sector can be considered recession proof. Shenk states "since

the 1990 recession healthcare employment has actually increased at a faster rate during recessions and at a slower rate during the post-recession period" (p. 20). Employment in the healthcare sector in relation to U.S. recessions is shown in Section 1.4. The increase of employment growth in the healthcare sector can be attributed to the increasing demand for healthcare services based on data for healthcare expenditures. Shenk observes that "healthcare expenditures make up 18.3 percent of the country's personal consumption expenditures that equates to roughly 12.8 percent of total GDP" (p. 20). The second observation by Shenk is that, although demand for healthcare has increased, so has its price. This is supported when he notes that "the increase in the cost of health insurance is a direct result of healthcare's relative price increase and peoples' demand for more services" (p. 20). Lastly, Shenk identifies the issue of healthcare reform and explains why there is such a desire for policymakers to make changes to the healthcare system. Shenk observes, "the increasing cost of healthcare is one of the driving forces behind calls for reform, there is no obvious or rational way to curb increases in demand for healthcare: it appears to be a natural result of rising incomes and improved medical technology" (p. 21).

There are many questions regarding healthcare reform, especially with the controversy surrounding the Affordable Care Act (ACA), also known as Obamacare. The goal of the Affordable Care Act is to provide more affordable health care protection for U.S. citizens. However, controversy over the ACA arises because large increases in taxes for wealthy individuals, businesses, and healthcare firms are expected. As a result, many health enterprises in the U.S. are trying to cut costs as much as possible while keeping up with demand. Due to the controversy over healthcare reform, the ACA continues to be an issue for policymakers. Shenk gives two reasons for the push of healthcare reform. The first deals with consumers' access to

healthcare. He notes that "as of 2007, only 67.5 percent of people were covered by private health insurance" (p. 21). He also discusses government programs, such as Medicare and Medicaid, and states that these programs "covered an additional 17.2 percent of people, 15.3 percent of people had no health insurance in 2007" (p. 21). Second, Shenk states "that our employer-based system places an unnecessary burden on companies, making it more difficult for them to compete in the global economy" (p. 21). This deals with employers providing health insurance for their employees. However, it is obvious that the author does not agree with this reason for health care reform. Shenk observes that "employer-provided healthcare is purchased pre-tax; the employer can purchase more coverage than the employee would be able to if compensated with an equivalent amount of cash" (p. 22). Another reason that employers provide health insurance is explained when he states that "employers can purchase group coverage for a lower premium than a typical employee could get on their own" (p. 22).

The author's major findings include that the increase of employment in the healthcare sector is a result of more consumption among citizens, there has been a rise in the cost of healthcare, and potential reasons for healthcare reform. As noted by Shenk, personal consumption expenditures (PCE) of medical assistance are at an all-time high. This is explored more fully in the article "Trends in Consumer Spending and Personal Saving, 1959-2009" by Clinton P. McCully, in which the author identifies how personal consumption expenditures for healthcare have grown at a faster rate than ever before. This is evident when McCully states:

> The share of PCE accounted for by healthcare that includes healthcare commodities such as prescription drugs and optical goods, and healthcare services increased from 5.9 percent in 1959 to 19.7 percent in 2009. The increase in the healthcare services share of PCE was accounted for by outpatient services, which increased from 2.7 percent to 7.7 percent, and by hospital and nursing home services, which increased from 1.9 percent to 8.5 percent. The share of PCE accounted for by healthcare commodities increased from

> 1.2 to 3.5 percent; almost all of the increase was accounted for by prescription drugs. (p.15)

Reasons for this increase include an aging U.S. population, government funding for medical programs, and advancements by healthcare firms in terms of research and technology. Shenk mentioned government programs as a reason for healthcare reform in his article but McCully elaborates on the government programs Medicare and Medicaid in his article. He explains that "Medicare, which began in 1966, provides healthcare for those 65 years of age and older, certain disabled persons, and those with kidney failure" (p. 16). On the other hand, the author states that "Medicaid provides healthcare to those at low income levels, which is determined as a percentage of the federal poverty line" (p. 16). Enrollments for these programs have grown tremendously. McCully notes that "enrollment has grown from 15 million in 1969 to 55 million in 2009, an average rate of growth of 3.3 percent, more than triple the rate of population growth over that time" (p. 16). Since there are more citizens on Medicare and Medicaid, there are increased expenditures for healthcare paid for by the government. McCully validates this when he writes that "the share of PCE paid for by government increased from 3.4 percent (in 1959) to 45.4 (in 2009)" (p. 16). With such a significant increase in consumption, there is a large demand for medical assistance by healthcare firms resulting in a need for more and more medical employees.

1.1: Defining Employment: Official Definitions

Having introduced various aspects and challenges of the healthcare system in the United States, we can now look at the variable of interest in this study, employment. As stated previously, the purpose of this study is to examine the determinants of employment growth in the healthcare sector. A simple definition is the state of having paid work available to citizens.

However, in a more detailed description, the Bureau of Labor Statistics (BLS) defines employed persons as those:

> Persons 16 years and over in the civilian noninstitutional population who, during the reference week, (a) did any work at all (at least 1 hour) as paid employees; worked in their own business, profession, or on their own farm, or worked 15 hours or more as unpaid workers in an enterprise operated by a member of the family; and (b) all those who were not working but who had jobs or businesses from which they were temporarily absent because of vacation, illness, bad weather, childcare problems, maternity or paternity leave, labor-management dispute, job training, or other family or personal reasons, whether or not they were paid for the time off or were seeking other jobs. Each employed person is counted only once, even if he or she holds more than one job. Source: http://www.bls.gov/bls/glossary.htm

Since I am examining employment growth in the healthcare industry, it is critical to understand how the government defines the sector. According to the 2012 North American Industry Classification System (NAICS), Sector 62 includes Healthcare and Social Assistance. The NAICS explains that:

> The Healthcare and Social Assistance sector comprises establishments providing healthcare and social assistance for individuals. The sector includes both healthcare and social assistance because it is sometimes difficult to distinguish between the boundaries of these two activities. The industries in this sector are arranged on a continuum starting with those establishments providing medical care exclusively, continuing with those providing healthcare and social assistance, and finally finishing with those providing only social assistance. The services provided by establishments in this sector are delivered by trained professionals. All industries in the sector share this commonality of process, namely, labor inputs of health practitioners or social workers with the requisite expertise. Many of the industries in the sector are defined based on the educational degree held by the practitioners included in the industry. Source: http://www.census.gov/cgibin/sssd/naics/naicsrch?code=62&search=2012%20NAICS%20Search

However, much of the data in the *Economic Report of the President* combine education and healthcare services together as one sector, but education is a relatively small sector. Thus, it is important to also define the educational sector of the economy. According to the NAICS, education is classified under Sector 61. This sector is described as follows:

> The Educational Services sector comprises establishments that provide instruction and training in a wide variety of subjects. This instruction and training is provided by specialized establishments, such as schools, colleges, universities, and training centers. These establishments may be privately owned and operated for profit or not for profit, or they may be publicly owned and operated. They may also offer food and/or accommodation services to their students.
>
> Educational services are usually delivered by teachers or instructors that explain, tell, demonstrate, supervise, and direct learning. Instruction is imparted in diverse settings, such as educational institutions, the workplace, or the home, and through diverse means, such as correspondence, television, the Internet, or other electronic and distance-learning methods. The training provided by these establishments may include the use of simulators and simulation methods. It can be adapted to the particular needs of the students, for example sign language can replace verbal language for teaching students with hearing impairments. All industries in the sector share this commonality of process, namely, labor inputs of instructors with the requisite subject matter expertise and teaching ability. Source: http://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=61&search=2012%20NAICS%20Search

Having provided the official definitions made by the government of employment in the healthcare sector, attention now turns to employment within the healthcare sector. As mentioned already, data in the *Economic Report of the President* categorize Education and Healthcare Services as one sector although they are separate sectors according to the NAICS. In the following review, the authors consider Education and Healthcare Services as one sector. Characteristics of employment in healthcare are explained more fully in the article "Employment in Education and Healthcare Services" by Tim Dunne and Kyle Fee. The authors set out to achieve three objectives in their article. The first is to show how the sector can be considered recession proof. The second is to define what the Education and Healthcare Services sector consists of and how it is divided in terms of percentages. The third is to explain how employment in the sector has expanded over time and is predicted to continue its growth. This review focuses on the healthcare portion of the sector since it directly relates to my study and is the largest industry within the sector.

The first objective that the authors mentioned addresses employment in the healthcare sector during the Great Recession. Dunne and Fee state that "over the course of the Great Recession and the subsequent recovery the Education and Healthcare Services sector has expanded by almost 2 million jobs (10.7 percent), while the rest of economy has lost 5.9 million jobs and remains 5 percent below pre-recession employment levels" (p. 14). This statement reiterates Shenk's observation that employment in the healthcare sector can be considered recession proof. In support of their second objective, to show how the sector is composed, Dunne and Fee note that "the education and healthcare services sector is composed of three distinct parts – private educational services, healthcare, and social assistance" (p. 14). The authors also provide examples of employment facilities in the healthcare portion of the sector including "doctor's offices, hospitals, nursing home facilities, outpatient services, and diagnostic laboratories" (p. 14). Although there are many more job classifications of healthcare in addition to these, it is informative to know some of the components of healthcare that they identified in their article.

As noted, the government combines healthcare with education and social assistance services in the *Economic Report of the President*. Therefore, it is important to recognize that the driving force behind the sector is the healthcare portion. To support this, Dunne and Fee note that "educational services make up 16.3 percent of the sector, healthcare accounts for 70.7 percent, and social assistance contains the remaining 13.0 percent of employment" (p. 14). This illustrates how healthcare is the largest component of the sector and has the principal influence, so that using data for the combined sector mostly reflects what is happening in the healthcare sector. As stated previously, the third objective is to show how the sector has grown over the last

five years. Dunne and Fee observe, "healthcare industries have added the greatest amount of employment over the period, roughly 1.4 million jobs (a 10.8 percent rise)" (p. 15).

The authors also identify three subindustries of healthcare that have experienced the largest increase in employment. The first and largest is the ambulatory care services. According to Dunne and Fee "these services include doctor's offices, outpatient services, and home healthcare services, and over the five-year period, ambulatory care industries expanded by 15.9 percent" (p. 15).

The second division that the author's identify is hospital employment. Dunne and Fee observe that "hospital employment expanded but by a much slower rate of 6.6 percent over the period" (p. 15). They note that this "slower expansion likely reflects the fact that hospital groups have been substituting outpatient services for traditional inpatient services" (p. 15). This indicates that, although people may not be hired at a hospital, they are still hired into the sector at an outpatient clinic. This is evident when Dunne and Fee state that "employment in outpatient services has grown by over 29 percent since the end of 2007, making it one of the fastest-growing subindustries within healthcare services" (p. 15). The authors also look beyond their five year analysis and provide the Bureau of Labor Statistics (BLS) projections for the sector within their article. Dunne and Fee note that the BLS "projects that employment in healthcare and social assistance will continue to grow at a much faster pace than the rest of the economy, resulting in a net gain of 5.6 million jobs between 2010 and 2020" (p. 16). In their article Dunne and Fee show that employment in the healthcare sector was not greatly affected by the Great Recession, how the Education and Healthcare Services sector is composed in terms of percentages, and that employment in healthcare has increased over the last five years and is projected to increase through 2020.

To confirm the statements made by Dunne and Fee, the article "Employment Patterns During the Recovery: Who Are Getting the Jobs and Why," Aysegul Sahin and Jonathan L. Willis, achieve four objectives. First, the authors identify employment patterns as a whole during the economic recovery following the Great Recession. Second, Sahin and Willis look at patterns based on education. Third, the authors identify patterns based on gender. Lastly, Sahin and Willis look at patterns based on age.

Their major findings include that "workers with high levels of education, workers age 55 and older, and men have experienced the strongest employment gains in the recovery" (p. 5). The authors looked at various sectors of the economy and found that "the four industries with the most-educated workforce are education and healthcare, professional and business services, information, and finance" (p. 11). This indicates that many employees in the healthcare industry have a higher level of education. In terms of gender and employment patterns, Sahin and Willis found that "throughout the recent recession and recovery periods, the largest swings in employment have been for the male segment of the workforce" (p. 19). For instance, the authors note that "during the labor recession, the decline in employment for men accounted for 70 percent of the total fall in employment" (p. 19). On the other hand, Sahin and Willis identify "the pattern during the labor recovery has been even more dramatic as 90 percent of the increase in employment has accrued to men" (p. 19). The authors also found that age was a key factor on employment during the recession and recovery. Sahin and Willis note that "the average employment gain for those age 55 and older has been the strongest, increasing by 75 thousand per month since January 2010" (p. 23). The authors also mention that "employment of prime-age workers (ages 25-54) during the labor recession exhibited the sharpest decline" (p. 23).

Sahin and Willis show that employment in the United State has been increasing since 2010, post-Great Recession. Those that have benefitted the most are those with higher levels of education, older in age, and male workers. Sahin and Willis' findings are confirmed by the Bureau of Labor Statistics (BLS) in the "Occupational Outlook Quarterly." In this article, the BLS looks at the projected employment and education of workers in the healthcare sector for healthcare practitioners and technical occupations. The BLS shows that the lowest education in the sector is a high school diploma or equivalent (p. 26). However, the average education in the healthcare industry is a doctoral or professional degree (p. 26). By looking at the occupational outlook, it is evident employees in the healthcare sector hold an associate or bachelor's degree.

1.2: The Importance of Employment

The aforementioned articles provided an overview of the healthcare system, identified how personal consumption expenditures for healthcare have grown exponentially, defined the official terms of employment and healthcare sector, and looked at employment within the healthcare sector along with the qualifications of employees. This section observes employment's role in the economy. Employment helps determine the "overall health of the economy" (bls.gov). If there are a large number of civilians employed, it indicates that the economy is doing well, since there is less unemployment and a larger number of citizens are earning an income. In addition, "particularly low national employment rates may signal a long-lasting depression and underdevelopment" (economicswebinstitute.org). Employment is closely monitored in the United States, the Bureau of Labor Statistics measures employment on a regular basis. Each month, the BLS releases the *Current Employment Statistics*, this survey "provides employment, hours, and earnings estimates based on payroll records of business establishments"

(bls.gov). By studying employment in the healthcare sector, I am able to analyze the determinants of employment growth within the sector.

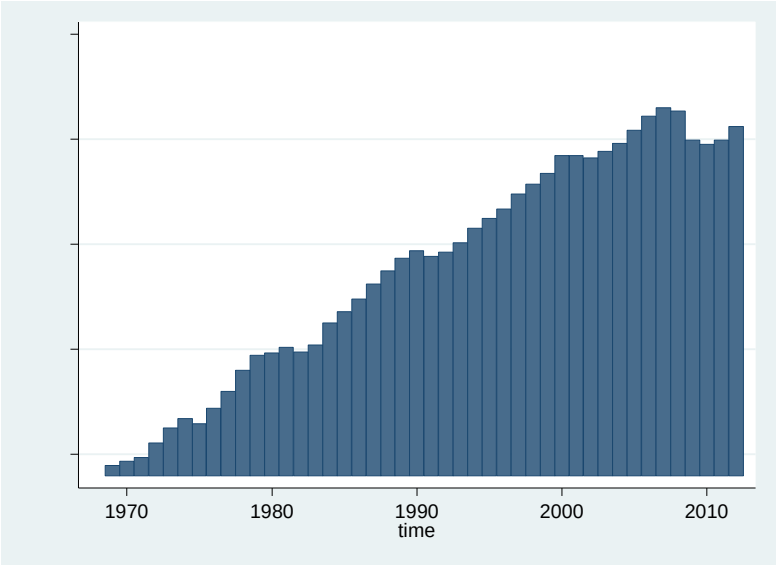
1.3: Healthcare Sector Relevant Data

Along with a review of the analyses of other researchers, I gathered information from the *Economic Report of the President, 2013* and the Bureau of Economic Analysis (BEA) government website. The data consist of total employment for the United States broken down into the Education and Healthcare Services sector. Real GDP is analyzed in comparison to healthcare employment along with the growth rates of both. Value added of the healthcare sector shows how the industry has grown in importance and is a key contributor to the overall well-being of the economy. Table A1: Employment, GDP, and Value Added Data in the appendix show the raw data.

1.4: Employment Graphs

As a basis for evaluating employment in the healthcare sector, the following graphs compare overall employment and healthcare employment in the United States. Real GDP growth is also assessed in comparison to the growth rate of employment in the healthcare sector. The data are also analyzed in comparison to United States business cycles, as defined by the NBER.

Figure 1.1:
Total U.S. Civilian Employment Over Time



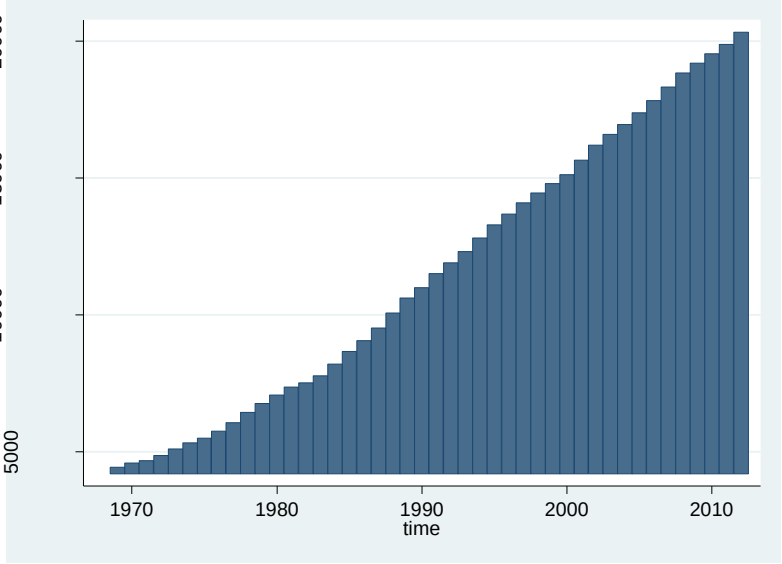
Source: Based on data from Table A1

Figure 1.1 shows a graph of total U.S. civilian employment over time. Although, total employment has grown tremendously from 1968 to 2012, it is evident that employment falls during times of recession. Since 1968, there have been seven recessions (NBER, 2013). According to the NBER, the United States experienced a recession in the following years: 1969-1970, 1973-1975, 1980, 1981-1982, 1990-1991, 2001, and 2007-2009 (NBER, 2013). Whenever the U.S. economy was declared to be in a recession, total civilian employment fell. This is most recognizable during the Great Recession, which lasted from 2007-2009, during which total employment fell significantly. Figure 1.1 reveals that total civilian employment in the U.S. peaked before the Great Recession in 2007 and decreased until 2012 in which there was a small peak in total employment.

A measure of structural change includes the Great Moderation, which started during the 1980's and lasted until the Great Recession. This period of stability is described in the article

"What Caused the Great Moderation: Some Cross Country Evidence" by Peter Summers. The author explains that "macroeconomic volatility fell noticeably in the United States sometime in the early to middle 1980's" (p. 7). This indicates that this was a time of prosperity in the U.S. business cycles. Summers refers to structural change with inventory management when he writes, "the inventory-based explanations of The Great Moderation rest on the observation that the volatility of durable goods *sales* has remained essentially constant, while the volatility of durable goods *production* has declined by an amount similar to that of GDP" (p. 7). During the Great Moderation, total civilian employment increased, except for minor declines in 1991 and 2001.

Figure 1.2:
Total Employment in Education and Healthcare Services Sector Over Time



Source: Based on data from Table A1

Having discussed total civilian employment in the U.S., Figure 1.2 displays employment in the Education and Healthcare Services sector over time. Employment levels in the industry have increased each year since 1968, despite contractions in the United States business cycles

defined by the NBER. In comparison with Figure 1.1, employment in the healthcare sector appears to be recession proof, whereas employment in general looks recession prone. This fact was noted by Shenk along with Dunn and Fee in the aforementioned articles. By observing Figure 1.2, it is clear that there is not a year when there has been a reduction in number of those employed in the Educational and Healthcare Service sector, resulting in a steady upward trend.

Although Figure 1.2 shows employment in the healthcare sector from 1968 to present; there have been projections made for healthcare employment through 2020. These projections are found in the article "Occupational Employment Projections to 2020" by C. Brett Lockard and Michael Wolf, written in 2012, in which the authors present the projections of major occupational groups and predicted trends across groups from 2010 through 2020. The article is useful in understanding how employment in the healthcare sector is predicted to develop in the future. The authors state "from 2010 to 2020, the U.S. economy is projected to add 20.5 million new jobs as total employment grows from nearly 143.1 million to more than 163.5 million" (p. 84). This indicates that total employment in the U.S. will continue to increase through 2020. Lockard and Wolf also mention that "the fastest growth is expected among healthcare, personal care, and community and social service occupations" (p. 84). Consistent with the goals of my study, I focus on healthcare employment and trends.

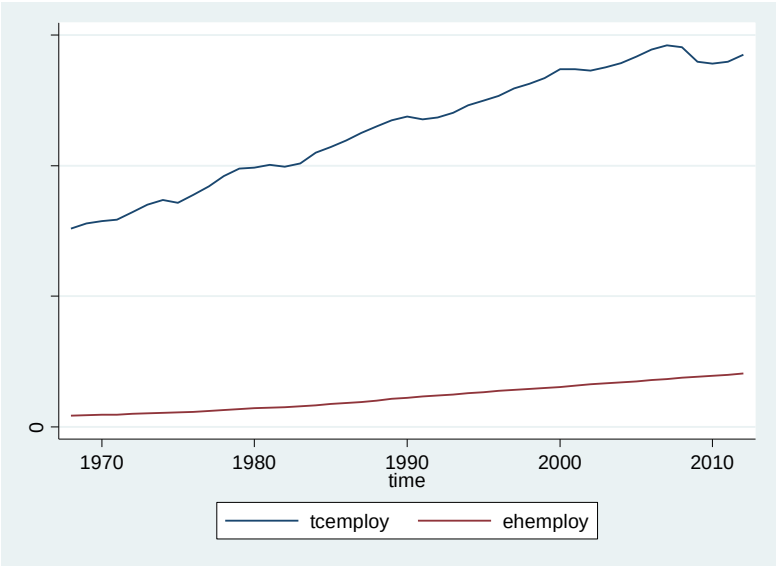
Lockard and Wolf break healthcare occupations into two divisions: healthcare practitioners and technical occupations, and healthcare support occupations. The authors state that "healthcare practitioners and technical occupations are projected to add 2.0 million new jobs from 2010 to 2020, the second most of any major group" (p. 95). This statement suggests that employment in healthcare is likely to continue the upward trend seen in Figure 1.2. Lockard and Wolf note that "the healthcare practitioners and technical occupations growth rate of 25.9 percent

from 2010 to 2020 is also the third fastest" (p. 95). Occupations in this division of the healthcare sector include physicians, surgeons, registered nurses, radiologists, paramedics, along with many others (p. 95). The authors observe that "the fast growth for the healthcare practitioners and technical occupational group is driven by increased spending on healthcare services, particularly an aging population" (p. 95). Basically, since the United States has an aging population, there is an anticipated increase in the demand for healthcare services.

The second division, healthcare support occupations, is also expected to increase. This is evident when the authors write that "the healthcare support occupations group is projected to be the fastest growing occupational group from 2010 to 2020, growing by 34.5 percent and creating 1.4 million more new jobs" (p. 95). This means that both divisions of healthcare are expected to be among the fastest growing occupations. The increase in healthcare support occupations is caused by the same factors that are expected to increase employment in healthcare practitioners and technical occupations. Lockard and Wolf describe the main difference between these divisions of healthcare when they write that "healthcare support occupations are more highly concentrated in ambulatory healthcare services, while healthcare practitioners and technical occupations are more highly concentrated in hospitals" (p. 96).

In their article Lockard and Wolf find that the healthcare sector as a whole is projected have the largest increases in employment through 2020. Although the authors present two divisions of healthcare occupations, they both fall under the healthcare industry. The article identifies healthcare as the fastest growing sector among major occupational groups.

Figure 1.3:
Total U.S. Civilian Employment in Comparison to Education and Healthcare Sector Employment



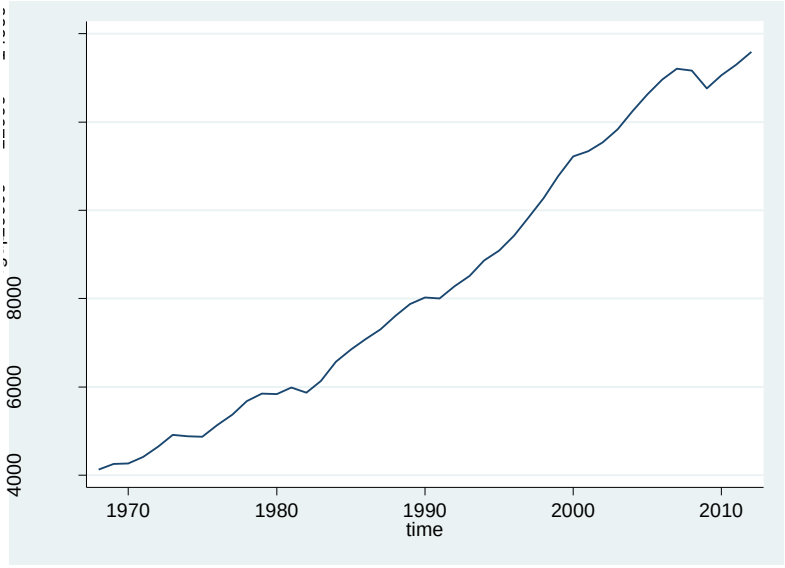
Source: Based on data from Table A1

Having examined total civilian employment and employment in the Education and Healthcare Services sector separately and identifying the projections of the healthcare sector through 2020, Figure 1.3 shows total civilian employment in comparison with employment in the Education and Healthcare Services sector. Figure 1.3 illustrates how employment levels in the sector do not decrease despite times of recession in the economy. On the other hand, total U.S. civilian employment slumps when the economy experiences a contraction in the business cycle. As stated previously and noted by multiple researchers, employment in general appears to be recession prone but employment in healthcare seems to be recession proof. An example of this difference is seen during the Great Recession, during which total civilian employment decreased from about 145 million workers in 2008 to around 139 million workers to 2009. In comparison, employment in the Education and Healthcare Services sector increased from around 18 million workers in 2008 to about 19 million workers in 2009.

1.5: Real GDP and Growth Rate of Employment in Healthcare Sector Graphs

The previous section focused on the evolution of employment in the healthcare sector from 1968 through 2012 and presented the projections of the sector through 2020 by the BLS. Since changes in GDP define the business cycle, this section addresses real GDP in comparison to employment in the Education and Healthcare Services sector. Growth rates were calculated for both real GDP and healthcare employment to examine the differences in the volatility.

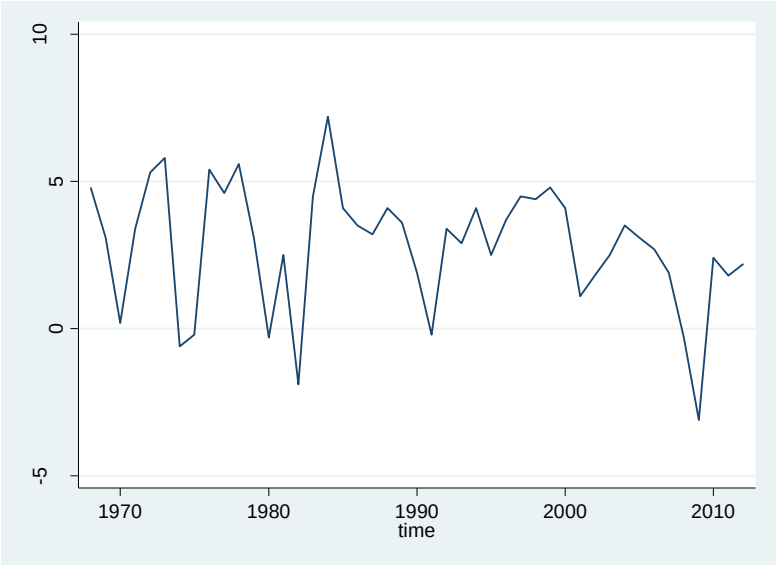
Figure 1.4:
Real GDP Over Time



Source: Based on data from Table A1

Figure 1.4 shows real GDP over time. The NBER defines a recession as "a period between a peak and a trough" (NBER, 2013); it is evident that by the NBER's definition of a recession that real GDP in the U.S. falls whenever there is a recession, such as in the early 90's recession. The NBER states that "during a recession, a significant decline in economic activity spreads across the economy and can last from a few months to more than a year" (NBER, 2013). An example of how real GDP decreases during times of recession is during the Great Recession. In 2008, real GDP was around $13 billion but decreased in 2009 to about $12 billion.

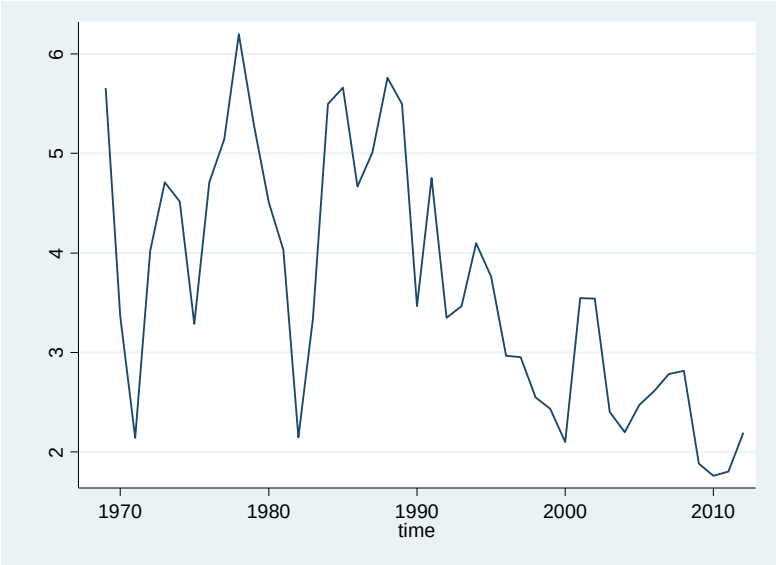
Figure 1.5:
Growth Rate in Real GDP



Source: Based on data from Table A1

Figure 1.5 shows the growth rate of real GDP over time. The graph illustrates that real GDP is very volatile during expansions and contractions in the business cycle. For every recession declared by the NBER, there is a sharp decrease in the growth rate of real GDP. From Table A1, the highest rates of real GDP growth occur in 1973, 1978, 1984, and 1999. On the other hand, the lowest rates of real GDP growth are negative and take place in 1970, 1974, 1980, 1982, 1991, 2001, and 2009.

Figure 1.6:
Growth Rate of Employment in Education and Healthcare Services Sector

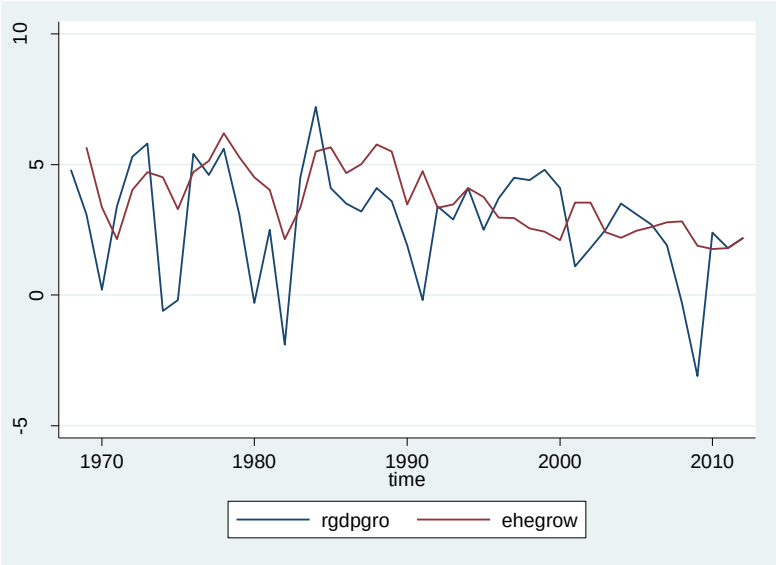


Source: Based on data from Table A1

To contrast the volatility of real GDP and its movements with the U.S. business cycles, attention now turns to the growth rate of employment in Education and Healthcare Services sector. Figure 1.6 shows employment growth in the Education and Healthcare Services sector. Although there are sharp decreases in the growth rate of employment in the sector, there is never a year that it falls into negative growth. Figure 1.6 shows that employment growth in the Education and Healthcare Services sector is increasing at a decreasing rate since 1990. This indicates that employment growth in the healthcare sector experienced structural change in 1990. Reasons for this decline are a key issue addressed in the empirical section of this study. However, as mentioned previously, Lockard and Wolf note that "the healthcare practitioners and technical occupations growth rate of 25.9 percent from 2010 to 2020 is also the third fastest" (p. 95). Employment growth in the sector peaked in 1978 at 6% followed by a substantial recessionary decrease in 1982 at 2%. This appears to be a repetitive trend when looking at Figure 1.6. Possible reasons for this trend could include increased regulation in the sector, the

expansion of government programs such as Medicare and Medicaid, or the result of healthcare firms cutting costs in order to maximize profit.

Figure 1.7:
Growth Rate of Real GDP in Comparison to Growth Rate of Employment in Education and Healthcare Services Sector



Source: Based on data from Table A1

Figure 1.7 compares the growth rates of real GDP and employment growth in the Education and Healthcare Services sector. From 1970 until 2000, real GDP and employment growth in the sector move procyclically - as GDP growth rises, so does employment growth. After 2000, the relationship becomes countercyclical because, as GDP growth falls, healthcare employment growth rises. GDP growth appears to be more volatile than healthcare employment growth. The cyclical peaks for GDP growth are higher in comparison to employment growth in the sector throughout the years. However, the cyclical troughs are lower for GDP growth in contrast to employment growth in the Education and Healthcare Services sector. From Table A1, the highest rates of GDP growth occur in 1973, 1978, 1984, and 1999. The rates for these years equal 5.8% in 1973, 5.6% in 1978, 7.2% in 1984, and 4.8% in 1999. Corresponding rates

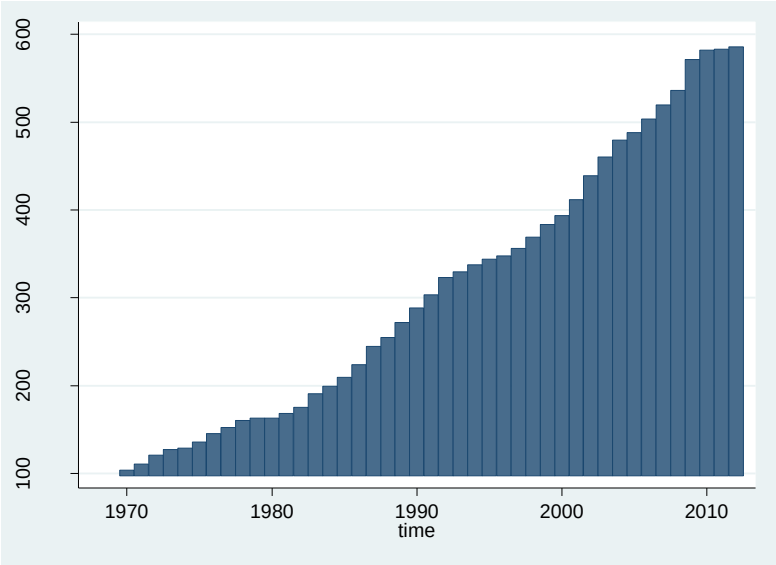
for healthcare employment growth for these years equal 4.7% in 1973, 6.2% in 1978, 5.5% in 1984, and 2.4% in 1999. On the other hand, lowest levels of real GDP growth relate to years identified as recessionary by the NBER and occur in 1970 at 0.2%, 1974 at -0.6%, 1980 at -0.3%, 1982 at -1.9%, 1991 at -0.2%, 2001 at 1.1%, and 2009 at -3.1%. Corresponding values for employment growth in the Education and Healthcare Services sector include 3.4% in 1970, 4.5% in 1974, 4.5% in 1980, 2.1% in 1982, 4.8% in 1991, 3.5% in 2001, and 1.2% in 2009.

The data show that employment growth in the Education and Healthcare Services sector grow despite times of recession. This again confirms that employment in the sector is recession proof. In addition, peaks in employment growth seem to lag behind peaks in real GDP from 1970 to 1985. From 1985 to present, the peaks and troughs appear to be coincident with each other.

1.6: Value Added of the Healthcare Sector: Graphical Analysis

The previous section showed the volatility of real GDP in comparison to the growth rate of employment in the Education and Healthcare Services sectors. Attention now turns to the value added by the sector and how it has increased from 1968 to 2012. GDP is the sum of the values added by each sector of the economy. Value added is the augmentation of the value of a product at each stage of the production process. The figures in this section show the share of real output and real value added of the Education and Healthcare Services sector along with the share of total employment that the sector makes up.

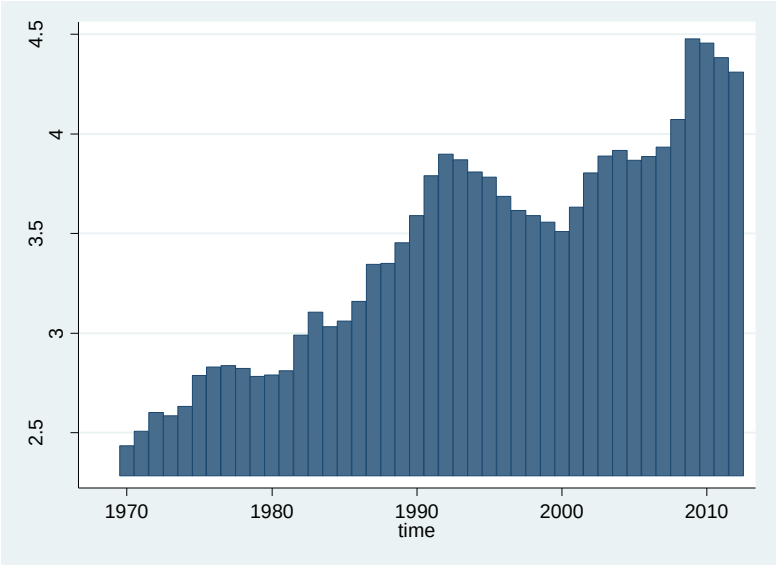
Figure 1.8:
Education and Healthcare Services Sector Real Value Added Over Time



Source: Based on data from Table A1

Having defined value added, attention now turns to how the Education and Healthcare Services have contributed to the economy's GDP from 1969 through 2012. Figure 1.8 shows the real value added of the sector and indicates a steady upward trend since the healthcare sector's value added has risen each year since 1968. Even during times of recession, there is a positive increase in the value added by the Education and Healthcare Services sector. This means that, at each stage of the production process, there has been an escalation of value added to GDP by the healthcare sector.

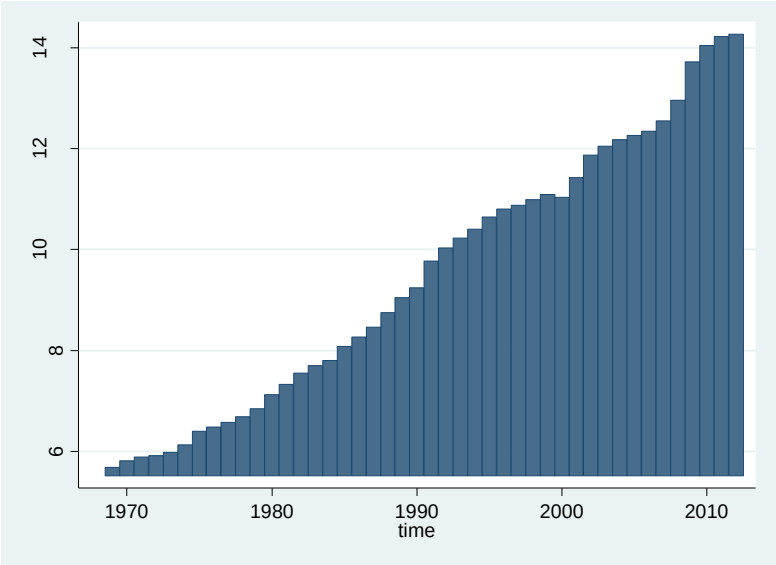
Figure 1.9:
Education and Healthcare Services Sector Real Output Share Over Time



Source: Based on data from Table A1

Figure 1.9 shows the real value added by the Education and Healthcare Services Sector over time as a share of total output. Data underlying this figure were calculated in Table A1 by taking the real value added by the sector divided by real GDP and multiplying by 100. Figure 1.9 indicates that, during times of recession, such as in the early 2000's, the healthcare share of value added of GDP as a percentage of total U.S. output decreases. The real share of value added by the Education and Healthcare Services sector reached a peak in 2009 at 4.5% and has slowly decreased ever since. However, this figure shows how the real value added by the sector has grown in importance since 1968.

Figure 1.10:
Education and Healthcare Services Sector Employment Share Over Time



Source: Based on data from Table A1

Figures 1.8 and 1.9 showed the value added of the Education and Healthcare Services sector individually and as a percentage of total output. Figure 1.10 shows the Education and Healthcare Services sector share of total employment over time. It is apparent that the employment in healthcare has grown tremendously since 1968, when employment in the sector accounted for less than 5% of total employment in the United States. Since 2010, healthcare employment has accounted for over 14% of total employment in the United States. This increase in healthcare employment could be attributed to the aging U.S. population and increased personal consumption as identified previously.

1.7: Conclusion

This chapter has demonstrated how the healthcare sector has evolved since 1968. Articles introduced in this chapter provide an overview of the healthcare system in the United States and the Affordable Care Act, show how personal consumption of healthcare has reached an all-time high, and provide projections of employment within the sector, along with the

qualifications of workers in the industry. It is evident that employment is a key economic variable and indicates the overall well-being of the economy. All of the figures presented in this chapter were created from data presented in Table A1. These data were then entered into Stata where the figures provided in this chapter were generated. The employment figures show how employment in the Education and Healthcare Services sector increase each year despite contractions or recessions in the business cycle, as was also mentioned by previous researchers in their articles. The growth rate figures demonstrate how GDP is more volatile than healthcare employment growth. There has never been a year in which the employment in the healthcare sector has had negative growth but appears to be increasing at a decreasing rate since 1990. The figures on the real value added of the sector show how the sector contributes to the economy of the United States. Employment in the sector has reached a peak of 14% of total U.S. employment as a result of increased expenditures on healthcare. Chapter Two discusses the economic theory of cost minimization subject to producing a desired level of output. From the theoretical discussion in Chapter Two, the independent variables of this study were identified and Chapter Three recognizes the impact that these variables have on healthcare employment growth. Lastly, Chapter Four analyzes the major empirical findings of this study.

The Determinants of Employment Growth in the Healthcare Sector: Theoretical Considerations

2.0 Introduction

As identified in Chapter One, the healthcare sector plays a prominent role in the United States as a result of increased consumption. In order to keep up with demand, healthcare firms need to continue hiring qualified employees and make use of up to date capital equipment. However, healthcare reform through the Affordable Care Act (ACA) has forced health enterprises to shift their operations to more cost efficient practices. To illustrate the issues involved, this chapter examines the economic theory associated with healthcare employment growth. The theory most related to this study is cost minimization subject to producing a desired level of output. This chapter is comprised of four sections. The first examines the iso-cost line and shows how a healthcare firm's total cost is defined. The second defines the isoquant and provides information regarding the economic concept known as the marginal rate of technical substitution. The third elaborates on the optimality assumption made by economists that firms seek to minimize cost subject to production of a given level of output. The final section of this chapter explains the use of comparative static analysis and how the optimal levels of medical labor and capital inputs are affected by their determinants, the exogenous variables of the model.

The theoretical model introduced in this chapter is used to determine the variables included in the empirical model discussed in Chapter Three. These variables include real healthcare consumption growth, which is predicted to increase employment growth in the healthcare sector. The second variable is the growth rate in the share of civilians over the age of 65, which is expected to increase the healthcare employment growth. Next, real wage growth is anticipated to decrease healthcare employment growth. Alternatively, the real price of capital growth is anticipated to increase the employment growth in the healthcare sector if labor and

capital are substitutes. However, it is important to recognize that labor and capital may be complements in the healthcare sector. Lastly, productivity growth, which captures the effects of technological change, is expected to decrease healthcare employment growth.

2.1: The Iso-cost Line of Employment in the Healthcare Sector

The first component of the economic theory of cost minimization subject to producing a desired level of output is the iso-cost line. According to Jeffrey Perloff, the iso-cost line shows "all the combinations that require the same (iso) total expenditure (cost)" (p. 199). For a healthcare firm, these combinations include various quantities and different types of medical labor and capital that make up the firm's total cost. Perloff states that "the cost of producing a given level of output depends on the price of labor and capital" (p. 199). Labor (L) services are hired at wage (w) per hour. This implies that the labor costs for a firm equal the product of w, dollars of wage per worker, multiplied by L, the number of workers. On the other hand, healthcare firms also have capital (K) purchases, such as medical equipment. Capital is priced using the rental rate (r), measured as dollars per unit of capital, resulting in a capital cost of rK. Labor input in a healthcare firm includes workers such as nurses, doctors, financial employees, and human resources personnel. Examples of medical capital inputs of a healthcare firm include all of the equipment used in a hospital from chairs in the waiting room to operating tables. This combination of labor and capital costs results in the firm's total cost (TC). This is expressed by the formula:

$$TC = wL + rK.$$

Table 2.1:
Bundles of Labor and Capital that Cost the Firm $100

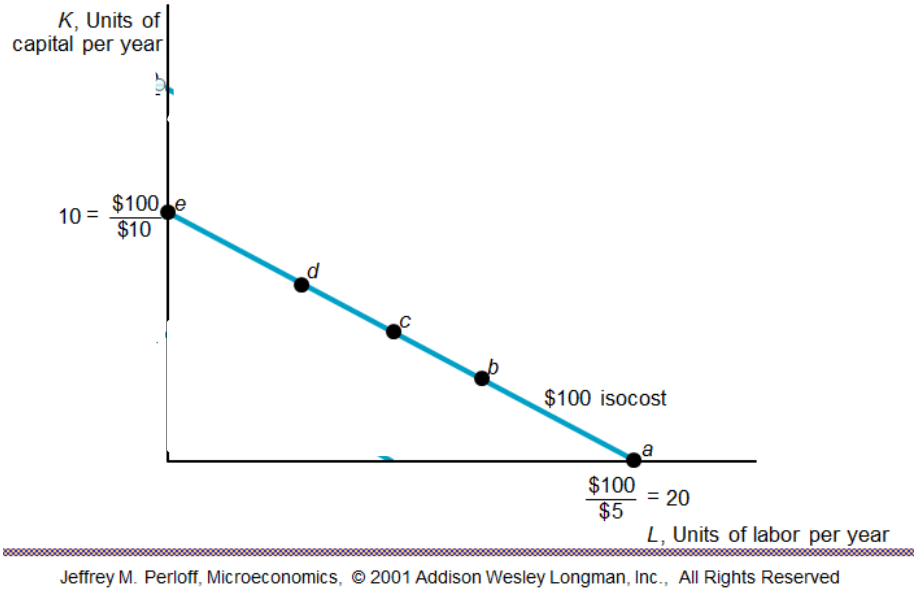
Bundle	Labor, L	Capital, K	Labor Cost, $wL = \$5L$	Capital Cost, $rK = \$10K$	Total Cost, $wL + rK$
a	20	0	$100	$0	$100
b	14	3	$70	$30	$100
c	10	5	$50	$50	$100
d	6	7	$30	$70	$100
e	0	10	$0	$10	$100

Source: Perloff. "Microeconomics." 6th Edition. Page 200.

Having defined the elements of total cost, Table 2.1 presents various combinations of labor and capital input on an iso-cost line. Suppose the total cost of the healthcare firm is fixed at $100, regardless of the combination of inputs. In this table, it is assumed that the wage is $5 per worker and rate of rental for capital is $10. Each combination shows varying amounts of labor and capital inputs. For example, input combination *a* consists entirely of labor costs. With a total cost of $100, this would mean that there would be 20 units of labor; $100/5 per worker equals 20 workers. Each combination after *a* has a variety of labor and capital inputs until bundle *e*. In this final bundle, there is no labor input but 10 units of capital at a rental rate of $10, resulting in a total cost for the firm of $100.

A visual example of the information given in Table 2.1 is presented in Figure 2.1. The iso-cost line in Figure 2.1 shows the combinations of labor and capital inputs in Table 2.1. The vertical axis is labeled as K, measured in units of capital. The horizontal axis is labeled as L, measured in units of labor per year. For example, combination *c* has labor costs of $50 with 10 units of labor and $50 of capital costs with 5 units of capital. When these costs are combined, the healthcare firm's total costs equal $100.

Figure 2.1:
An Iso-cost Line



Source: Perloff. "Microeconomics." 6th Edition. Page 200.

The slope of the iso-cost line in Figure 2.1 can be determined by understanding that if the healthcare firm decides to increase labor input then it must decrease its capital input to keep cost constant. Perloff notes that "the slope of the iso-cost line depends on the relative prices of the inputs" (p. 201). Thus from Figure 2.1, the slope of the line is:

$$\frac{dK}{dL} = -\frac{w}{r} = -\frac{5}{10} = -\frac{1}{2}$$

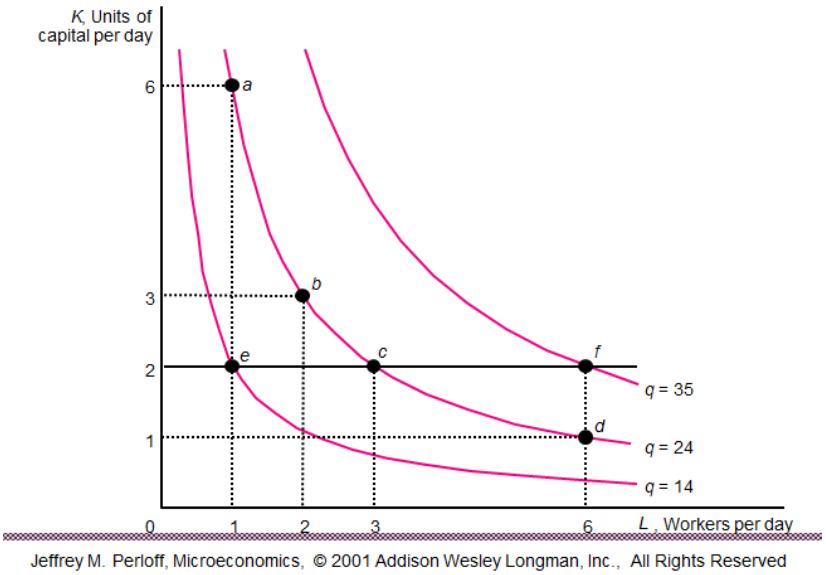
This indicates that if the healthcare firm were to increase its labor by two units, it would have to decrease its capital by one unit to keep total cost constant, which follows from the fact that capital is twice as expensive as labor. Therefore, in this example, the opportunity cost to the healthcare firm of increasing its medical capital by one unit is two units of labor. The slope for all iso-cost lines is the same as long as the prices per unit of capital or labor remain constant.

2.2: The Isoquant of Employment in the Healthcare Sector

Having discussed iso-cost lines and provided a numerical example which aided in understanding the characteristics of the line, attention now turns to isoquant lines. The isoquant is a graphical representation of the production function that help firms determine input combinations associated with possible output levels. Perloff defines the isoquant as "a curve that shows the efficient combinations of labor and capital that can produce a single (iso) level of output (quantity)" (p. 164). Isoquants are similar to indifference curves but they do have notable differences. Perloff notes that "an isoquant holds quantity constant, whereas an indifference curve holds utility constant" (p. 164).

Economists make three major assumptions that determine the characteristics of isoquants. These can be understood by examining Figure 2.2. In the figure, the inputs of the healthcare firm are medical capital (K) on the vertical axis and medical labor (L) on the horizontal axis.

Figure 2.2:
Family of Isoquants



Source: Perloff. "Microeconomics." 6th Edition. Page 165.

The first assumption economists make about isoquants is that the farther an isoquant is from the origin, the greater the level of output. Perloff notes that "the more inputs a firm uses, the more output it gets if it produces efficiently" (p. 165). In Figure 2.2, it is evident that the isoquant farthest from the origin would produce 35 units of medical goods output while only using 2 units of capital and 6 units of labor at point *t*, while only 24 units of output would be produced with 2 units of capital and 3 units of labor at point *c*. The second assumption is that isoquants do not cross. Perloff states that "intersections are inconsistent with the requirement that the firm always produces efficiently" (p. 165). Since isoquant curves are used to show efficient combinations of labor and capital, there is never an instance when they would cross one another. This is illustrated in Figure 2.2; although there are three different isoquant curves, they do not intersect each other.

The final assumption made by economists is that isoquants slope downward. Perloff explains that "if an isoquant sloped upward, the firm could produce the same level of output with relatively few inputs or relatively many inputs" (p. 165). This would not make sense because it would be inefficient for the healthcare firm. Isoquants only show efficient combinations of labor and capital for production, so an upward-sloping isoquant is not possible (p. 165).

Having recognized the three major assumptions about the isoquant, attention now turns to the slope of an isoquant. This is referred to as the marginal rate of technical substitution (MRTS). Perloff defines the MRTS as "the number of extra units of one input needed to replace one unit of another input that enables a firm to keep the amount of output it produces constant" (p. 169). As discussed in the three major assumptions, isoquants always slope downwards. This means that the MRTS is always negative, since the firm "can produce a given level of output by

substituting more capital for less labor or vice versa" (p. 169). The formula that is used to determine MRTS is as follows:

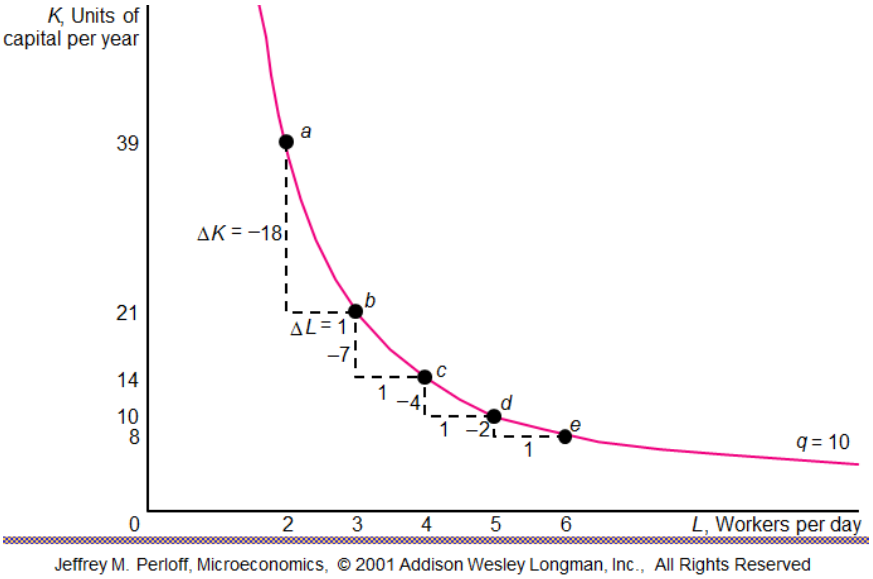
$$\frac{dK}{dL} = \frac{\frac{dq}{dL}}{\frac{dq}{dK}} = \frac{MP_L}{MP_K}.$$

Perloff explains how the ratio in the MRTS is related to the marginal product of capital and marginal product of labor, MP_L and MP_K, when he writes:

> Because the marginal product of labor, $MP_L = {\Delta q}/{\Delta L}$, is the increase in output per extra unit of labor, if the firm hires ΔL more workers, its output increases by $MP_L \, X \, \Delta L$. A decrease in capital alone causes output to fall by $MP_K \, X \, \Delta K$, where $MP_K = {\Delta q}/{\Delta K}$ is the marginal product of capital – the output the firm loses from decreasing capital by one unit, holding all other factors fixed. To keep output constant, ΔQ=0, this fall in output from reducing capital must exactly equal the increase in output from increasing labor. (p. 170)

In terms of the technology available to the firm, the MRTS also represents an opportunity cost. The pressure for more advanced technology in the medical field is a result of intense competition among firms in the sector. Healthcare firms form a budget each year and must determine how they plan to spend their money for the most efficient combination of medical capital and labor inputs. This is related to the opportunity cost that the MRTS presents. With output constant, if the firm were to spend more money on capital, it would spend less on labor. Thus, any of the budget set aside by healthcare firms to spend on improved technology or research cannot also be spent on labor, creating an opportunity cost. On the other hand, to keep output constant, the use of more labor implies capital use must fall and vice versa.

Figure 2.3:
How the Marginal Rate of Technical Substitution Varies Along an Isoquant



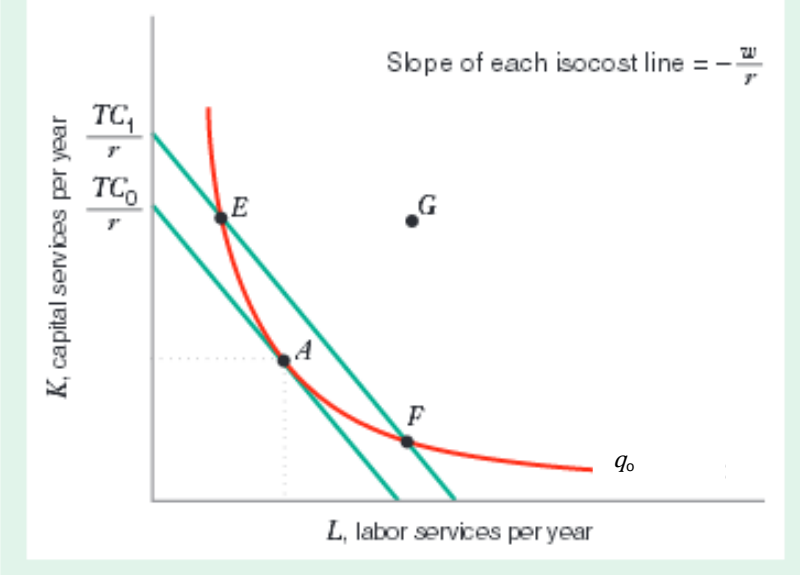
Source: Perloff. "Microeconomics." 6th Edition. Page 169.

Having presented the formula used to calculate the MRTS, explained how the marginal product of labor and capital are used in the ratio, and the opportunity cost of using different input levels available to the healthcare firm. Attention now turns to the assumption that the MRTS diminishes along an isoquant, as more of one input and less of the other are used in the production process. Figure 2.3 shows how the MRTS varies along an isoquant. If the healthcare firm starts at point *a* and hires one more worker, the firm gives up 18 units of capital but still remains on the isoquant at point *b*, so the MRTS is -18. Another example is seen in the movement from point *c* to point *d*; in this instance the healthcare firm hires another worker but gives up 4 units of capital to remain on the isoquant. The MRTS in this example is -4. This decrease continues until point *e*, and with each movement the MRTS continues to diminish. Perloff identifies that "the more labor the firm has, the harder it is to replace the remaining capital with labor, so the MRTS falls as the isoquant becomes flatter" (p. 169).

2.3: Optimality

The previous section addressed the use of isoquants by healthcare firms and provided examples of the MRTS, this section explains the implications of the assumption that healthcare firms seek to minimize cost subject to production of a given level of output. This concept is best demonstrated through the use of graphs.

Figure 2,4:
Cost Minimizing Input Combination



Source: David Besanko and Ronald Braeutigam. "Microeconomics." 4th Edition. Page 233.

Figure 2.4 shows four combinations of medical labor and capital inputs along with the isoquant line (q_0). Point A is the optimal point in this figure because it reflects the lowest level of cost consistent with production of the output level q_0. At this point, the slopes of each iso-cost line are equal:

$$\frac{w}{r} = \frac{MP_L}{MP_k}$$

At point A, the marginal product per dollar spent is equal for all inputs purchased and the isoquant line is tangent to the iso-cost line.

Although the best combination of inputs is at point A, it is evident that there are alternative combinations. It is not optimal for the healthcare firm to operate at point G because it produces more than the desired level of output. The other possible combination of medical labor and capital inputs are shown at points E and F. Although these points are technically efficient, Besanko and Braeutigam explain that "they are not cost minimizing because they are on an iso-cost line that corresponds to higher level of cost than the iso-cost line passing through the cost minimizing point A" (p. 232). In other words, the combinations of medical labor and capital at points E and F are not optimal because the healthcare firm can produce the same amount of medical output at a lower total cost if it produces at point A.

At the point of equilibrium, Figure 2.4 demonstrates that the slopes of the iso-cost line and isoquant curve are equal. At this point the ratio of input prices equals the marginal rate of technical substitution (MRTS). According to Besanko and Braeutigam, "this condition tells us that, at a cost-minimizing combination, the additional output per dollar spent on labor services equals the additional output per dollar spent on capital services" (p. 233). This is an optimal situation because at this point the healthcare firm is able to get more "bang for the buck" from each medical labor and capital input (p. 233).

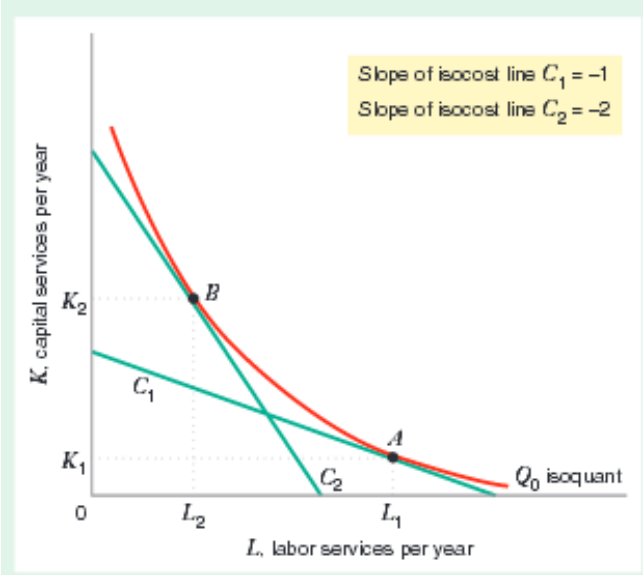
There are also situations in which this condition is violated. An example occurs at point E in Figure 2.4 when $MRTS > {}^{w}/_{r} \rightarrow {}^{MP_L}/_{w} > {}^{MP_k}/_{r}$. In the ratio, $MRTS > {}^{w}/_{r}$, the slope of the isoquant is greater than the slope of the iso-cost line. When this ratio is written

as $MP_L/_W > MP_K/_r$, it means that the additional output per dollar spent on medical labor is greater than the additional output per dollar spent on capital services. If this were the case, the healthcare firm would want to use more labor at the expense of capital to produce the same output until $\frac{MP_L}{W} = \frac{MP_K}{r}$. This would help the firm move towards the point of optimality.

2.4: Comparative Static Analysis

As noted in Chapter One, the cost of healthcare services has increased. Shenk notes that "the increase in the cost of health insurance is a direct result of healthcare's relative price increase and peoples' demand for more services" (p. 20). This statement illustrates how costs for healthcare have increased as a result of increasing costs for health enterprises and demand from consumers. Employment has also increased since 1968 and, as identified earlier, most healthcare professionals are highly educated resulting in increased labor costs. With the principle that firms seek to minimize cost subject to production of a given level of output explained, attention now turns to comparative static analysis. This section shows how the optimal point is affected by changes in exogenous variables: input prices, the desired level of output, and technology in healthcare firms.

Figure 2.5:
Comparative Statics Analysis of Cost-Minimization Problem with Respect to the Price of Labor

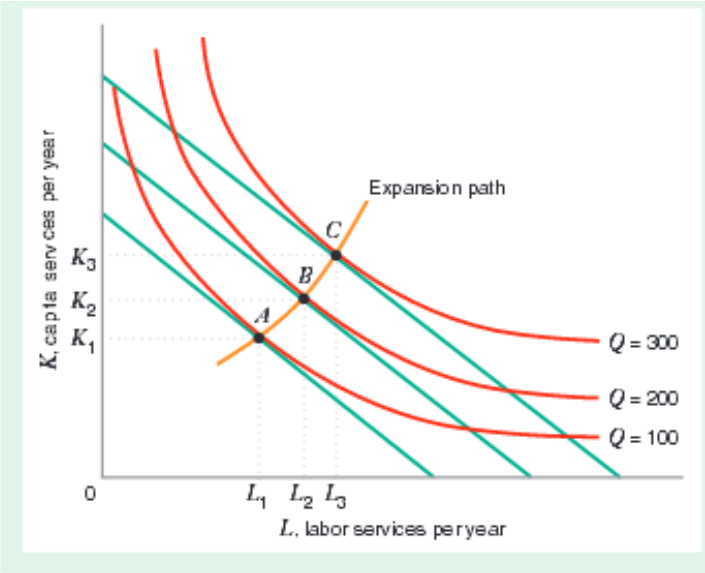


Source: David Besanko and Ronald Braeutigam. "Microeconomics." 4th Edition. Page 237.

Figure 2.5 shows the effects of an increase in the price of labor. In this example, it is assumed that medical output (Q_0) is held constant. If there were an increase in the price of medical labor, w, it makes the iso-cost line steeper, since the slope is $\frac{w}{r}$, which changes the tangency point. According to Besanko and Braeutigam, "when $w = 1$, the tangency is at point A (where the optimal input combination is L_1, K_1); when $w = 2$, the tangency is at point B (where the optimal input combination is L_2, K_2)" (p. 236). To produce the desired amount of medical output, the healthcare firm would use more capital and less labor because labor would be more expensive compared to capital. On the other hand, if the price of medical capital were to increase, one could expect that the iso-cost would pivot to a point at which there would be less capital used and more labor hired, since it would be cheaper. Hence, the major predictions given an increase in the wage of medical employees and an increase capital rental rate are that

employment in the healthcare sector would decrease if there were an increase in wages and increase if there were an increase in capital rental rates.

Figure 2.6:
Comparative Statics Analysis of Cost-Minimization Problem with Respect to Quantity: Normal Inputs

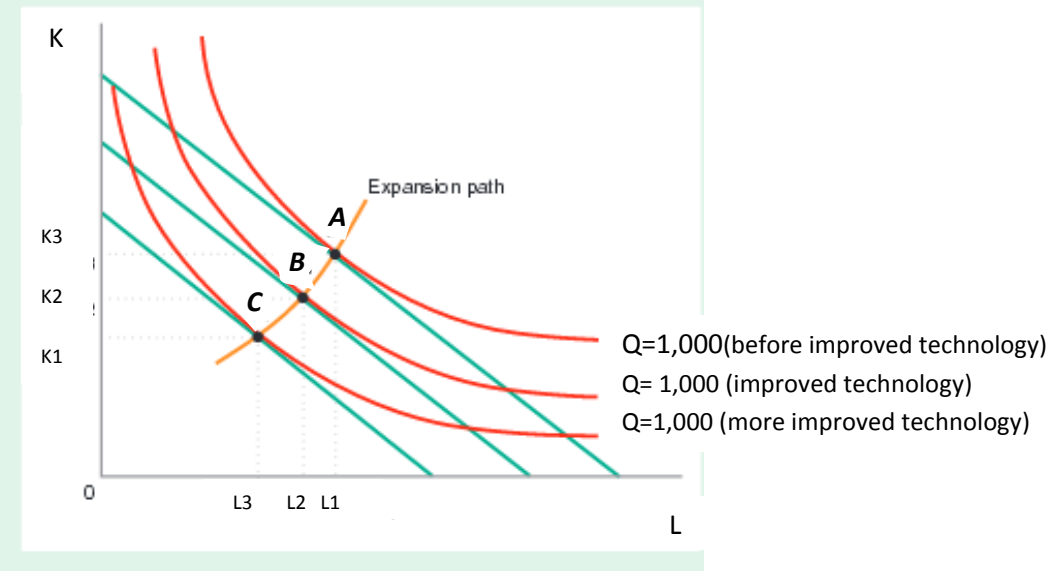


Source: David Besanko and Ronald Braeutigam. "Microeconomics." 4th Edition. Page 239.

The second comparative static relation arises if the healthcare firm decided to raise its desired level of medical output due to an increase in the demand for medical services. The optimal levels of medical labor and capital inputs would also be affected, as demonstrated in Figure 2.6, which shows three isoquants with increasing output levels. The figure shows that when Q=100, the tangency point is at point A (where the optimal input combination is L_1, K_1); when Q=200, the tangency point is at point B (where the optimal input combination is L_2, K_2); when Q=300, the tangency point is at point C (where the optimal input combination is L_3, K_3). This shows that if the healthcare firm decides to increase its level of medical output that there would also be an increase in medical labor and capital inputs. According to Besanko and

Braeutigam, "when both capital and labor inputs are normal, the quantities of both increase as the quantity of output increases ($L_1 > L_2 > L_3$, and $K_1 > K_2 > K_3$) and the expansion path is upward sloping" (p. 239).

Figure 2.7:
Effects of Technological Advancements



Source: Created by Author

A final comparative static analysis identifies the effects of technological change for a healthcare firm. When there is a technological improvement, isoquants shift in. In this example, this means that the tangency point starts at point A but, with each state of technological advancement, there is a shift down until reaching point C. The medical output is held constant with each shift, but the firm is able to reduce its capital and labor inputs due to improved technology. Advanced technology allows the healthcare firm to maintain its desired level of outputs while minimizing costs. A hypothetical example of technological change occurs if there was a new cancer cure developed by a healthcare firm. With output held constant, capital and labor would fall. However, output would probably rise because there would be a significant

increase in demand. Therefore, in this example which considers the impact on demand of a new medical technology, the healthcare firm would get a larger quantity and increased demand but the quantity/labor could rise or fall due to technological change.

2.5 Conclusion

This chapter explained the economic theory related to healthcare employment growth. Cost minimization subject to producing a desired level of output is important because, with changes in the healthcare industry, companies need to cut costs but still meet the medical needs of those who demand it. Iso-cost lines show various combinations of medical labor and capital used by a healthcare firm and determines the total cost of each output. Iso-cost lines identify the opportunity cost in each combination of goods, if the firm were to hold its total costs constant. Isoquant lines are used to analyze the efficient combinations of medical labor and capital inputs. These lines also demonstrate the marginal rate of technical substitution and how a healthcare firm must give up one input in order to use more of another. Iso-cost and isoquant lines are combined to show the optimal point for a healthcare firm in terms of minimizing cost.

Comparative statics analyses were used to predict how healthcare firms determine which combination of inputs should be used in order to produce a certain amount of output. These analyses are also essential to show the effects of increases in input prices, changes in output levels, or technological improvements. From theory, it is predicted that healthcare employment growth would decrease if there were an increase in the wage of employees in the field, increase if the rental rate of capital were to increase (if labor and capital are substitutes but they could be complements), increase if there were a larger quantity of medical output desired by the firm, and with all else constant, decrease with improved technology. The next chapter introduces the effects that these independent variables have on employment growth in the healthcare sector.

Empirical Analysis of Employment Growth in the Healthcare Sector

3.0: Introduction

Having established the importance of employment as an economic variable and explained the economic theory of cost minimization subject to producing a desired level of output, this chapter focuses on the empirical relationship between healthcare employment growth and the group of independent variables introduced in the theoretical discussion of Chapter Two. This chapter is composed of seven sections. The first explains what a regression model is and identifies the variables used in this study. The second describes the form of the regression equation in my model and provides an interpretation of the independent variables' effects on employment growth in healthcare sector. The third discusses the use of t-statistics in regressions and provides an example of a formal t-test. The fourth illustrates the importance of the coefficient of determination as a measure of fit in regression models. The fifth shows the effects that intercept and slope dummies have on employment growth in the healthcare sector. The sixth introduces a formal F-test to test the significance of all the regression coefficients as a group. Lastly, violations of assumptions are investigated for this model.

Prior to looking at the regression model used in this study, it is important to note that employment growth in the healthcare sector, the dependent variable, appears to have undergone a structural change around 1990, as mentioned in Chapter One. This structural change is recognizable in Figure 1.6 which shows the growth rate of employment in the Education and Healthcare Services sector. By observing this figure, it is apparent that healthcare employment growth seems to be increasing at a decreasing rate since 1990. Prior to 1990, employment growth in the healthcare sector had very distinctive rates of growth. On the other hand, after 1990, healthcare employment growth is not as volatile. As a result of this structural change all of

the independent variables are split up into two time periods to account for before and after 1990, except the growth rate in the share of civilians over the age of 65 and the real price of capital growth. The variable, real price of capital growth was not significantly affected by structural change since its coefficient was almost identical before and after 1990. Thus, it was not necessary to split the real price of capital growth in the regression model of this study. Structural change in employment growth in the healthcare sector is validated by the mean data.

Table 3.1:
Summary Statistics Before 1990

```
. sum  emplhgro rhcongro p65shgro rwgro rpkgro prodgro if year <1990
```

Variable	Obs	Mean	Std. Dev.	Min	Max
emplhgro	21	4.531219	1.144166	2.14114	6.196299
rhcongro	21	6.130952	2.897307	-.07	10.77
p65shgro	21	1.193976	.3131921	.6198391	1.824297
rwgro	22	-.6681818	2.294587	-5.8	4.4
rpkgro	21	-1.700917	1.873509	-4.463919	4.833705
prodgro	22	1.790909	1.600271	-1.7	4.1

Source: Based on Table A2 and Stata calculations

Table 3.2:
Summary Statistics After 1990

```
sum  emplhgro rhcongro p65shgro rwgro rpkgro prodgro if year >= 1990
```

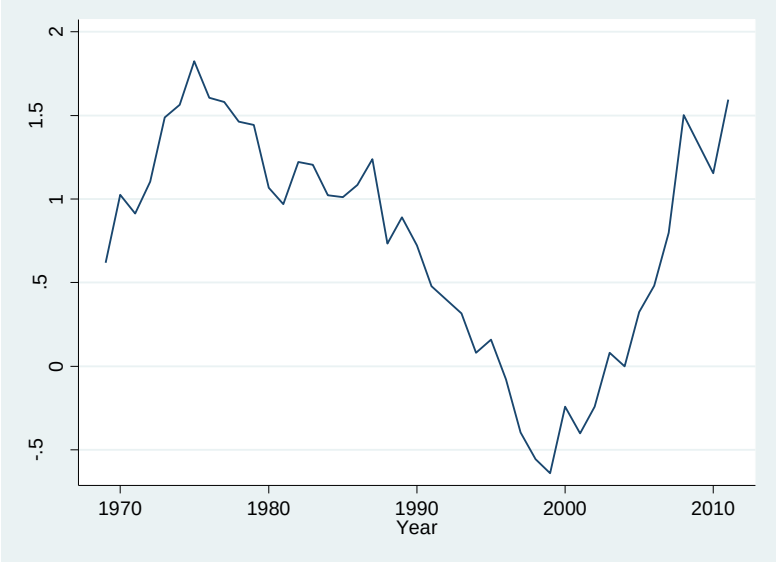
Variable	Obs	Mean	Std. Dev.	Min	Max
emplhgro	23	2.865597	.7772778	1.761059	4.752367
rhcongro	22	3.69	2.052641	.42	7.66
p65shgro	22	.311644	.6521705	-.6399994	1.593928
rwgro	23	.2913044	1.148087	-1.8	2.5
rpkgro	23	-3.050373	1.217726	-5.509416	-.4147393
prodgro	22	2.245455	1.329062	0	4.5

Source: Based on Table A2 and Stata calculations

While observing Tables 3.1 and 3.2, it is evident that the mean of employment growth in the healthcare sector decreased from 4.53 percent before 1990 to 2.86 percent after 1990. This validates the observation made in Chapter One of this study that employment growth in the healthcare sector seems to be increasing at a decreasing rate.

Another variable in this study, the growth rate in the share of civilians over the age of 65, also seems to have undergone structural change, but in 1999. This is most recognizable in Figure 3.1.

Figure 3.1:
Growth Rate in the Share of Population Over the Age of 65



Source: Based on Table A2

Figure 3.1 shows the growth in the share of population over the age of 65 from 1968 to 2012. It is important to note the stop of decline in growth in 1999. For this reason, the independent variable – share of population over the age of 65 growth, is split to capture the effects it has on healthcare employment growth before and after 1999.

3.1: Regression Models

Having identified the structural changes that have occurred in the healthcare sector, this section focuses on the regression model. A regression analysis is a means of estimating and evaluating the average linear relationship between two or more variables. Newbold et al. state that "a multiple regression model defines the relationship between a dependent or endogenous variable, and a set of independent or exogenous variables" (p. 461). For this study, a multiple regression model was created to show the effect that various independent variables have on employment growth in the healthcare sector. It is measured as the percentage rate of change of total civilian employment in this sector of the United States. Based on the theoretical discussion in Chapter Two, Table 3.3 shows the ten independent variables in this study, their expected impact on employment, along with the variables' coefficient, t-statistic, statistical significance, and whether or not the independent variable conforms to theory.

Table 3.3:
Independent Variables

Variable: An Increase in…	Expected Effect on Employment	Actual Coefficient	T-Statistic	Significant	Conform to Theory
Real Healthcare Consumption Growth Before 1990 (rhcgrob)	Increase (+)	-0.054177	-0.69	No	No
Real Healthcare Consumption Growth After 1990 (rhcgroa)	Increase (+)	0.0708262	0.54	No	Yes
Growth Rate of the Share of Civilians Over the Age of 65 Before 1999 (p65sb99)	Increase (+)	0.9860072	2.03	Yes	Yes
Growth Rate of the Share of Civilians Over the Age of 65 After 1999 (p65sa99)	Increase (+)	-0.8170819	-1.77	Yes	No
Real Wage Growth Before 1990 (rwgrob)	Decrease (-)	-0.045062	-0.32	No	Yes
Real Wage Growth After 1990 (rwgroa)	Decrease (-)	0.0847209	0.34	No	No
Real Price of Capital Growth (rpkgro)	Increase (+)	-0.1105718	-0.79	No	No
Productivity Growth Before 1990 (prodgrob)	Decrease (-)	-0.050061	-0.26	No	Yes
Productivity Growth After 1990 (prodgroa)	Decrease (-)	-0.4143837	-2.21	Yes	Yes
Recession Dummy (dumrec)	Decrease (-)	-0.2504503	-0.62	No	Yes

Source: Based on data from Table A2 and Stata calculations

The first and second independent variables are real healthcare consumption growth before and after 1990. These variables measure output of the industry, and, from theory, are expected to increase employment growth in the healthcare sector due to an increase in demand for medical services. This was demonstrated by various researchers introduced in Chapter One of this study who observed that the personal consumption for healthcare has reached an all-time high. A rise in healthcare consumption would result in healthcare firms increasing their employment levels to keep up with demand. The third and fourth independent variables, the growth rate of the share of civilians over the age of 65 before and after 1999, are expected to increase healthcare employment growth, because if there are older citizens in the United States there would be a larger demand for medical attention, resulting in increased employment in the sector. These variables measure the effects of an aging U.S. population, mentioned in Chapter One of this study.

The fifth and sixth independent variables are real wage growth before and after 1990, a cost factor. Increased wages are expected to decrease employment growth in the sector because, according to the cost minimization theory, firms may be able to use medical capital at a relatively cheaper rate, if the two are substitutes. On the other hand, the seventh independent variable, the real price of capital growth, is expected to increase employment in the sector because, according to theory, healthcare firms may be able to increase their employment levels instead of capital, if they are substitutes. The last independent variables, productivity growth before and after 1990, are expected to decrease healthcare employment growth because, if the firm is operating more efficiently, there would be no need to increase employment. The dummy variable that represents times of recession and its expected effect on employment in the healthcare sector is described in Section 3.6 of this chapter. Next, by using a multiple regression

model, the relationship between the independent variables introduced in Table 3.3 and the dependent variable is explained.

3.2: Regression Equation

The previous section defined what a regression model is, what the dependent and independent variables in this study are, and how a regression is useful in examining the relationship between the dependent variable and group of independent variables. Attention now turns to the regression equation for this study. The fundamental equation of the sample regression model in this study is:

$$Emplhgro = 3.56 - 0.05rhcgrob + 0.07rhcgroa + 0.99p65sb99 - 0.82p65sa99 - 0.05rwgrob + 0.08rwgroa - 0.11rpkgro - 0.05prodgrob - 0.41prodgroa - 0.25dumrec$$

where emplhgro is the dependent variable, healthcare employment growth, measured as a percentage; the model's intercept is 3.56, the value of employment in the sector when all other independent variables equal zero; rhcgrob is real healthcare consumption growth before 1990, measured as a percentage; rhcgroa is real healthcare consumption growth after 1990, measured as a percentage; p65sb99 is the growth rate in the share of civilians over the age of 65 before 1999, measured as a percentage; p65sa99 is the growth rate in the share of civilians over the age of 65 after 1999, measured as a percentage; rwgrob is real wage growth before 1990, measured as a percentage; rwgroa is real wage growth after 1990, measured as a percentage; rpkgro is the real price of capital growth, measured as percentage; prodgrob is productivity growth before 1990, measured as a percentage; prodgroa is productivity growth after 1990, measured as a percentage; dumrec is a dummy variable that represents times of recession, measured as a value of zero during expansions and one during recessions.

To better understand the effects that the independent variables have on employment growth in the healthcare sector, a proper interpretation of the coefficient for each of the ten independent variables is necessary. First, a one percent increase in the real healthcare consumption before 1990 is expected to cause employment in the healthcare sector to decrease by 0.05 percent. Second, a one percent increase in the real healthcare consumption after 1990 is expected to cause healthcare employment to increase by 0.07 percent. Third, a one percentage point increase in the growth rate of the share of civilians over the age of 65 before 1999 is expected to cause employment in the healthcare sector to increase by 0.98 percentage points. Fourth, a one percentage point increase in the growth rate of the share of civilians over the age of 65 after 1999 is expected to cause healthcare employment to decrease by 0.82 percentage points. Next, a one percent increase in real wages before 1990 is expected to cause employment in the healthcare sector to decrease by 0.05 percent. Sixth, a one percent increase in real wages after 1990 is expected to cause healthcare employment to increase by 0.08 percent. Seventh, a one percentage point increase in the real price of capital is expected to cause employment in the healthcare sector to decrease by 0.11 percentage points. Eighth, a one percent increase in productivity before 1990 is expected to cause healthcare employment to decrease by 0.05 percent. Lastly, a one percent increase in productivity after 1990 is expected to cause employment in the healthcare sector to decrease by 0.41 percent.

3.3: T-Statistics

Having presented this study's regression equation and the interpretation of the coefficients of the independent variables, attention now turns to evaluation of the statistical significance of a regression coefficient. To determine whether the independent variables have an impact on employment growth in the healthcare sector, a t-test is helpful in determining the

statistical significance of the variables. Harnett and Murphy suggest the "use of a test on the significance of the sample regression line to help determine if the independent variables are meaningful in predicting the dependent variable" (p. 424). The independent variable that is used in the following example is the growth rate in the share of civilians over the age of 65 before 1999, with coefficient β_3.

Example 3.1:
A Formal T-Test

$$H_o: \beta_3 = 0$$

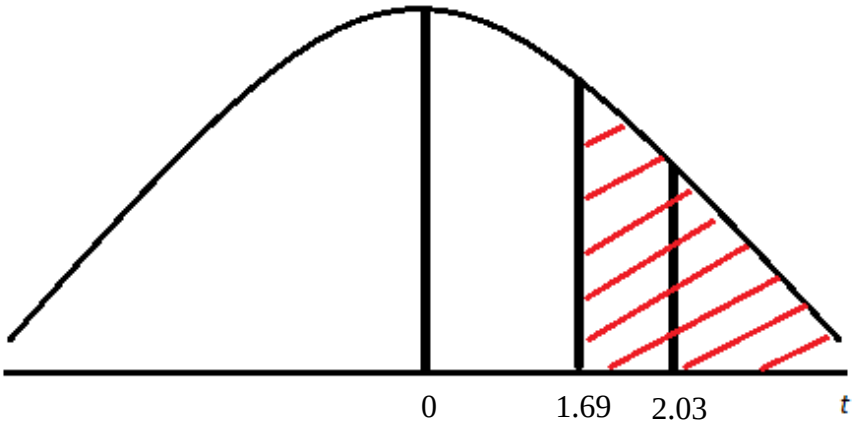
$$H_1: \beta_3 > 0$$

The null hypothesis implies that there is no relation between growth in the share of civilians over the age of 65 before 1999 and healthcare employment growth. That is, changes in the growth rate of the share of civilians over the age of 65 before 1999 will have no effect on employment growth in the healthcare sector. The alternative hypothesis is based on theory and implies that increases in the growth rate of the share of civilian over the age of 65 will increase healthcare employment growth. The test statistic appears as:

$$t = \frac{b_3 - \beta_3}{S_{b3}} = \frac{b_3}{S_{b3}} = \frac{0.9860072}{0.4860108} = 2.03$$

In this equation, β_3 represents the coefficient of the growth rate in the share of civilians over the age of 65 before 1999, which is assumed to equal zero under the null hypothesis, and S_{b3} is the standard error of the coefficient b_3. When the coefficient is divided by the standard error, the t-statistic is found.

Under the alternative hypothesis, this is a right tail test. Given 32 degrees of freedom the critical value equals 1.69.



Since the value of the test statistic lies in the critical region, we reject the null hypothesis that the growth in the share of civilians over the age of 65 before 1999 has no effect on employment in the healthcare sector growth. Thus, growth in the share of civilians over the age of 65 before 1999 is significant in this model. Based on a similar test, as shown in Table 3.3 the three independent variables that are significant in this model are the growth in the share of civilians over the age of 65 before and after 1999 and productivity growth after 1990.

3.4: The Coefficient of Determination

The previous section showed the importance of using a t-test to determine whether the independent variables used in this model had a significant impact on employment in the healthcare sector. This section discusses the coefficient of determination and its purpose in this study. According to Harnett and Murphy the coefficient of determination "is useful in interpreting the *relative* amount of the variation that has been explained by the sample regression line" (p. 417), this is often denoted by the symbol R^2. The coefficient of determination is based on the following equation:

$$SST = SSE + SSR$$

$$\left(y_i - \bar{y}\right) = (y_i - \hat{y}_i) + (\hat{y} - \bar{y})$$

Total = Unexplained + Explained

In this equation, SST is the total sum of squares, SSR is the regression sum of squares, and SSE is the error sum of squares. To determine the value of R^2, the equation is divided by the total of sum squares.

$$\frac{SST}{SST} = \frac{SSE}{SST} + \frac{SSR}{SST}$$

or

$$1 = \frac{SSE}{SST} + \frac{SSR}{SST}.$$

The equation $\frac{SSE}{SST}$ is the fraction of the variance of the dependent variable that is unexplained and $\frac{SSR}{SST}$ is the fraction explained. So if we subtract the fraction that is unexplained from one we obtain the fraction that is explained:

$$\frac{SSR}{SST} = 1 - \frac{SSE}{SST}.$$

Thus the equation for R^2 appears as

$$R^2 = \frac{SSR}{SST} = \frac{Variation\ Explained}{Total\ Variation}.$$

According to Newbold et al., "R^2 can vary from 0 to 1, since SST is fixed and 0 < SSE < SST" (p. 423). The larger an R^2 value is in a regression model, the better the fit is. In general, if $R^2 = 1$ this implies a perfect fit, if $R^2 = 0$ it suggests that there is no relation between the dependent and independent variables, and if R^2 equals a number close to 1 this suggests a good fit. The fit of my model is not that good due to the R^2 value in the model. The coefficient of

determination in my model indicates that 56.75% of the variance in employment growth in the healthcare sector from its mean is explained by the independent variables.

3.5: Dummy Variables

Having explained the coefficient of determination and the overall fit of my model, attention now turns to the dummy variables used in this study. An intercept dummy captures the effects of a qualitative event on a dependent variable. According to Newbold et al., the use of a dummy variable "provides a valuable tool for applying multiple regression to situations involving categorical variables" (p. 510). The intercept dummy used in this study captures times of recession in the U.S. economy, determined by the NBER. Employment in the healthcare sector is considered recession proof, since there is a constant demand from citizens that need medical attention, as noted in Chapter One by multiple researchers. In this model, during times of recession, employment growth in the healthcare sector is expected to decrease by 0.25 percentage points, regardless of the levels of the other explanatory variables, which is not a very large decline.

As mentioned previously, this study also uses slope dummies to capture the effects of the independent variables have on employment in the healthcare growth before and after 1990, along with before and after 1999 for the growth rate in the share of population over the age of 65. Slope dummies are used to evaluate the effects of a qualitative characteristic on the slope coefficient for some variable. An example of a slope dummy in this study is the variable productivity growth. The slope dummy captures the effects of productivity growth before and after 1990. Thus, before 1990, a one percentage point rise in productivity is expected to cause employment in the healthcare sector to decrease 0.05 percentage points. On the other hand, after 1990, a one percent rise in productivity is expected to cause healthcare employment to decrease

by 0.41 percent. The use of dummy variables in this model was helpful in determining how events in history and separate time periods impact employment in the healthcare sector.

3.6: Formal F-Test

The previous section discussed the use of dummy variables in this model. Attention now turns to how to perform a test of significance on all the regression coefficients as a group through a formal F-test. To begin, it is important to identify the null and alternative hypotheses.

$$H_o: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = \beta_8 = \beta_9 = \beta_{10} = 0$$

$$H_1: \text{At least one } \beta_i \neq 0$$

The null hypothesis implies that the explanatory variables have no effect on employment growth in the healthcare sector. In order to show what test statistic to use, a formula based on R^2 is provided:

$$F = \frac{\frac{SSR}{m}}{\frac{SSE}{n-m-1}} = \frac{\frac{SSR}{SST}}{\frac{SST-SSR}{SST}} \cdot \frac{n-m-1}{m} = \frac{R^2}{1-R^2} \cdot \frac{n-m-1}{m}$$

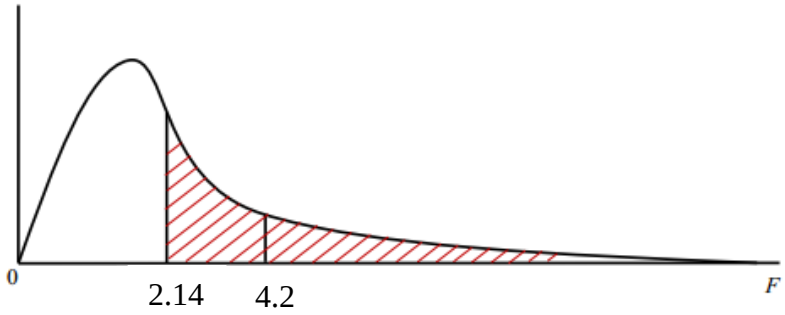
or

$$\frac{R^2}{1-R^2} \cdot \frac{n-m-1}{m} = \frac{0.5675}{1-0.5675} \cdot \frac{32}{10} = 4.20.$$

In this equation SSR is the explained sum of squares and SSE is the unexplained sum of squares. If the alternative hypothesis is true, the model has explanatory power so R^2 is big and 1-R^2 is small, so F is big. Therefore, F will be located in the right tail.

Now that the appropriate test statistic has been identified, it is possible to show a graph of the critical value and the critical region for this test. Since the value of the test statistic lies in the

critical region, the null hypothesis is rejected that the explanatory variables have no effect on employment growth in the healthcare sector.



3.7: Possible Violations of Model

Having shown that the explanatory variables have an impact on healthcare employment growth, attention now turns whether the model has any issues of multicollinearity, heteroskedasticity, or autocorrelation.

Table 3.4:
Looking for Multicollinearity

```
. cor  emplhgro rhcgrob rhcgroa p65sgrob p65sgroa rwgrob rwgroa rpkgro prodgrob prodgroa
(obs=43)
```

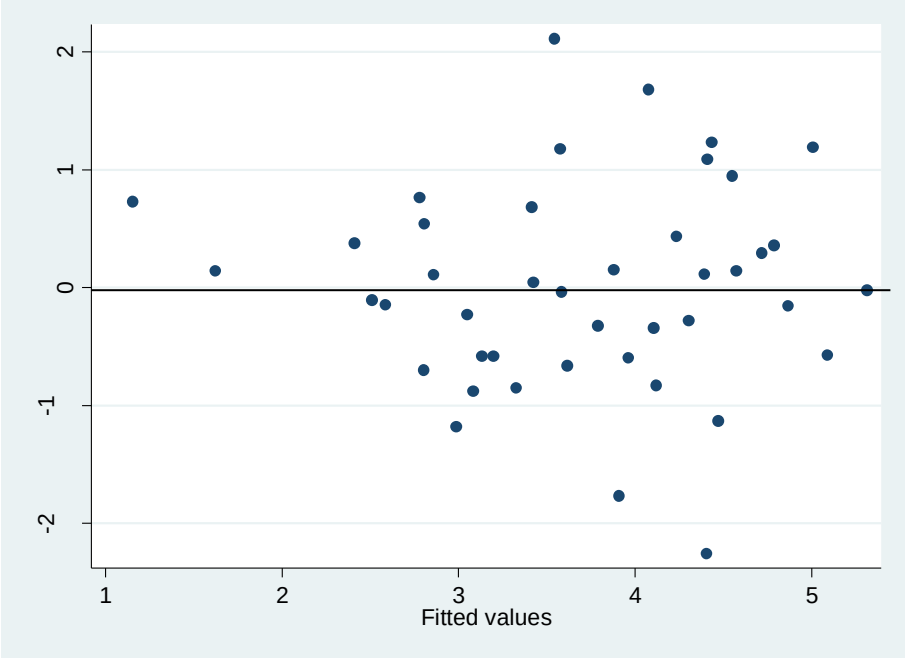
	emplhgro	rhcgrob	rhcgroa	p65sgrob	p65sgroa	rwgrob	rwgroa	rpkgro	prodgrob	prodgroa
emplhgro	1.0000									
rhcgrob	0.3780	1.0000								
rhcgroa	-0.3750	-0.6634	1.0000							
p65sgrob	0.5926	0.7395	-0.7432	1.0000						
p65sgroa	-0.3181	-0.2718	0.2793	-0.3045	1.0000					
rwgrob	-0.1875	-0.1222	0.1828	-0.2845	0.0749	1.0000				
rwgroa	-0.2680	-0.1583	-0.1634	-0.1773	-0.2284	0.0436	1.0000			
rpkgro	0.1637	0.4905	-0.3166	0.5395	0.2557	-0.3761	-0.2369	1.0000		
prodgrob	0.2893	0.6588	-0.4879	0.5837	-0.1999	0.3447	-0.1164	0.3003	1.0000	
prodgroa	-0.5666	-0.6475	0.6696	-0.7254	0.0007	0.1784	0.3406	-0.4501	-0.4762	1.0000

Multicollinearity means that two or more of the independent variables are linearly related to one another. If perfect multicollinearity is present the correlation coefficient between two independent variables is plus or minus 1 causing an impossible estimation of the regression. A

possible effect of multicollinearity is that the standard error of the affected variables will increase causing t-values to become smaller which makes it more likely for the null hypothesis to be retained when it is false. There are two methods that can be used to detect if multicollinearity is an issue.

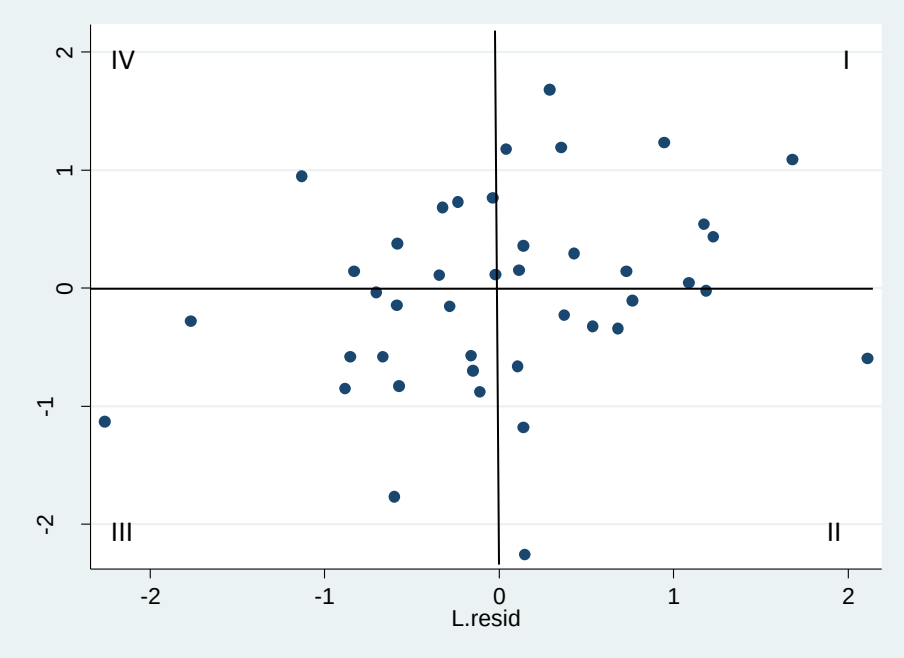
The first method used to identify multicollinearity makes use of data in Table 3.4. It shows the correlation coefficients between each of the ten independent variables in the model. It is apparent that there are no correlation coefficients among the independent variables that are larger than plus or minus 0.9, which indicates that multicollinearity is not an issue in the model. In fact, the largest correlation coefficients between two independent variables is observed for the growth rate in the share of civilians over the age of 65 before 1999 and real healthcare consumption growth before and after 1990. The second method to determine if multicollinearity is present deals with the R^2 and F-values of the regression. Based on this method, the R^2 and F-values are both large while the t-statistics are mostly insignificant. Thus, multicollinearity is not a problem according to this method because, although the majority of the independent variables are insignificant, the model has relatively small R^2 and F-values.

Figure 3.2:
Looking for Heteroskedasticity



The second potential violation of assumptions is heteroskedasticity. Heteroskedasticity means that the variance of the error terms is not constant. If this issue is present, the least squares estimators are still unbiased but no longer most efficient. This potential violation can be identified by examining at Figure 3.2 which shows the model residuals and fitted values. Based on this figure, the errors (residuals) show a random pattern among the fitted values so the variance of errors doesn't seem to change. Also, the data used in this study are time series which does not usually lead to heteroskedasticity.

Figure 3.3:
Looking for Autocorrelation



The last potential violation of assumptions is autocorrelation. Autocorrelation means that the error terms are linearly related to one another. If this problem is present, the least squares estimators are still unbiased but no longer most efficient. Autocorrelation is usually associated with time series data; this means that this violation could be present in this model. This potential issue investigated by using Figure 3.3. The figure shows that there seems to be a random pattern among the residuals labeled on the vertical axis and lagged residuals labeled on the horizontal axis. Therefore, first order autocorrelation does not seem to be a problem according to Figure 3.3. Another method to determine autocorrelation deals with the value of the Durbin Watson statistic. The value of this statistic from the regression output is 1.327014. Since it is less than 2, positive autocorrelation could be a problem. However, as noted the estimates of the model are still unbiased.

3.8: Conclusion

This chapter has provided a statistical analysis of the empirical data found by creating a regression model to show the relationship between the independent variables and the dependent variable, healthcare employment growth. From the theoretical discussion in Chapter Two, there are many independent variables that have an impact on employment growth in the healthcare sector. This chapter provided the regression model used in this study to illustrate how the independent variables' coefficient is interpreted to impact employment growth in the healthcare sector. The implications of this model are discussed in Chapter Four.

Determinants of Healthcare Employment Growth: Conclusion

4.1: Introduction

This study has examined the determinants of healthcare employment growth and how the independent variables from the theoretical discussion influence it. There are many previous studies that deal with the healthcare system in the United States, and this study of the determinants of healthcare employment adds to what is known. Having found that healthcare expenditures in the United States have reached an all-time high, an indication that the demand for healthcare services has also grown, employment growth in the sector is expected remain positive. It has also been noted by the Bureau of Labor Statistics that the healthcare sector is predicted to grow through 2020 and is the fastest growing sector in the United States (BLS). However, this study has identified that healthcare employment growth experienced structural change in 1990 and it appears that employment growth is increasing at a decreasing rate. After introducing the determinants of employment growth in the healthcare sector in Chapter One, evaluating these determinants in relation to the economic theory of cost minimization in Chapter Two, and creating an empirical model based on these theoretical considerations in Chapter Three, this chapter focuses on analyzing the implications of findings in the study.

The healthcare system has evolved greatly since 1968. An indicator of consumer demand, personal consumption expenditures (PCE) of healthcare services were around 20% in 2009 (McCully). Also, government spending on healthcare has increased, as enrollment in government programs such as Medicare and Medicaid continue to increase. McCully validates this when he writes that "the share of PCE paid for by government increased from 3.4 percent (in 1959) to 45.4 (in 2009)" (p. 16). Other causes of increased consumption of healthcare include an aging U.S. population and more research and technology developed by healthcare firms. As a

result of this consumption among U.S. citizens, firms have to hire more employees to keep up with demand. This is evident, since employment in healthcare has increased every year since 1968 and now accounts for over 14 percent of total civilian employment. It is also clear that employment in the healthcare sector is more recession proof in comparison to total employment. Therefore, some factors affecting healthcare employment growth include consumption, an aging population, and periods of recessions, which are defined by the National Bureau of Economic Research (NBER).

Healthcare reform is affecting how healthcare systems operate in the United States. As a result of this reform, healthcare firms constantly need to cut costs while still providing high quality service to keep up with demand. Thus, the economic theory of cost minimization subject to producing a desired level of output was investigated. Every healthcare system has medical labor and capital inputs that affect the total cost of the firm. Healthcare firms need to decide the opportunity cost of these inputs to keep cost constant through the use of iso-cost lines. On the other hand, isoquants are used by healthcare firms to analyze efficient combinations of medical labor and capital inputs. The marginal rate of technical substitution shows how a healthcare firm must give up one input in order to increase another. The combined iso-cost and isoquant shows how healthcare firms determine which combination of inputs should be used in order to produce a certain level of output. Using this economic theory, the independent variables real wage growth, real price of capital growth, and productivity growth were incorporated into the model. These effects on healthcare employment growth are captured using the regression model shown in Chapter Three.

After identifying that structural change appears to have occurred in 1990, adjustments were needed to capture this effect in the model's regression. Therefore, the impacts of the

independent variables except real price of capital growth and the growth rate in the share of civilians over the age of 65, were evaluated using slope dummies that represented before and after 1990. As noted in Chapter Three, the independent variable real price of capital growth did not need to be split because the coefficients representing before and after 1990 were almost identical. Alternatively, the growth rate in the share of civilians over the age of 65 appeared to have undergone structural change in 1999, during which the growth rate stopped declining, resulting in a slope dummy representing the periods before and after 1999.

The variables used in this study's regression model were developed from the theoretical discussion in Chapter Two. Real healthcare consumption growth and the growth rate in the share of civilians over the age of 65 represent output factors and were expected to increase employment growth in the healthcare sector. Cost factors in the model include real wage growth and real price of capital growth. Increases in real wage growth were expected to decrease employment growth in the healthcare sector, while an increase in the price of capital was expected to increase employment growth in the healthcare sector, if capital and labor are substitutes in the healthcare sector. Technological change is represented by the independent variable productivity growth and, from theory, is expected to decrease healthcare employment growth, because, if firms are operating more efficiently through technology, there may not be a need for more employees. Lastly, an intercept dummy was created to represent times of recession declared by the NBER and was not expected to significantly affect healthcare employment growth, since the sector is considered recession proof.

4.2: Major Empirical Findings

Although only three independent variables were statistically significant in my model, the overall fit was relatively good, at least in terms of the F-test. Some of the signs of my

independent variables did not conform to the theoretical predictions. For instance, real healthcare consumption growth before 1990 was found to decrease healthcare employment growth according to my regression. However, a possible reason for this could be that there was less consumption of healthcare services prior to 1990 in comparison to after 1990. If this were the case, then healthcare firms would not need to hire new employees during that time period.

The variables that represent the growth rate in the share of civilians over the age of 65 before and after 1999 had large coefficients in this study. Growth in the share of civilians over the age of 65 after 1999 was found to decrease employment growth in the healthcare sector in my model. However, baby boomers are still in the lower end of old age and are not fully accounted for in the share of civilians over the age of 65.

According to the regression, the independent variables that represent labor and capital prices indicate that the two are complements in the healthcare sector. This makes sense because, although there is much technology in the healthcare sector, many machines and procedures still need human operators. Since the sign for real wage growth after 1990 is less than zero, this implies that labor demand is insensitive to an increase in wages. Changes in medical technology are captured by the independent variable, productivity growth.

The coefficients for productivity growth representing before and after 1990 had the most recognizable difference in the model. The value for productivity growth after 1990 is much larger in magnitude than before 1990, so, in terms of healthcare costs, since there is less labor demanded, we might expect a leveling off of employment growth. This verifies the observation made throughout this study that employment growth in the healthcare sector appears to be increasing at a decreasing rate. In terms of future jobs, the coefficient for productivity growth

after 1999 implies employment growth might not be so strong with an increase in technology. Technology in the healthcare sector can be predicted to become more advanced and will increase efficiency in the medical field, which may also contribute to the leveling off of employment in the healthcare sector. Alternatively, if technological developments spur demand for healthcare services, employment growth would accelerate.

In the empirical section, it was found that during times of recession in the U.S., a minor decrease in employment growth in the healthcare sector results. However, the healthcare sector can still be considered recession proof because the coefficient that represented times of recession is relatively small. Although there is a decrease of healthcare employment growth during times of recession, the growth rate is still positive. By looking at Figure 1.6, which indicates that healthcare employment growth is increasing at a decreasing rate; recessions prior to 1990 appear to have more profound impacts on healthcare employment growth in comparison to after 1990.

Other factors that could have been considered in this study include a variable that captures the effects of enrollment in the government programs Medicare and Medicaid in order to see the effect that the Affordable Care Act will have on employment in the healthcare sector. As noted in Chapter One, enrollment for these programs has reached an all-time high. Another variable that captures the effect that times of recession before and after 1990 had on employment growth would also provide insight as to how the healthcare employment during recessions has changed. This would allow us to see how employment growth in the healthcare sector has become less volatile in terms of peaks and troughs since 1990. Lastly, an independent variable that captures the effects of education could have been incorporated into this study, since it was noted in Chapter One that the majority of employees in the healthcare sector hold a post-

secondary degree. It would be interesting to see the effect that educational attainment has on healthcare employment growth.

4.3: Concluding Remarks

The purpose of this study was to examine the determinants of healthcare employment growth. This study has found that employment growth in the healthcare sector experienced structural change in 1990, a relationship between increased consumption of healthcare services in the United States and employment growth in the healthcare sector, and that even the healthcare sector does suffer a minor setback of employment growth during times of recession. The structural change identified in this study indicates that employment growth is increasing at a decreasing rate. Despite this observation, the growth rate of employment in the healthcare sector is still positive. Therefore, healthcare employment is predicted to continue its growth, but not at the rates observed from 1968 to 1990. More advanced technology in the healthcare sector may contribute to the leveling off of employment in the sector. Employment in the healthcare sector can still be considered recession proof, despite the minor decrease in my model, since there is an ever present demand for medical attention, and other industries suffer far more substantial employment losses during times of recession. Demand for healthcare services can be predicted to rise as the baby boom generation continues to age. With increased consumption and expenditures of healthcare, the healthcare sector will continue to impact the economy of the United States.

Appendix

Figure A1: Regression of Employment Growth in the Healthcare Sector

```
. reg emplhgro rhcgrob rhcgroa  p65sb99 p65sa99 rwgrob rwgroa rpkgro prodgrob prodgroa dumrec
```

Source	SS	df	MS		
Model	38.4362105	10	3.84362105	Number of obs	= 43
Residual	29.2875465	32	.915235828	F(10, 32)	= 4.20
				Prob > F	= 0.0009
Total	67.723757	42	1.6124704	R-squared	= 0.5675
				Adj R-squared	= 0.4324
				Root MSE	= .95668

emplhgro	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
rhcgrob	-.0541477	.0788664	-0.69	0.497	-.2147932	.1064978
rhcgroa	.0708262	.1302707	0.54	0.590	-.1945265	.3361789
p65sb99	.9860072	.4860108	2.03	0.051	-.0039644	1.975979
p65sa99	-.8170819	.4613932	-1.77	0.086	-1.756909	.1227453
rwgrob	-.045062	.1396297	-0.32	0.749	-.3294783	.2393543
rwgroa	.0847209	.2472472	0.34	0.734	-.4189052	.5883469
rpkgro	-.1105718	.1400076	-0.79	0.435	-.395758	.1746144
prodgrob	-.0500614	.1925829	-0.26	0.797	-.4423399	.3422172
prodgroa	-.4143837	.1873419	-2.21	0.034	-.7959866	-.0327808
dumrec	-.2504503	.4031357	-0.62	0.539	-1.071611	.5707102
_cons	3.557804	.8462737	4.20	0.000	1.834001	5.281607

Table A1: Employment, GDP, and Value Added Data

Table A1: Employment, GDP, Value Added Data											
Time	Total Civilian Employment	Education and Health Care Employment	Growth Rate of Employment in Education and Healthcare Sector	Real GDP	Growth Rate of Real GDP	Consumer Price Index	Nominal Value Added of Education and Healthcare Sector	Real Value Added of Education and Healthcare Sector	Value Added of Education and Healthcare Sector as % of GDP	Education and Healthcare Sector Share of Total Employment	Education and Healthcare Sector Value Added Share of Total Value Added
1968	75920	4191		4129.9	4.8		31.1		3.4	5.52028451	
1969	77902	4428	5.654974946	4258.2	3.1	36.7	35.7	97.27520436	3.6	5.684064594	2.28442075
1970	78678	4577	3.364950316	4266.3	0.2	38.8	40.3	103.8659794	3.9	5.817382242	2.434568112
1971	79367	4675	2.141140485	4409.5	3.4	40.5	44.8	110.617284	4	5.890357453	2.508612857
1972	82153	4863	4.021390374	4643.8	5.3	41.8	50.5	120.8133971	4.1	5.919442991	2.601606381
1973	85064	5092	4.709027349	4912.8	5.8	44.4	56.4	127.027027	4.1	5.986081068	2.585633997
1974	86794	5322	4.516889238	4885.7	-0.6	49.3	63.4	128.6004057	4.2	6.13176026	2.632179743
1975	85846	5497	3.288237505	4875.4	-0.2	53.8	73.1	135.8736059	4.5	6.403326888	2.786922221
1976	88752	5756	4.711660906	5136.9	5.4	56.9	82.7	145.3427065	4.5	6.485487651	2.829385554
1977	92017	6052	5.142460042	5373.1	4.6	60.6	92.4	152.4752475	4.5	6.577045546	2.837751903
1978	96048	6427	6.196298744	5672.8	5.6	65.2	104.4	160.1226994	4.6	6.691445944	2.822639603
1979	98824	6767	5.290182044	5850.1	3.1	72.6	118.2	162.8099174	4.6	6.847526917	2.783027937
1980	99303	7072	4.507167135	5834	-0.3	82.4	134.1	162.7427184	4.8	7.121637816	2.789556367
1981	100397	7357	4.029977376	5982.1	2.5	90.9	152.9	168.2068207	4.9	7.327908204	2.811835654
1982	99526	7515	2.147614517	5865.9	-1.9	96.5	169.2	175.3367876	5.2	7.550790748	2.989085862
1983	100834	7766	3.339986693	6130.9	4.5	99.6	189.7	190.4618474	5.4	7.701767261	3.106588713
1984	105005	8193	5.498326037	6571.5	7.2	103.9	207.1	199.3262753	5.3	7.802485596	3.033192958
1985	107150	8657	5.663371171	6843.4	4.1	107.6	225.4	209.4795539	5.3	8.079328045	3.061045005
1986	109597	9061	4.666743676	7080.5	3.5	109.6	245.2	223.7226277	5.5	8.267562068	3.159700978
1987	112440	9515	5.010484494	7307	3.2	113.6	277.7	244.4542254	5.9	8.462291	3.345480024
1988	114968	10063	5.759327378	7607.4	4.1	118.3	301.5	254.8605241	5.9	8.752870364	3.350165945
1989	117342	10616	5.495379112	7879.2	3.6	124	337.4	272.0967742	6.2	9.047059024	3.453355343
1990	118793	10984	3.466465712	8027.1	1.9	130.7	376.7	288.2172915	6.5	9.246336064	3.590553145
1991	117718	11506	4.752367079	8008.3	-0.2	136.2	413.4	303.5242291	6.9	9.774206154	3.790120613
1992	118492	11891	3.346080306	8280	3.4	140.3	452.9	322.808268	7.1	10.03527664	3.89865058
1993	120259	12303	3.464805315	8516.2	2.9	144.5	476.4	329.6885813	7.1	10.23041934	3.871310929
1994	123060	12807	4.096561814	8863.1	4.1	148.2	500.2	337.5168691	7.1	10.40711848	3.808113065
1995	124900	13289	3.763566799	9086	2.5	152.4	523.9	343.7664042	7.1	10.63971177	3.783473522
1996	126708	13683	2.964858153	9425.8	3.7	156.9	545.4	347.6099426	7	10.79884459	3.687856125
1997	129558	14087	2.952568881	9845.9	4.5	160.5	571.4	356.0124611	6.9	10.87312246	3.615844779
1998	131463	14446	2.548448925	10274.7	4.4	163	601.2	368.8343558	6.8	10.98864319	3.589733577
1999	133488	14798	2.436660667	10770.7	4.8	166.6	638.5	383.2533013	6.8	11.08564066	3.558295202
2000	136891	15109	2.101635356	11216.4	4.1	172.2	678	393.728223	6.8	11.03724861	3.510290494
2001	136933	15645	3.547554438	11337.5	1.1	177.1	729.2	411.744777	7.1	11.42529558	3.631706963
2002	136485	16199	3.541067434	11543.1	1.8	179.9	789.8	439.0216787	7.4	11.86870352	3.803325612
2003	137736	16588	2.401382801	11836.4	2.5	184	847.1	460.3804348	7.6	12.04332927	3.889530894
2004	139252	16953	2.200385821	12246.9	3.5	188.9	906.1	479.671784	7.6	12.17433143	3.916679192
2005	141730	17372	2.471538961	12623	3.1	195.3	953.5	488.2232463	7.6	12.25710859	3.867727531
2006	144427	17826	2.613400875	12958.5	2.7	201.6	1015.3	503.6210317	7.6	12.34256753	3.886414568
2007	146047	18322	2.782452597	13206.4	1.9	207.342	1076.9	519.3834341	7.7	12.54527652	3.932816166
2008	145362	18838	2.816286432	13161.9	-0.3	215.303	1153.9	535.9423696	8.1	12.9593704	4.071922516
2009	139877	19193	1.884488799	12757.9	-3.1	214.537	1225.6	571.2767495	8.8	13.72134089	4.47782746
2010	139064	19531	1.761058719	13063	2.4	218.056	1269.2	582.0523168	8.8	14.04461255	4.45573235
2011	139869	19883	1.802263069	13299.1	1.8	224.939	1311.1	582.8691334	8.7	14.21544445	4.382771266
2012	142469	20319	2.192828044	13591.1	2.2	229.594	1344.7	585.6860371	8.6	14.26204999	4.309335058

Source: *Economic Report of the President, 2013,* Tables B1, B2, B4, B46, and B60. The Bureau of Economic Analysis website: http://www.bea.gov/iTable/iTable.cfm?ReqID=5&step=1#reqid=5&step=1&isuri=1&402=1&403=1. The author's Stata calculations are also provided in this table.

Table A2: Empirical Analysis Data

Table A2: Empirical Analysis Data											
Year	Healthcare Employment Growth	Real Healthcare Consumption Growth Before 1990	Real Healthcare Consumption Growth After 1990	Share of Civilians Over the Age of 65 Growth Before 1999	Share of Civilians Over the Age of 65 Growth After 1999	Real Wage Growth Before 1990	Real Wage Growth After 1990	Real Price of Capital Growth	Productivity Growth Before 1990	Productivity Growth After 1990	Recession = 1 (dumrec)
1968						1.1	0		3.4	0	0
1969	5.654975	8.8	0	0.6198391	0	0.6	0	-2.063337	0.5	0	1
1970	3.36495	8.55	0	1.024594	0	-1.4	0	-1.511454	2	0	1
1971	2.14114	9.08	0	0.9132339	0	1.5	0	-1.933292	4.1	0	0
1972	4.02139	4.84	0	1.104979	0	4.4	0	-2.979705	3.2	0	0
1973	4.709027	1.21	0	1.487354	0	-0.1	0	-3.641438	3.1	0	1
1974	4.516889	3.77	0	1.562499	0	-4.5	0	-1.535543	-1.7	0	1
1975	3.288238	10.58	0	1.824297	0	-3.4	0	4.833705	3.5	0	1
1976	4.711661	7.4	0	1.604531	0	1.4	0	0.1358474	3.2	0	0
1977	5.14246	5.64	0	1.579193	0	0.6	0	-0.3963156	1.7	0	0
1978	6.196299	1.84	0	1.463859	0	-0.2	0	-1.623421	1.1	0	0
1979	5.290182	-0.07	0	1.44274	0	-3.7	0	-1.824579	-0.1	0	0
1980	4.507167	4.6	0	1.068565	0	-5.8	0	-0.5525059	-0.2	0	1
1981	4.029977	10.77	0	0.9695871	0	-1.6	0	-2.086696	2.1	0	1
1982	2.147614	8.07	0	1.220578	0	-1.5	0	-2.0662	-0.8	0	1
1983	3.339987	7.74	0	1.20586	0	1.8	0	-3.593319	3.6	0	0
1984	5.498326	5.49	0	1.022146	0	0.6	0	-4.463919	2.7	0	0
1985	5.663371	7.3	0	1.011803	0	-1.3	0	-3.054681	2.3	0	0
1986	4.666744	5.42	0	1.08469	0	0.1	0	-0.6249798	2.9	0	0
1987	5.010485	6.44	0	1.23711	0	-1.1	0	-2.185293	0.3	0	0
1988	5.759327	6.9	0	0.7349951	0	-1.1	0	-2.118047	1.5	0	0
1989	5.495379	4.38	0	0.8910462	0	-1.1	0	-2.434077	1	0	0
1990	3.466466	0	7.66	0	0.7231833	0	-1.8	-2.482	0	2.1	1
1991	4.752367	0	6.59	0	0.4792366	0	-1.5	-2.032588	0	1.5	1
1992	3.34608	0	7.05	0	0.3976158	0	-0.2	-3.467519	0	4.2	0
1993	3.464805	0	3.23	0	0.3169569	0	0.1	-3.145151	0	0.5	0
1994	4.096562	0	2	0	0.0790769	0	0.8	-2.621544	0	0.9	0
1995	3.763567	0	2.76	0	0.1579815	0	-0.6	-3.175681	0	0	0
1996	2.964858	0	2.13	0	-0.0789596	0	0.4	-4.228067	0	2.9	0
1997	2.952569	0	3.55	0	-0.3957277	0	2.2	-4.650783	0	1.8	0
1998	2.548449	0	2.92	0	-0.5566576	0	2.5	-5.509416	0	3	0
1999	2.436661	0	0.42	0	-0.6399994	0	1	-4.332594	0	3.5	0
2000	2.101635	0	3.4	0	-0.2410585	0	0.4	-3.301269	0	3.5	0
2001	3.547554	0	6.83	0	-0.4030648	0	-0.1	-4.525616	0	3	1
2002	3.541067	0	6.24	0	-0.2426181	0	1.2	-3.587668	0	4.5	0
2003	2.401383	0	3.28	0	0.080933	0	0	-3.77768	0	3.9	0
2004	2.200386	0	3.49	0	0	0	-0.5	-3.2706	0	2.8	0
2005	2.471539	0	3.22	0	0.3231015	0	-0.6	-3.119119	0	1.7	0
2006	2.613401	0	2.04	0	0.4827065	0	1.1	-3.08804	0	0.9	0
2007	2.782453	0	2.19	0	0.7993636	0	1	-2.356028	0	1.5	1
2008	2.816286	0	5.51	0	1.501379	0	-1	-1.687503	0	0.7	1
2009	1.884489	0	2.82	0	1.324504	0	2.2	-0.4147393	0	3.1	1
2010	1.761059	0	0.66	0	1.154287	0	1.1	-2.949172	0	3	0
2011	1.802263	0	3.19	0	1.593928	0	-0.8	-1.460998	0	0.4	0
2012	2.192828					0	-0.2	-0.9747956			0

Source: *Economic Report of the President, 2013* . Tables B7, B16, B34, B47, B50, B60

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