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CONSTRUCTING AND VALIDATING AN INTEGRATIVE ECONOMIC MODEL OF HEALTH CARE SYSTEMS AND HEALTH CARE MARKETS: A COMPARATIVE ANALYSIS OF OECD COUNTRIES

by

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A dissertation submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy
in the Doctoral Program in Public Affairs
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at the University of Central Florida
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Major Professor: Thomas T.H. Wan

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ABSTRACT

This dissertation argues that there are three basic types of health care systems used in industrial nations: free market (private insurance and provision), universal (public insurance and private provision), and socialized (public insurance and provision). It examines the role of market forces (supply and demand) within the health care systems and their effects on health outcomes by constructing an integrative model of health care markets and policies that is lacking within the scientific and academic literature. The results show that, free market systems have decreased access to care, good quality of care, and are economically inefficient resulting in 2.7 years of life expectancy lost and wasted expenditures (expenditures that do not increase life expectancy) of $3474 per capita ($1.12 trillion per year in the U.S.). Socialized systems are the most economically efficient systems but have decreased access to care compared to universal systems, increased access to care compared to free market systems and have the lowest quality of care of all three systems resulting in 3 months of life expectancy lost per capita and a saving of $335 per capita. Universal systems perform better than either of the other 2 systems based on quality and access to care. The models show that health insurance is a Giffen Good; a good that defies the law of demand. This study is the first fully demonstrated case of a Giffen good. This investigation shows how the theoretically informed integrative model behaves as predicted and influences health outcomes contingent upon the system type. To test and substantiate this integrative model, regression analysis, Time-Series-Cross-Section analysis, and structural equation modeling were performed using longitudinal data provided and standardized by the Organization for Economic Cooperation and Development (OECD). The results demonstrate that universal health care systems are superior to the other two systems.

For my son “J.J.”, Jesse James Madison Helligso,
may you live in a world where no one must choose between their health care and feeding themselves, providing for their families or attaining an education.

In memory of Alec Smith, who died June 2017, and the countless, nameless others that are no longer with us, because they could not afford their insulin (Mazziotta, 2018); “There but for the grace of God, go I”.

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Thank you to my mother, Jeri Johnson, for her encouragement to attain an education and all the sacrifices she has made on my behalf.

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Lastly, thank you to my wife, Kaitlyn, who has been my emotional support throughout this Ph.D. program, and for listening to me drone on and on endlessly for hours about health care economics and statistical modelling.

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CHAPTER 1: INTRODUCTION

Health care expenditures are a major concern for all countries as the costs of health care continue to rise faster than the rate of inflation and consume larger portions of a country's wealth. These high costs limit access to care and severely reduce the health outcomes of those without access. A recent survey from National Opinion Research Center (NORC) at the University of Chicago and the West Health Institute found that 40% of Americans skipped recommended medical tests and 44% did not seek medical care when sick or injured due to costs of care (NORC, 2018). This self-rationing of care causes premature mortality (Mazziotta, 2018). Solving this issue is not as simple as restricting the costs of care, as cost restrictions may lead to decreased quality of care and waitlists for services despite increasing access to care. Developed nations are using a wide variety of policy interventions to reduce the cost of care while attempting to maintain the quality and increase the access to care (Ellis, Chen, & Luscombe, 2014; Joumard & Nicq; OECD, 2010). No matter the country or system of health care, the poor have the lowest access to care, and bare the largest burden of decreased access to care (Blendon et al., 2002). Most of the literature that analyzes these policy interventions uses benchmarking and Data Envelopment Analysis to evaluate the outcomes and the efficiency of the interventions. Benchmarking can lead to good advice for countries on how to improve efficiency but does not establish causation and is based on estimates of "relative" efficiency. The literature that attempts to establish causation looks to the economic market structures within health care that influence price, quality, and access to care. These studies use the market forces to predict and determine health outcomes and quality of care. There are no studies that attempt to integrate these two

aspects of health care—the market forces and the policy interventions, into an integrative model that allows for the evaluation of health outcomes based on policy interventions while controlling for economic forces. The purpose of this study is to develop and evaluate an integrative model of health care systems and markets that can account for the differences in economic efficiency, access to care, quality of care, and health outcomes that is lacking within the academic literature using newly released data from the Organization for Economic Cooperation and Development (OECD) and analyzes the model using regression analysis, Cross-Sectional-Time-Series analysis, and structural equation modeling (SEM) to establish causative relationships between health care system types and health outcomes. The results from this analysis demonstrate an increase in total life expectancy of over 1 billion years for the 34 OECD countries included within the data set.

Health outcomes across the developed world differ based on the quality of care and access to care; these differences in quality and access to care are caused by the funding mechanisms and provision mechanisms within the health care system. Within the developed world three main systems of health care that are used for the funding and provision of care:

1. Free market—where both the provision of care and the funding of care (health insurance) are private for profit.
2. Universal—where the provision of care is private for profit, and the funding of care is public and non-profit.
3. Socialized—where both the provision of care and the funding of care are public and non-profit.

Each system will have differing effects on the economic efficiency of care, the quality of care, and access to care based on the forces of supply and demand within the health care market.

These differences in economic efficiency, quality, and access will cause measurable differences in health outcomes. The academic literature has yet to disaggregate performance and outcomes due to a lack of a systems framework. This dissertation uses a systems framework (Wan, 2002) to discuss these connections of context, design, performance, and outcomes within health care that will allow for the evaluation of policy interventions, shown in **Table 1**:

Table 1: A Health Systems Framework

Context →	**Design →**	**Performance →**	**Outcomes**
Market Forces Population Wealth Population Rates of Health Life Style Factors	Public or Private Provision of Care Public or Private Insurance	Price of Care Access to Care Quality of care	Life Expectancy Infant Mortality Rates

Markets determine the price, quantity, and quality of all goods and services based on supply and demand. In health care economic terms these concepts are discussed as economic efficiency (price), quality of care (quality), and access to care (quantity) (Brekke, Cellini, Siciliani, & Straume, 2010; Costa-Font, Sato, & Rovira Forns, 2017; Gaynor, Ho, & Town, 2014). Market forces (Context) do not differ between countries; however, the structures of those markets based on health policy (Design) do differ, leading to different levels of economic efficiency, quality of care, access to care (Performance), which causes differences in health outcomes (Outcomes).

Due to a lack of empirical analyses of health care systems within the academic literature and a lack of a systems framework for evaluation, this dissertation develops an integrative theory with a testable model of health care system components, including the context/market, design, performance, and outcomes. This theoretically specified model argues that differences in health outcomes are based on the policy choices of governments in regard to the funding of health insurance and health care provision, and attempts to demonstrate that the demand for health insurance behaves as a Giffen Good (Jensen & Miller, 2007). Because markets function in

predictable manners, the differences between health outcomes must be based on health care systems in terms of the policy choices of governments (Design), and no country is an outlier in terms of performance and outcomes.

The fundamental issue within the academic literature that this analysis addresses is, the divergence in theory between the fields of economics and health policy analysis. Economic theory states that consolidated markets increase costs and decrease quality due to monopoly price setting and a lack of competition. Health policy theory suggests that consolidated markets decrease costs, and increase quality due to increased efficiency, communication between providers, and a reduction in redundancy.

1.1: Background

Health care is a unique market due to important differences from normal competitive markets (Crawford, 2010; OECD, 2010; Olsen, 2009)

1. In health care, there are two separate demands for care: A. The theoretical demand (those that need treatment), and B. The demand with the ability to pay for said care. The theoretical demand for care is perfectly inelastic—those that need care, need the care at any cost. Utility of care is not based on consumer choices alone, but rather on the overall health of the consumer and the consumer's family (Hurley, Mentzakis, Giacomini, DeJean, & Grignon, 2017).
2. Consumers rarely directly pay for health services, instead purchasing health insurance to cover the costs of health care (Gaynor, 2006; Gaynor et al., 2014; Gaynor, Mostashari, & Ginsburg, 2017; Olsen, 2009). Even with insurance, consumers must also pay out of pocket for care through copays and coinsurance that were never negotiated prior to

receiving the care (Gaynor et al., 2014). Medical providers do not tell clients the costs for their portion of the care before the care is given, and clients receive a bill afterward that they legally must pay without negotiation; essentially any price the provider has deemed necessary (Batty & Ippolito, 2017; Crawford, 2010). Most providers will work with their clients' financial situations, and many providers do behave altruistically, but the standard policy is to bill, and then negotiate after the service has already been provided with price reductions only considered due to financial limitations. Essentially, after having provided the care, medical providers can say, "Here is how much you legally owe me. If you cannot afford it, give me everything you currently have (and then some through debt)". This does not occur in normal competitive markets.

3. The demand for health insurance is fundamentally different from the demand for health care (Dunn, 2016; Lieber, 2017; Wigger & Anlauf, 2007). For those at high risk, the demand for insurance is only limited by the ability to pay (or previously, by the insurance company's acceptance of those high-risk clients). For those fortunate enough to be in good health, the demand for insurance is based on their individual cost benefit analyses based on their perceived risk. Health insurance utility is usually based on the family unit and not the individual unit. Health insurance companies are profit motivated—they are not motivated to provide care for their clients. In fact, health insurance companies make substantially higher profits by not paying for care for their clients, which is the reason for countries requiring insurance to cover all despite pre-existing conditions. The demand for health insurance, which will be argued in this dissertation, functions as a Giffen Good; as price increases, demand increases until the point where insurance becomes

unaffordable or unreasonable in the eyes of consumers, and demand begins to correspondingly decrease.

4. And lastly, health care providers act as a series of regional monopolies and cartelistic oligarchies, rather than direct competitors or oligarchical competitors. Rampant monopoly price setting occurs within health care, and differential pricing occurs after the fact through price discounts based on financial ability (as mentioned above) to further maximize profits to health care providers (Batty & Ippolito, 2017; Crawford, 2010; Gaynor et al., 2017; Krabbe-Alkemade, Groot, & Lindeboom, 2017).

Because health care differs from a competitive market, governments have intervened with a wide variety of policies to compensate for the market failures in health care and achieve better quality and equity within health care provision (Ellis et al., 2014; OECD, 2010; Olsen, 2009). Policies dealing with the provision of care and funding of care determine the type of health care system a country uses. The interaction between supply and demand for health care (the market), and the system (determined by policies about the provision of care and insurance of care) determines the "market model based on the system".

The literature using econometric modelling and market analysis of supply and demand in health care is substantial, but the majority of the academic literature focuses on supply and demand within various aspects of the health care market such as: the insurance market (Lieber, 2017; Wang, 2017), the provision of primary care services (Simon, Soni, & Cawley, 2017), the provision of acute hospital care, negotiation of prices, and quality between insurers and providers (Lyon, 1999), but few studies focus on the role of market forces within the system as a whole (Gaynor et al., 2014; OECD, 2010; Squires, Chilcott, Akehurst, Burr, & Kelly, 2016). The studies that measure efficiency based on the different policies used within countries primarily

rely on Data Envelopment Analysis, which measures relative efficiency based on differing levels of inputs and outputs (OECD, 2010; Ozcan & Khushalani, 2017).

1.2: Research Questions

The purpose of this study is to create and evaluate an integrative model of health care systems and markets lacking within the academic literature through the systems framework (Wan, 2002). Therefore, the central research questions focus on the context of health care (the market forces), the design of health care systems (health care funding and provision policies), and the performance and outcomes of the interaction between the context and the design:

1. Context: What are the market forces at work within health care and how do these forces differ from a competitive market (how does supply and demand in health care differ from supply and demand within competitive markets)?
2. Design: Based on these market forces and their effects on the overall health care market, what are the differences in health care policies and structures that lead to disparate health outcomes in terms of quality, access, and economic efficiency in advanced industrial nations (based on the supply and demand in health care, what are the different policies used in advanced industrial nations that lead to different outcomes in terms of quality, access and economic efficiency)?

   How do the health care policies and structures in a country affect the market forces for health care within said country (how do different health care policies affect the supply and demand of care)?
3. Performance: What are the differences in price, quality, and access to care caused by these policy interventions?

4. Outcomes: What are the individual effects of price, access, and quality of care to health outcomes based on these different policies and market forces?

In other words, how do supply and demand markets affect health policies, and how do health policies affect the supply and demand of health care? And, how do these differences affect the price, quality of care, access to care, and health outcomes?

1.3: Study Layout and Approach

Chapter 2 delves into previous studies and discusses their findings in depth regarding the provision of health care, the demand for care, and the demand for insurance. The next two subchapters in Chapter 2 discuss existing models of health care that involve combinations of the above aspects of health care, and studies that attempt to evaluate health outcomes based on policy interventions, respectively. And, the last subchapter of Chapter 2 discusses the gap within the academic literature that this dissertation attempts to fill. Chapter 3 develops a system wide, integrative market model of health care systems that is lacking within the academic literature. Chapter 4 discusses the methods that will be used to test this market model against real world data and analyze the differences between systems based on economic efficiency, quality of care, access to care, and health outcomes. Regression analysis, Time-Series-Cross-Section analysis, and structural equation modeling will be used to test the model created in Chapter 3 based on the most recent data from the Organization for Economic Cooperation and Development as well as the U.S. Bureau of Labor Statistics.

1.4: Terminology and Abbreviations

In this dissertation the "health care market" refers to the supply and demand of health care and their interactions with each other. The "health care system" refers to the policy

combinations chosen by a government regarding health care provision and insurance. The "market model based on system" refers to the integrative model of the interaction between the health care market and the health care system. The Organization for Economic Cooperation and Development is known as the OECD, Data Envelopment Analysis is abbreviated as DEA analysis, Time-Series-Cross-Section analysis is abbreviated as TSCS, and Structural Equation Modeling is abbreviated as SEM.

CHAPTER 2: LITERATURE REVIEW

Prior to 2009, data on health care systems' funding and provision of care was limited and had to be collected from individual government agencies. To address this issue, the OECD developed a uniform survey sent to all member nations about their funding systems, provision systems, and health care policies in 2009 (OECD, 2010). They provided this data to the public for the first time ever in 2012, with a follow up survey in 2016. This survey adds greatly to a more nuanced understanding of health care systems within OECD nations. The data demonstrates that not all universal or socialized systems are the same across countries (Gaynor et al., 2014; OECD, 2010). Due to a lack of comprehensive comparative data on health care systems, there have been few studies on this topic. This dissertation examines the previous literature on market forces within the health care sector, but as systemic market models are few and far between (Gaynor et al., 2014; Squires et al., 2016), a unique theory and model of systemic health care markets had to be created in Chapter 3. This current Chapter discusses previous literature on market forces within health care systems separated by supply of care, demand for care, and demand for insurance within health care. These individual aspects affect the quality of care, the access to care, and the economic efficiency of care. The United States has the most "free market" health care system, therefore the discussion of health care based on markets is primarily focused on the United States because other countries alter the functioning of the free market through greater levels of policy intervention. Subchapter 2.4 discusses the few studies that attempt to analyze multiple aspects of health care systems simultaneously. Chapter 3 discusses and builds the theory and model of health care systems and markets from an integrative

perspective that is lacking within the academic literature that will be used within this study. Chapter 4 discusses the research methods and the statistical methods and models used to evaluate the theory and model created in Chapter 3.

2.1: Markets and the Supply of Medical Providers

Studies dealing with market forces within the provision of health care, and supply of care, primarily analyze the role of competition and its effects on quality of care (Gaynor et al., 2014). Economic theory clearly shows that increased competition leads to increases in investments in quality and product differentiation. Price increases lead to higher entry into the market as new firms enter to gain economic profits: as competition increases the price should decrease to attract consumers. These studies generally focus on how competition for consumers increases the quality of care through increased investments in quality by providers to attract consumers whether within free market systems or within single payer systems (Chandra, Finkelstein, Sacarny, & Syverson, 2016; Gaynor, 2006; Gaynor et al., 2014). Increased prices should therefore result in more competition, a higher quality of care, and eventually a slowing of the growth rate of prices due to price competition. However, some studies within health care have actually found that increased competition has led to lower quality of care (Propper, Burgess, & Green, 2004; Volpp et al., 2003), or led to increases in costs (Krabbe-Alkemade et al., 2017).

Krabbe-Alkemade, Groot and Lindeboom (2017) analyze the market for health provision within the Netherlands due to the recent changes in policy dealing with health provider price competition. The Netherlands had public insurance and changed to managed competition of insurance. They examine whether hospitals focus their price competition to different aspects of the provision of health care. Their major findings are that inpatient costs increased (for unknown reasons according to the authors) and outpatient costs decreased due to a decrease in the number

of activities to treat outpatients. They conclude that hospitals primarily look for cost savings through more efficient outpatient treatments (Krabbe-Alkemade et al., 2017).

There is relatively a large agreement within the literature that health care markets contain a high level of market concentration and that market concentration is increasing, particularly in the area of acute care hospitals (Dunn & Shapiro, 2012; Gaynor et al., 2014; Kleiner, White, & Lyons, 2015). Primary care practices tend to be concentrated as well, but to a lesser extent than hospitals and with great variation in concentration based on regional differences (Dunn & Shapiro, 2012; Gaynor et al., 2014; Kleiner et al., 2015). Specialty practices, like hospital practices, tend to be highly concentrated and increasing in concentration (Kleiner et al., 2015). In economic theory, concentration of markets leads to higher prices of care and often decrease the quality of goods and service (Gaynor & Town, 2011). Anti-trust laws are created to avoid the concentration of markets to stave off price increases and decreases in quality. However, in health care, market concentration appears to have no effect on the quality of care either positively or negatively (Gaynor et al., 2017; Kleiner et al., 2015; Romano & Balan, 2010).

These two aspects of competition within health care provision create a paradox; higher prices are a product of market concentration but do not lead to decreases in the quality of care like market concentration causes for other goods and services. Higher prices lead to more competition for consumers which should lead to lower prices and increase in investments to the quality of care. Therefore, market concentration causes high prices, which should, in turn, increase competition over time, and cause a decrease in prices as firms attempt to attract consumers, but the studies are divided. A lack of competition allows for price setting, and high prices without ensuring the provision of good quality of care. These high prices should then increase competition as new suppliers enter the market. Competition should then increase the

quality of care and decrease price. However, in health care, the markets are becoming more concentrated and prices continue to rise, while simultaneously investments in quality continue to increase. In health care the trend is for increasing market concentration, increasing prices, and increasing quality of care despite the increase in overall market concentration (OECD, 2010).

Kyle and Williams (2017) offer one explanation for this apparent paradox. They argue that fee-for-service and no supply constraints leads to the rapid adoption and diffusion of medical technologies with small or unknown benefits which drives cost upward. Medical providers rapidly adopt new technologies and treatments to compete for consumers, but these "new" technologies cost more and do not necessarily increase health outcomes (Kyle & Williams, 2017). Therefore, competition can lead to higher prices and does not lead to higher quality of care despite the investments in increasing the quality of care.

However, Gaynor, Ho, and Town (2014) offer a slightly different explanation for this apparent paradox. They argue that;

> A standard result in models with administered prices is that non-price (quality) competition gets tougher in the number of firms so long as the regulated price is set above marginal cost. Firms facing tougher competition will increase their quality in order to attract (and retain) consumers. This result is essentially the same as in models of industries with regulated prices (e.g. airlines, trucking) from a number of years ago. […] As is well known, the increased quality due to tougher competition can benefit consumers, but in general is not necessarily welfare increasing [does not reduce prices]. In particular, with entry costs, if firms neglect business stealing effects there can be excessive entry. In equilibrium firms capture less demand than they had anticipated, due to business stealing, so the benefits of entry from increased quality are more than offset by the entry costs of the additional firms. (pg 8)

Simply put, when price is set (whether by the government or due to market concentration), if the price is higher than the marginal costs of care, firms will compete for customers by increasing investments in quality of care (non-price competition) not by competing for consumers by

offering lower costs of care (price competition). The costs of this increased investment in quality are not spread out among consumers evenly due to business stealing which leads to higher prices overall. Firms invest more in quality than they recoup from their consumers, so they increase prices on their consumers to recoup costs. In other words, there is an excess of investment in quality in the market which leads to higher prices without creating proportional benefit to health outcomes despite the increased investment in quality of care due to business stealing (Gaynor et al., 2014). Another part of their explanation is that the measure of market concentration—the Herfindahl-Hirschmann Index:

> […] (or any market structure measure) is likely endogenous. Unmeasured variation in demand and cost factors affect both quality and market structure. For example, a firm with low costs is likely to both have a high market share (leading to a high HHI) and choose high quality. Alternatively, if high fixed cost investments improve quality, then hospitals in high density markets will have higher quality simply because they spread these costs over more patients. (pg. 12)

Gaynor, Ho, and Town then also examine the role that health insurance plays in the supply of care which will be discussed further in subchapter 2.4, as well as another explanation offered by Dunn and Shapiro (2012) offered for this apparent paradox by incorporating the role of health insurance when interacting with health care providers.

Trends in the supply of health care, therefore, are increasing prices due to increased market concentration and counterintuitive increases in investment into the quality of care which does not usually occur simultaneously with increasing market concentration. **Figure 1** shows this interaction based on the argument by Gaynor, Ho, and Town (2014):

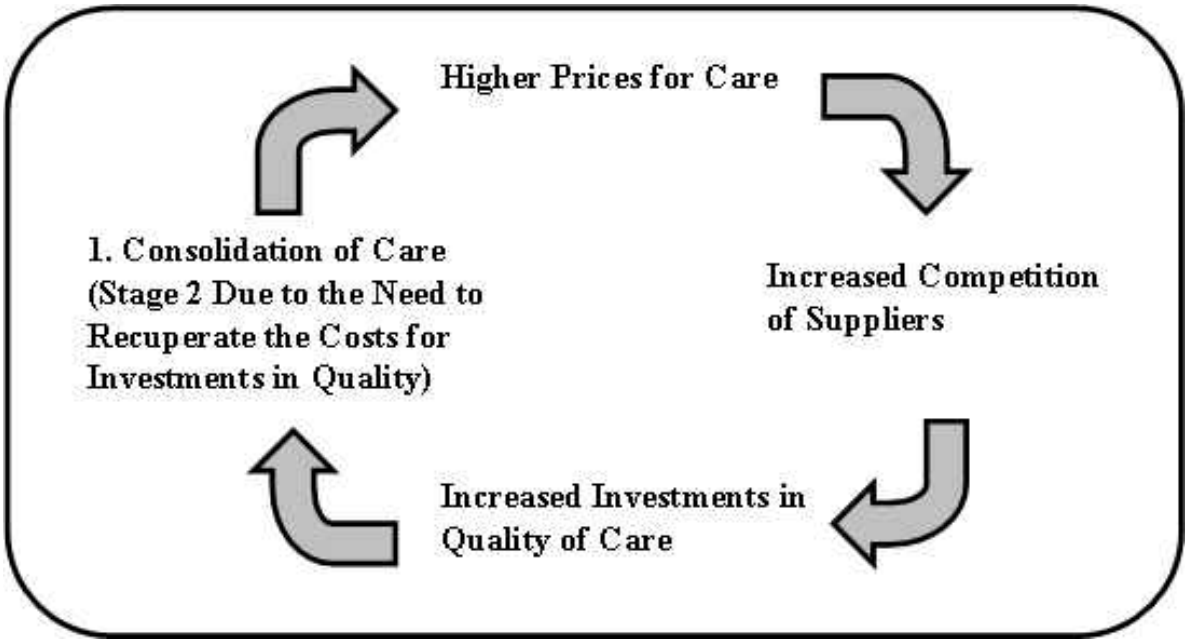


Figure 1: The Market and the Supply of Care

Figure 1 begins with a somewhat concentrated supply of health care providers. The increased market concentration causes an increase in prices. High prices lead to the ability to gain economic profit, which causes more competition in the supply of health care, which leads to more investments in the quality of care to attract consumers instead of price competition. Business stealing due to competition leads to more market consolidation as firms consolidate to recuperate costs of quality investments, and this consolidation, in turn, continues to increase prices. The market for the supply of care, therefore, leads to increasing costs through increasing consolidation of services, and, also increasing costs due to increasing investments in quality of care.

2.2: Markets and the Demand for Health Care

The demand for health care cannot be viewed as only a question of utility based on consumers' willingness to pay; health care is also based on need. Defining need is not necessarily straight forward in health care. Often patients do not know what care is "needed"

and must rely on the expertise of health care professionals and gate-keeping (Gaynor et al., 2014; Lieber, 2017). Most studies avoid defining demand based on need, and instead assume that the demand for care can be assumed as the amount of care sought rather than a theoretical need for care. This view of demand for care, is more accurate as a view of demand based on the ability to pay for care, rather than the need for care. Viewing health care demand as the ability to pay for care has led to many arguments about "moral hazard" being caused by decreasing the price of health care. Under this view, consumers will demand more care because they will not safe guard against risk if the care is free or inexpensive. Kill and Arendt (2017) found this to be true even in countries with public insurance, by analyzing the use of secondary private health insurance. They found that secondary insurance did increase the amount of services sought (Kiil & Arendt, 2017). Financial penalties for injury and illness will, therefore, reduce the demand for care as consumers will take better care of themselves and work to avoid risk suggesting that demand for care will decrease when consumers are forced to pay a portion of the costs, thus reducing "unnecessary" treatments. The problem with this view is that it is based on the assumption that receiving care, is the same as needing care. Obviously, those that have guaranteed payment of care will seek more care than those that must pay for the care themselves. This is because more consumers that need care will have access to care that they could not afford without the guaranteed care. Lieber (2017) shows that consumers often do not know the cost of care due to health insurance, thereby allowing providers to charge more than a normal market. This means that those with insurance may demand more care than they would if they directly paid for the services (the uninsured) even without moral hazard being an issue. Proving moral hazard requires proving that the demand for care shifts to the right due to insurance, not that demand decreases along the demand with the ability to pay curve as prices rise (Simon et al., 2017). In

other words, moral hazard cannot be assumed simply because the insured seek more care than the uninsured; the need for care could very likely be identical, and the different levels of usage are based on the ability to pay for needed care (Gaynor, Haas-Wilson, & Vogt, 2000). Gaynor, Haas-Wilson, and Vogt (2000) assume moral hazard within health insurance, but then show that it has no real effect on the market due to the already inflated prices of care within the United States. A more nuanced understanding of the demand for care needs be developed that incorporates the two aspects of demand—the demand for care based on need, and the demand for care based on the ability to pay for care.

Some studies do attempt to empirically analyze and quantify health care demand based on need. Hurley, Mentzakis, Giacomini, DeJean, and Grignon (2017) attempt to define need based on the public's perception of need within health care using survey data collected by the authors. They begin by defining three aspects of need within economics and how they relate to health care:

1. Health Status—A person has need if he or she experiences a deficit relative to the norm in terms of overall health.
2. Ability-to-benefit—A person has a need for health care only if there is an ability for the person to benefit from the care (someone may be sick, but there is no treatment).
3. The amount of resources required to exhaust benefit—A person has need for health care if gaining the care does not exhaust resources from others (minor health issues may be expensive to remedy, and therefore are not a need because they take away resources from other that have a higher ability to benefit from those resources).

Their findings are that the public views all three aspects are important for determining need for care, but the highest weight in the public is given to health status.

Simon, Soni, and Cawley (2017) also examine the role of need versus the ability to pay for care by examining the role of Medicaid expansion under the ACA. They compare the effects of insurance expansion to the poor in States that took the Medicaid expansion to those that did not accept the Medicaid expansion. Need, based on their study, is measured by preventative care. Preventative care can be considered a need despite current health status. Medicaid expansion led to increased access to care, and more preventative services. Simultaneously, expansion of Medicaid did not lead to increases in risky behavior in States that expanded coverage compared to those States that did not expand Medicaid. Overall demand for care increased in Medicaid expansion States, but no increase in risky behaviors occurred. This means that there is no evidence of moral hazard (Simon et al., 2017). Demand in health care, therefore has two different demand curves—those that need care, and those that can afford care. Medicaid expansion led to an increase in the demand for care because more consumers that need care received care that they could not previously afford. Utility in health care demand cannot be measured by an individual's revealed preferences, e.g. it cannot be based on a consumer's willingness to pay.

2.3: Markets and the Demand for Health Insurance

Like medical providers, the health insurance market is also highly concentrated within the United States. A 2009 study by the Government Accountability Office found that insurance markets were highly concentrated and are becoming more concentrated (Dicken, 2009). Single payer health care systems are also highly concentrated, hence "single payer". Some single payer countries have increased competition and decreased concentration within their systems in an attempt to reduce costs and increase economic efficiency (OECD, 2010). Concentration of insurance markets may have multiple theoretical effects when the prices are not mandated.

Concentrated markets could have higher premiums, a reduction in coverage (Dafny, Duggan, & Ramanarayanan, 2012), but also increased negotiating power with medical providers and economies of scale which could reduce overall health care costs (Ho & Lee, 2017; Scheffler & Arnold, 2017). Premiums for health insurance are set after insurance companies have negotiated with providers and created networks (Dunn & Shapiro, 2012; Gaynor et al., 2014), and younger, healthier, and poorer consumers are the only consumers of low cost, low coverage insurance plans (Bes, Curfs, Groenewegen, & de Jong, 2017). The price of health insurance premiums has mixed effects on the demand for insurance depending on the quality and benefits of the insurance at the given price (Bes et al., 2017; Krabbe-Alkemade et al., 2017; Lyon, 1999; Wang, 2017).

2.3.1: Market Concentration, Costs of Care and Insurance Premiums

Dafny, Duggan and Ramanarayanan (2012) examine the role of insurance market competition on the costs of premiums and the levels of coverage provided within the U.S. private health insurance industry. They hypothesize that insurance market concentration could have multiple effects on the costs of health care: increased premiums due to price setting, increased bargaining power over providers and economies of scale leading to a lowering of premiums. They use longitudinal data to control for exogenous factors that may cause markets to concentrate or premiums to rise outside of concentration. They find that most insurance markets are concentrated and becoming more concentrated. Premiums are not rising faster in concentrating markets than in non-concentrating markets, but major shocks in concentration have led to a 7% increase in premiums. They also find that consolidation of insurance leads to a change in health care employment, fewer M.D.s, and an increase in nurses (Dafny et al., 2012). This means that slowly concentrating markets are not causing premiums to rise, but consolidation of the largest insurers does lead to increases in premiums despite being able to

negotiate lower reimbursement rates with providers, and that providers are substituting nurses for M.D.s as insurance increases in bargaining power.

Ho and Lee (2017), like Dafny et al. (2012), examine the role of market concentration of insurance premiums. They use data from the State of California and model the removal of insurance providers. Their findings are similar to Dafny et al (2012) with one caveat: insurance competition decreases premiums, but insurer consolidation also increases negotiating power for reimbursement rates thus also decreasing premiums if employers (payers) limit amount of help to employees causing insurance companies to offer lower premiums to attract customers. If employers do not successfully place restrictions on insurance plans, consolidation leads to higher premiums despite the lower reimbursement rates (Ho & Lee, 2017). This implies that a monopolistic health insurer can negotiate fairer prices with medical providers than competing firms, but these savings are only passed on to consumers if the price of premiums and profits of insurers are mandated through policy or by employers having enough power to do so.

2.3.2: Quality and Price of Insurance, Effects on Demand

Bes, Curfs, Groenewegen and de Jong's (2017) article, "Health Plan Choice in the Netherlands: Restrictive Health Plans Preferred by Young and Healthy Individuals," examines the demand for restrictive health insurance plans compared to less restrictive health insurance plans within the Netherlands. Restrictive plans require the use of chosen networks of providers in exchange for lower health insurance premiums. These restrictive plans increase the bargaining power of insurers with medical providers to keep costs lower. The authors argue that the goal of this "managed competition" system is to decrease costs of care by providing consumers with greater choices of insurance providers. They found that restrictive plans were selected by the young and the healthy, or those with low income. Those that need care (based on

health status) did not select these plans and preferred unrestricted plans that have higher premiums. According to the authors, "This means that [enrollees] who use care will be unlikely to choose a restrictive health plan and, therefore, health insurers will not be able to channel them to contracted care providers. This undermines the goals of the health care system based on managed competition."(Bes et al, 2017, pg. 345). This increased competition within health insurance does not lead to lower costs of care, or cause price competition among health insurance companies meaning there is no decrease in premiums to attract consumers. And, these plans remove the young and healthy from the insurance pools that include those that use the most care. Increasing health insurance competition by allowing a wide variety of plans does not reduce overall costs, as different types of consumers purchase the different levels of insurance based on income, and health status with more expensive insurance plans being more desirable than less expensive insurance plans.

Lakdawalla and Sood (2005) examine how health insurance markets affect the quality of care provided by examining how paying for insurance ex ante in exchange for a ex post fixed cost sufficiently rewards innovators economically for their innovations. Lakdawalla and Sood (2005) state that:

> Society must make a difficult choice between rewarding today's patients with lower prices, or rewarding tomorrow's patients by inducing more innovation. In many respects, this is viewed as a zero-sum game that requires trading off the welfare of one group for the welfare of the other. However, in the particular context of health care innovation, society may be able to achieve efficiency for both today's and tomorrow' patients. The unique and important role of insurance in these markets explains why. Health insurance resembles a two-part pricing contract, in which a group of consumers pays an upfront fee in exchange for lower prices in the event of illness. Such two-part pricing contracts can guarantee both the efficient utilization of a product for today's patients, and a sufficient level of profit to induce innovation on behalf of tomorrow's patients. (pg. 2)

Pre- paying insurance for future use leads to innovations in health care because consumers are given a guaranteed payment of services used and innovators can charge insurance for these new innovations when there is competition in the insurance market. However, a lack of competition within the health insurance market leads to less innovations as payment can be below marginal costs of future innovations. They argue the reason for insurance market concentration leading to a lack of innovation is because monopolistic insurers can reduce payments to medical providers below the marginal costs of the innovation. They also note that the uninsured will not have access to care, and therefore, they do not benefit from innovation due to monopoly price setting of medical innovators (Lakdawalla & Sood, 2005).

2.4: Comprehensive Market Analyses of Health Care

Lyon (1999) examines the role of insurance competition on the quality of care, price of care, and supply of care, but also adds in the role of quality of care helping determine the choice of consumers on their selection of health plans. His analysis attempts to examine the interaction between health insurance demand, the supply of providers, and the effects on the quality of care. His model argues that consumers prefer insurance that provides a choice between providers because consumers do not know quality differences beforehand, and choice allows them to change providers due to perceived quality. Choice of providers within insurance forces providers to compete and invest in quality of care. Managed care reduces quality due to lack of competition of providers (Lyon, 1999). Lyon (1999) states that:

> Pure insurance competition softens price competition between hospitals, leading to high prices; the resulting high margins induce hospitals to invest excessively in innovation as a way to attract consumers away from rivals. As the cost of quality enhancement rises, the insurance equilibrium is vulnerable to entry by managed care plans that lock up market share by eliminating ex post choice of hospital. Entry by managed care plans has a

> prisoner's dilemma character, however, and hospital prices and revenues fall as a result […] hospitals to control costs by reducing investments in quality of care. (pg. 574)

Competitive insurance markets mean less bargaining power for insurers and providers can set price, this high price leads to competition between providers through quality investments. The high costs lead to managed care plans (that limit choices for consumers) reducing profits and investments in quality of care, which induces consumers to prefer health insurance plans that provide choice of providers.

Herring and Trish (2015) examine the slowed growth in national health care spending in the United States during the Great Recession to determine if the recession decreased the growth of health care spending or if other structural changes occurred. Their work is pertinent to this study, not because of their analysis of the Great Recession, but due to their model of health care markets that incorporates the role of the insurance market and the provider market. They create a regression model that finds that the variables with the most explanatory power for health care spending are: income, insurance market characteristics, and provider market characteristics (Herring & Trish, 2015).

Another study to analyze health care markets more comprehensively was performed by Dunn and Shapiro (2012), "Physician Market Power and Medical-Care Expenditures". They examined only the U.S. health care market, and thus does not include an analysis or comparison of effects between the different system types. They attempt measure and analyze how market concentration within both the provision of care and the insurance market affects costs of care and utilization of care using the Herfindahl-Hirschmann Index (a commonly accepted measure of market concentration) (Dunn & Shapiro, 2012; Gaynor et al., 2014). Market concentration being the level of competition within the health care system—the more concentrated markets having less competition. Physician practices are less concentrated than hospitals, and therefore allowed

the authors to compare concentration level's effect on price and quantity of care. Their findings are (Dunn & Shapiro, 2012):

> The effects of physician bargaining power are important given the observed consolidation of physicians over the past few decades, and the potential increase in consolidation due to health care reform. This paper studies the role of physician bargaining leverage in determining service prices and service utilization—the two components of physician medical-care expenditures. Our estimates suggest that those physicians with greater market power relative to insurance carriers are able to receive higher service payments. Unlike typical markets, these higher payments do not correspond with lower utilization and may in fact increase utilization. We attribute this result to a low proportion of price sensitive patients as well as the presence of an upward sloping supply curve. Market power of insurance carriers also plays an important role. We provide evidence that insurance carriers with greater market power are able to negotiate lower service prices and are also able to reduce the generosity of physician benefits. (pg. 42)

The important findings in their research are: 1) physician concentration leads higher prices; 2) insurance concentration leads to lower prices, although both with low R squares of 0.001; 3) insurance concentration leads to higher out of pocket expenses and premiums; 4) price changes to the consumer (in terms of out of pocket expenses) do not affect demand for vital services (cardiology versus orthopedic services); and 5) provider concentration leads to higher prices, but not a reduction in quantity demanded, and in some cases causes an increase in quantity demanded (Dunn & Shapiro, 2012). These findings lead to important implications for the model of health care systems and markets laid out in Chapter 3:

1. Higher prices are a product of provider concentration; monopolies and oligopolies in health care provision cause higher prices.
2. Insurance concentration can negotiate lower reimbursement rates.

3. Insurance concentration allows insurance companies to increase profits by offering lower levels of service and higher premiums without increasing quantity of care, or quality of care.
4. Demand for care is dependent on need, not on price.
5. Higher prices of health care may increase demand for care, meaning that health insurance possibly acts like a Giffen Good.

Studies considering the interplay of multiple aspects of the health care market may lead to a more accurate interpretation of the effects of supply and demand within health care.

2.5: Analyses of Health Care Systems Based on Quality and Technical Efficiency

Ozcan and Khushalani (2017) attempt to integrate the analysis of system type and technical efficiency measures. They use Dynamic Network DEA analysis to compare efficiency of health reforms within the OECD by comparing them to their counterparts. Unfortunately, their analysis does not specify the type of reform in terms of increasing or decreasing markets within the systems. Their results showed that health care systems that altered policies to become more economically efficient, or efficient in the allocation of resources were all successful. In fact, countries that continually worked to become efficient were more efficient than countries that did not alter their policies (Ozcan & Khushalani, 2017).

The OECD's (2010), "Health Care Systems: Efficiency and Policy Settings" released their preliminary analysis of health care quality and efficiency caused by policy interventions based on their newly created survey in 2009. The study separates health care systems into six categories of systems based on policy differences within universal and socialized health care systems (the U.S. did not participate in the 2009 survey). The OECD study is large and has

several implications for this dissertation, and these differences within system type (universal and socialized) are discussed in further depth in Chapter 3.2. The study used DEA analysis to compare the efficiency of countries' health care systems by comparing them to their counterparts within these six groups and between groups within these six groups of countries. The OECD's (2010) main finding was that:

> There is no clear indication that one health care system systematically outperforms another. On the contrary, countries performing well can be found in all institutional groups. Countries doing poorly are also present in most groups. (pg. 138)

DEA analysis is limited in its ability to establish causation, and these in group results merely show that some countries are more efficient than others with similar policies and inputs. The interesting and important implication of their results, however, is that the between group variation was not as large as the within group variation. No system was more efficient at allocating resources than any other system (OECD, 2010).

There is a plethora of academic research on the efficiency and quality of health care within each system type that utilize a wide variety of statistical methods. Within system variation and outcomes show that there is not necessarily a tradeoff between quality and efficiency (both efficiency and quality could be increased/decreased simultaneously) (Lee, Wan, & Kwon, 2013; Lee & Wan, 2002; Stange, 2014; Tang, Wan, Ortiz, Meemon, & Paek, 2011; Wan, Lin, & Ma, 2002; Wan, Zhang, & Unruh, 2008). These studies focus on mechanisms for increasing both economic efficiency and quality of care within a given system type. The findings are substantial on policy interventions within a system that increase or decrease efficiency and quality of care.

Wan, Lin, and Ma (2002) examine the role of integration mechanisms in integrated health care delivery systems. Integration being the horizontal and vertical connection and network of

providers combined to provide seamless continuation of care to consumers. In economic terms, these networks represent a consolidation of small practices to reduce costs of care and increase the quality of care through coordination between providers and reduce waste and redundancy. Using SEM they find that integration of health care delivery systems are able to increase efficiency of care and quality of care (Wan et al., 2002). From a policy prospective (rather than an economic perspective), the consolidation of medical providers can lead to better economic efficiency and quality of care. This leads to important implications for health care markets, consolidation leads to higher quality and more efficiency for consolidated networks of providers. However, from the economic perspective, the efficiency increases caused through consolidation are not passed on to consumers as seen in the previous subchapter. Integrated health care delivery systems can increase the quality of care and efficiency of care, but these networks do not necessarily pass on these economic savings to consumers.

Lee and Wan (2002) confirmed the result that integration did not lead to an immediate financial benefit to consumers. They used structural equation modeling to analyze clinical integrations effects on economic efficiency and quality of care looking at the average total charges passed on to consumers. Their major finding was that:

> With the negative efficiency indicator used in the analysis, hospitals with lower average total charges for treating patients were considered more efficient as compared to others. Clinical integration was regarded as the strategic behavior of hospitals to reduce charges on the patient bill. Our data analysis does not support this assumption. The extent of structural clinical integration is significantly associated with the average total charge per discharge, but the sign is opposite to expectation. Hospitals with highly clinically integrated structures showed higher average total charges than others with less clinically integrated structures. (pg. 241)

Integration of health services should lead to better economic efficiency (for the provider) and quality of care, however, these results show that any savings through integration were not passed on to the consumer (Lee & Wan, 2002).

An important implication of these studies analyzing health care systems effects on quality and technical efficiency is that; quality and efficiency are not mutually exclusive, and that within each system there is great variation in efficiency and quality that needs to be accounted for and included in any analysis of health care systems and markets. An integrative model needs to account for this within system variation.

2.6: Theoretical Framework for Analysis

As seen above, there is an extensive academic literature dealing with various aspects of health care markets. And, there is great variation within each health care system used by OECD countries (Ellis et al., 2014; OECD, 2010). For the purpose of simplicity and beginning the discussion, this dissertation begins with a generalized version of each system type; and a basic supply and demand model based on these generalizations. **Figure 2** lays out the most simplistic version of the market model that will be developed and analyzed within this analysis:

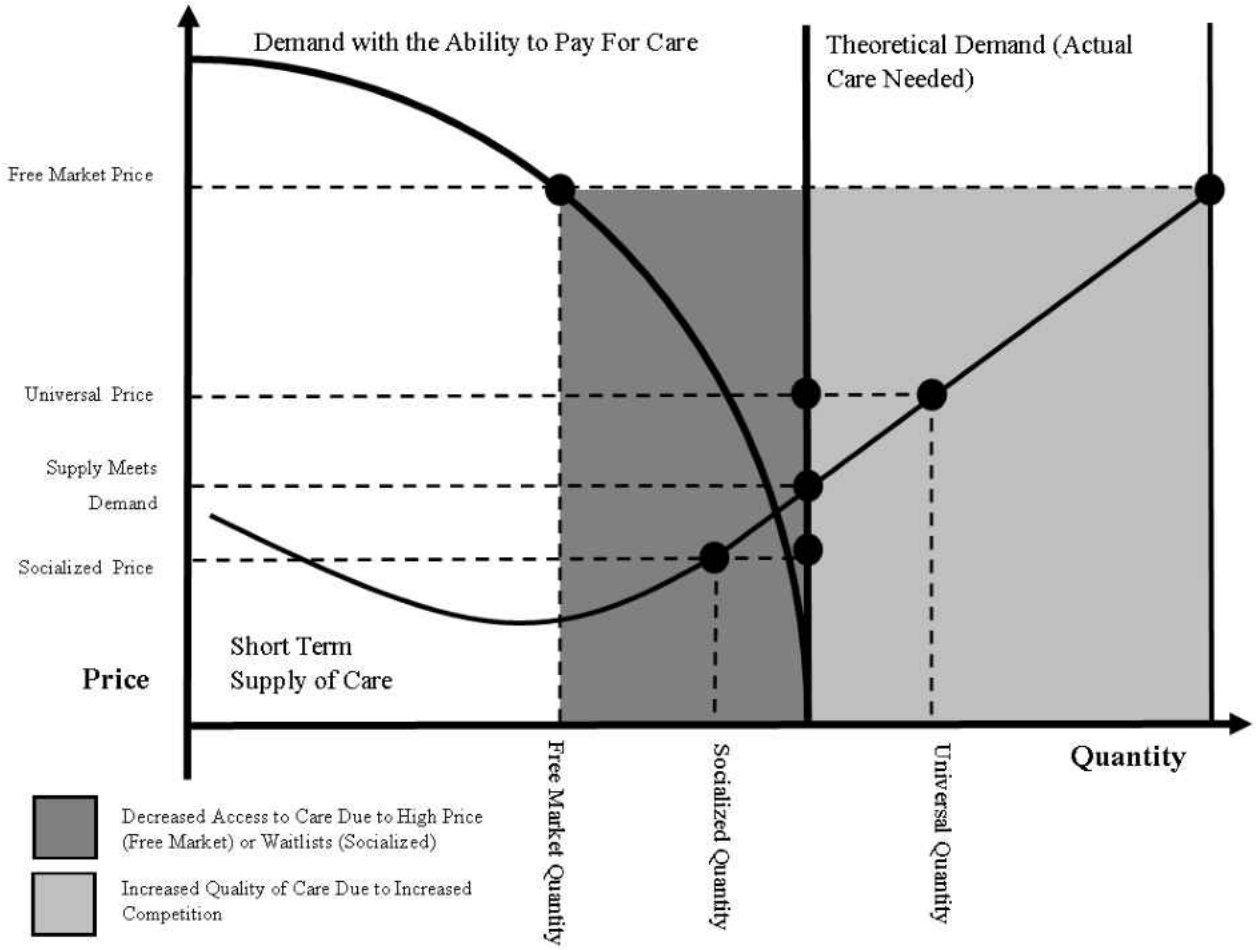


Figure 2: Basic Market Model of Health Care Based on Health System

This model builds upon my Master's Thesis (Helligso, 2007). In that research, a model of health care markets was created due to lack of previous literature using integrative system wide models of supply and demand (**Figure 2** is a variation on that original model), and was analyzed using regression analysis and dummy variables for health care system types. Regression analysis, unlike DEA analysis, allows for an establishment of causation. In **Figure 2**, the basic argument is that the type of health care system determines per capita expenditures (price) of health care, which determines the supply and quantity of care provided. Free market systems, due to provider price setting, will cost substantially more than the ideal price that would cause supply

and demand to meet. This elevated price will increase competition for providers entering the market, which will increase the quality of care. However, this elevated price will simultaneously reduce access to care as consumers are priced out of the market. Universal systems will force a negotiation between the single payer for care and the monopolistic providers of care. Due to information asymmetries, providers will be able to negotiate a price slightly higher than the point that the short-term costs of care meet the demand for care. This slight elevation in price will increase competition and thus quality of care, and full demand will be met. Socialized systems will push price closer to the point where long-term costs meet the demand for care (which is lower than the point where short-term costs meet demand). This occurs because the government controls the provision of care, and therefore knows the long-term costs of care. This will lead to possible shortages in supply creating waitlists, as all consumers are guaranteed care. It will also cause a decrease in the quality of care, as there is little financial motive for entry of new suppliers and therefore less competition. Mathematically these relationships and testable hypotheses of causation are expressed as **Equation 1**:

Equation 1: Relationships between Health Outcomes and Health Care System Types

Health Outcomes = *f* (Access to Care + Quality of Care).

Access to Care = *f* (Price).

Quality of Care = *f* (Price).

System Type = *f* (Level of Free Market Insurance + Level of Free Market Provision).

Price of Care = *f* (Wealth + System Type).

Therefore,

Health Outcomes = *f* (Wealth + System Type).

Equation 1 shows that, controlling for the wealth of a country, health outcomes are determined by the type of system used for funding care and providing care.

The results from my initial analysis of these relationships were encouraging and statistically significant at the 0.001 level and an R square of 0.71 (Helligso, 2007). The results showed that system type determined health care expenditures and that expenditures had a quadratic relationship with health outcomes as access to care and quality of care differed between system types. The use of dummy variables for system type created limits to the analysis, as policies within system types could not be analyzed. After my initial theory and analysis, the OECD has updated its data set and now includes data on funding mechanisms for insurance and private versus public provision of care based on surveys in 2009, 2012 and 2016. This new data allows for a more nuanced statistical analysis of health outcomes based on a variety of free market versus public policy choices within multiple aspects of health care systems.

CHAPTER 3: BUILDING AN INTEGRATIVE MODEL OF HEALTH CARE MARKETS AND SYSTEMS

As discussed in Chapter 2, there are no integrative theories or models for health care markets and their interactions with health care policies. To address this issue, Chapter 3 develops an integrative theory and model of health care markets and health care systems. Using a systems framework, this Chapter is divided into multiple subchapters shown in **Table 2**:

Table 2: The Health Systems Framework and Chapter Organization

Context →	**Design →**	**Performance →**	**Outcomes**
Market Forces: Subchapter 3.1 Demand for Care Supply of Medical Providers Demand for Health Insurance	Health Care System Type: Subchapter 3.2 Free Market Systems Universal Systems Socialized Systems Variation within System Type	Integrative Model and Performance Hypotheses: Subchapter 3.3 Price of Care Access to Care Quality of care	Methods for Testing the Integrative Model and Health Outcomes: Chapter 4 Analysis and Health Outcomes

Subchapter 3.1 discusses the economics of health care systems in terms of supply and demand. Because the demand for insurance and the demand for health care are separate but interrelated, the supply and demand for health care requires a discussion of the demand for care, the supply of medical providers, and a separate discussion of the demand for health insurance. Subchapter 3.2 discusses the role and effect of health care policies on the market for health care separating the policies into three major subgroups (free market, universal, and socialized). Then the differences within each subgroup are discussed. Subchapter 3.3 presents the final model based on the economics of health care and the interaction with health care policies based on the two previous subchapters.

3.1: Economics: Visualizing Supply and Demand within an Abstract, General Health Care Market

The market for health care is based on the supply of medical providers, and the demand for care based on the ability to pay for care. The ability to pay for care is based on health insurance; therefore, the market for health care is dependent on the demand for health insurance, the supply of care, and the demand for care.

3.1.1: The Demand for Care

Health care markets in every country, like markets for all goods and services, should be a function of supply and demand. In health care the demand for actual care is based on the need for care (Hurley et al., 2017). There are two separate demands for care within any given time period (Hurley et al., 2017): 1. The theoretical demand (**Dt**), those that need health care, 2. The demand with the ability to pay for care (**Da**) in **Figure 3**, those that can afford to pay for said care at a given price:

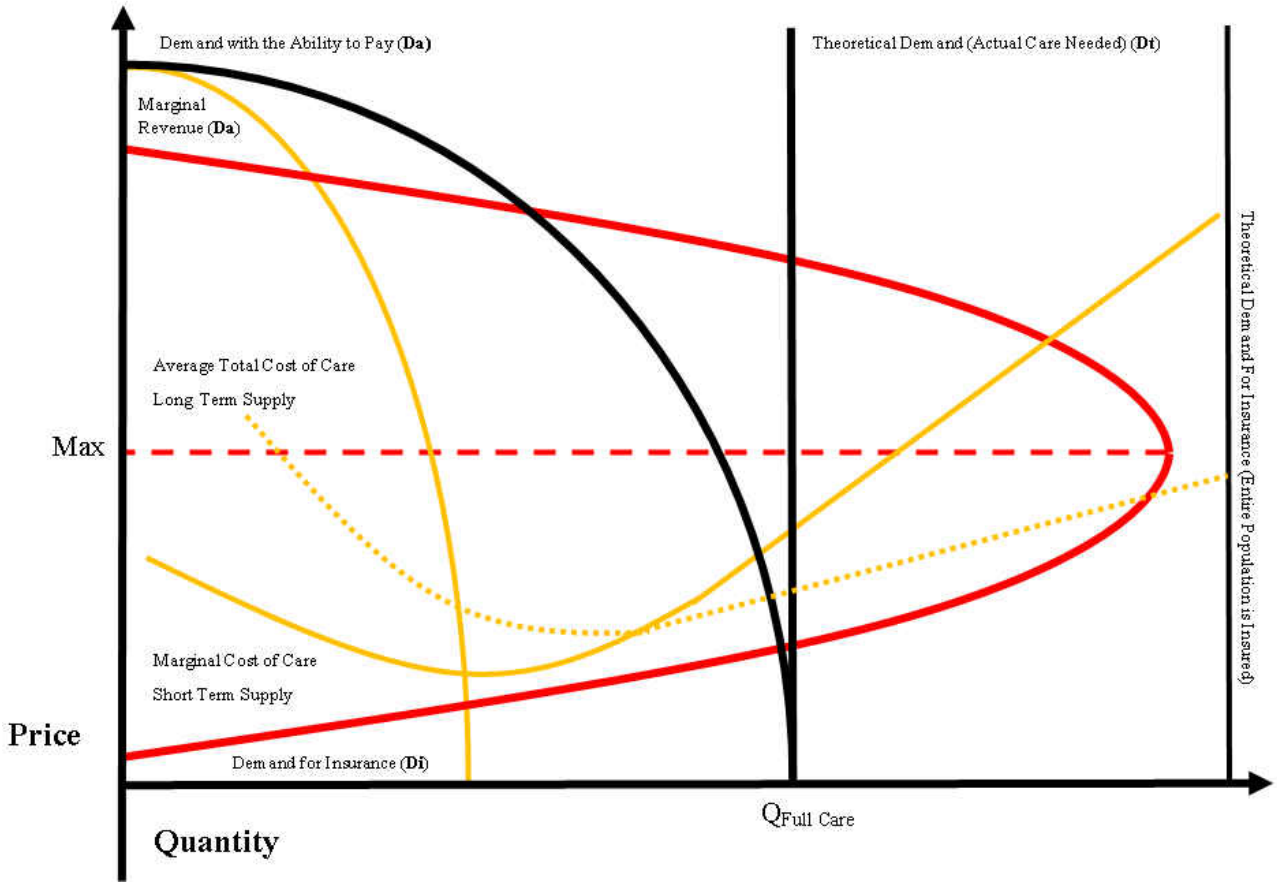


Figure 3: Base Supply and Demand Model for an Abstract, General Health Care Market

As seen in **Figure 3**, the theoretical demand for care is perfectly inelastic; no matter the price of the care, consumers still demand the care. The price of care is not a factor for the theoretical demand for care. As discussed in Chapter 2, the need for care is not equivalent to a consumer's choice in seeking care based on a given price (Hurley et al., 2017; Simon et al., 2017). If a consumer has cancer, that individual "needs" care no matter the price. The famous "RAND Health Insurance Experiment" found that the demand for care changed based on the level of coinsurance that consumers paid (Brook et al., 1984). Higher prices caused consumers to seek out less medical care whether they "need" the care or not. Consumers sought less health care in general, and the poor showed higher frequencies of sever health outcomes based on the increases in coinsurance (Brook et al., 1984). The poor still "needed" care but did not seek out care due to

the high costs. This leads to two different views on the demand for care—the "Theoretical Demand" and the "Demand with the Ability to Pay". This price-demand relationship is expressed as the "Demand with the Ability to Pay for Care" in **Figure 3**, and the "need" for care is expressed as the "Theoretical Demand for Care". The theoretical demand for care, like all inelastic demands, is represented as a vertical line at the quantity point that represents everyone that needs care. The demand with the ability to pay for care, however, will decrease as price increases. It would be a curvilinear relationship, as consumers would do anything necessary to pay for the care (including selling all assets or going bankrupt). These demands for care are represented in **Figure 3**, as **Dt** and **Da** respectively. The gap between Dt and Da represents those that need care but cannot afford care at any given price.

Figure 3 is not drawn to scale (if it were, the demand for care, and supply would be vertically elongated; making the figure much taller and thinner. Additionally, the demand for insurance would be horizontally elongated, making it shorter and thinner, and expanding much further right than the demand for care). **Figure 3** is drawn to represent multiple concepts in a visually appealing manner that allows for the concepts to be visualized from their abstractions, and with spacing set up for future analysis and information to be added. Demand for care is represented in black, the supply of care is represented in orange, and the demand for insurance is represented in red.

3.1.2: The Supply of Care

An important assumption for this analysis is that medical providers will act as normal, for profit suppliers, like suppliers for other goods and services based on their costs and revenues (Brekke et al., 2010; Crawford, 2010; Dunn & Shapiro, 2012; Gaynor et al., 2014). It could be argued that many, in the medical community, enter the medical field for reasons other than profit

(perhaps they are altruistic), and many organizations are non-profit. However, this analysis assumes that they will still behave as profit motivated actors (Brekke et al., 2010; Crawford, 2010; Dunn & Shapiro, 2012; Gaynor et al., 2014). The marginal revenue for providers, in **Figure 3**, for the demand with the ability to pay (**Da**) is either the demand curve itself (if provision occurs in perfect competition), or is one half the demand for the ability to pay for care (as with all marginal revenues for all monopolies) (Crawford, 2010) . The average total cost of care, and the marginal cost of care are drawn for visual representation and analysis based on "normal" economic concepts (Brekke et al., 2010; Crawford, 2010). In the short term, the marginal costs are the supply curve for health care provision (Gaynor et al., 2014); and in the long term, the average total cost of care is the supply curve for medical provision, as more providers will enter the market diminishing the economic profits (Brekke et al., 2010; Crawford, 2010). The average total cost represents the cost for treating a given quantity of patients including normal profit, there are always normal profits on the line even if there is zero economic profit (Crawford, 2010).

3.1.3: The Demand for Insurance

Health care is an extremely personal and intrinsically individualistic commodity. In academia, we often overlook the personal and individualistic—but to understand the nature of health care economics, and health care markets, requires an understanding of individual motives and utilities of those within the system. The demand for health insurance (**Di** in **Figure 3**) is different than the demand for health care (Dunn & Shapiro, 2012; Wang, 2017). The demand for care and the demand for insurance are related and have effects on each other, but they represent two separate demands for two separate goods or services (Bes et al., 2017; Dunn & Shapiro, 2012; Gaynor et al., 2014; Wigger & Anlauf, 2007). Consumers are willing and able to spend

less per month over a longer period of time to cover their expected use and/or perceived risk of medical complications (Ferreira & Gomes, 2017; Wang, 2017). Therefore, the demand for health insurance is based on a mixture of current need, and a cost benefit analysis of the consumer's risk on an individual basis (Bes et al., 2017; Gaynor et al., 2014; Wang, 2017). If one is high risk (currently needs substantial care due to chronic illness or disease), the demand for insurance behaves the same as the demand for care with the ability to pay (Bes et al., 2017). If one is not high risk, the demand for insurance is based on the judgement of individuals as to whether or not the recurring costs of the insurance will at least cover their possible future complications and/or use of health care. Individuals perform a cost benefit analysis based on the plans offered, and a calculation about how likely they will need to use the coverage (Bes et al., 2017; Gaynor et al., 2014; Wang, 2017; Wigger & Anlauf, 2007). Consumers will also look at the long term use of insurance, and they may choose to pay for insurance over a longer term, believing that, even if it is not utilized in the short term, it will eventually be worth the cost over the long term as complications arise (Wigger & Anlauf, 2007). How risk averse the individual is will also influence the decision to purchase health insurance (Olsen, 2009; Wang, 2017). Even if an individual is in good health that person may purchase more expensive plans due to risk aversity (Wang, 2017). The calculation looks something like **Equation 2**:

Equation 2: Cost Benefit Analysis for Utility of Health Insurance

Utility = ((# of utilizations per year) * (cost per utilization covered by the insurance) * (# of years)) + (Perceived likelihood of a catastrophic event per year * Risk Aversion) * (Cost of a catastrophic event) * (# of years)) ≥ ((Insurance cost per year) * (# of years)).

Under the assumptions from **Equation 2**, it would be very difficult for insurance companies to make a profit, as only those that think they will break even or come out ahead, in the long term, will choose to purchase the insurance plan (Bes et al., 2017). Due to incomplete information, however, many consumers will overestimate their costs and risks while others will underestimate, and insurance is almost guaranteed a profit due to this miscalculation of cost and risk (Gaynor et al., 2014; Wigger & Anlauf, 2007). Insurance companies also use more sophisticated models to determine and price risk than their customers. Even though insurance companies have an advantage in risk pricing, due to information asymmetry (Gaynor et al., 2014), profits are somewhat limited because consumers are making these cost benefit calculations. Insurance companies will also negotiate with health care providers to keep costs of care low (lower than the perceived costs to consumers) to further increase health insurance profits (Ho & Lee, 2017).

If the demand for health care is based on a given quantity needed within a given year, the demand for insurance would be represented as lower than the total demand for care at its highest point, but would exceed, in quantity, the actual demand for care at lower prices. Those that do not currently need care will still purchase insurance out of a perceived risk based on their individual cost benefit analyses (the highest price point on **Di** is lower than the highest price point on **Da**, and the quantity demanded on **Di** exceeds the quantity demanded on **Da** in **Figure 3**). To demonstrate how the demand for health insurance functions requires an examination of individual family utilities and budget constraints:

Case 1: The Middle-Class Family, Diabetic Child

Insurance is usually purchased at the family level, whether single member families or multimember families. The lower the cost of health insurance, the less coverage the insurance

provides. Low cost insurance, to save consumers money on their monthly premiums, will have limited coverage, high copays, high coinsurance, and high deductibles, or any combination thereof (Bes et al., 2017). As a result, these insurance plans offer little benefit for moderate health care utilization (Bes et al., 2017). The lowest cost health insurance plans are only desirable for those that will use them infrequently and only need catastrophic coverage (Bes et al., 2017). Those that need more frequent care will prefer to pay more per month for plans that reduce these copays, coinsurance and deductibles (Bes et al., 2017). Therefore, as the price of lower cost insurance decreases, the desirability of the plan will decrease, thus the demand will decrease. As the price of lower cost health insurance increases, the desirability of the plan will also increase, thus the demand will increase. This is counterintuitive unless one understands that inexpensive health insurance is an inferior good, and that higher priced plans are viewed as providing better returns on investment for consumers through a reduction in copays, coinsurance, and deductibles.

To demonstrate these concepts requires a look at budget constraints for various family units. Budget constraint analysis graphically demonstrates the decision-making process of individuals while choosing between two goods or services while facing budget limits. **Figure 4** represents a family of four, with a moderate family income, and one family member that has a chronic illness. In this scenario, "The Middle-Class Family, Diabetic child", there is a two-parent household, with two children, one of which has Type 1 Diabetes:

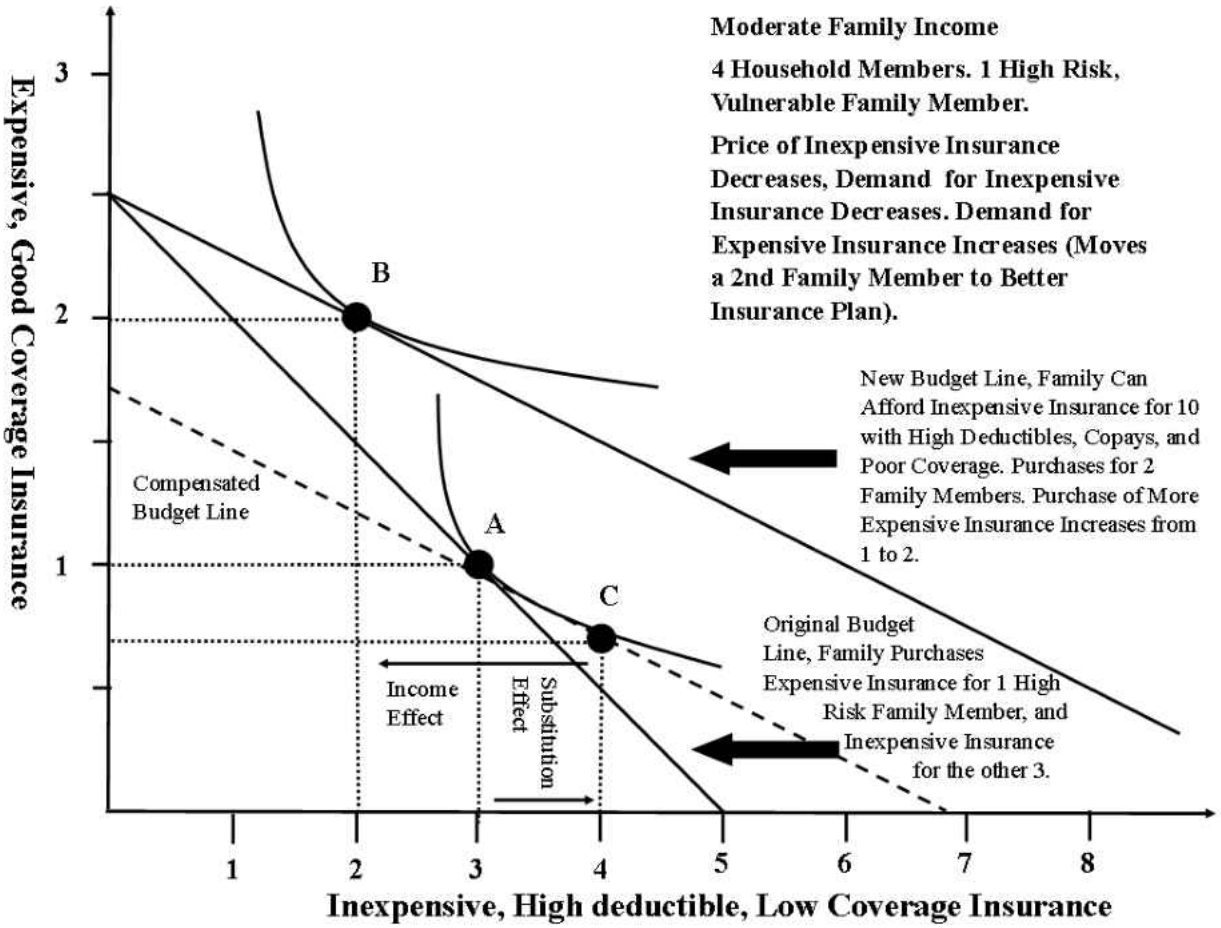


Figure 4: Budget Constraint for Moderate Income Family, Price Decrease of Inexpensive Insurance

In **Figure 4**, under the original budget constraints the family can afford inexpensive insurance for five family members, or expensive insurance for two and a half family members (partial insurance plans cannot be purchased). The family chooses to purchase the better plan offered for sale for their Diabetic child and the other three family members purchase the inexpensive plan (point A in **Figure 4**). Under this scenario the head of household's employer offers a new, less expensive health plan for purchase, or the price of the existing plan decreases. A new budget line is created using the new price of the inexpensive insurance. Under the new budget line, the family can now afford inexpensive insurance for a family of 10. The price of the expensive plan

has not changed, and therefore the family can still only afford the expensive plan for two and a half family members. Because the inexpensive plan has become even more affordable, there should be an incentive for the family to substitute the inexpensive plan in place of the more expensive plan they are currently purchasing (the substitution effect). However, the new price means that the family can now afford to purchase the more expensive plan for both of their children, and still afford inexpensive coverage for the parents (the income effect). More income has been freed up to purchase the more expensive, and desirable plan due to the decrease in price of the inexpensive plan. The substitution effect pushes the family to purchase more of the inexpensive insurance (point C in **Figure 4**), but the income effect outweighs the substitution effect in the opposite direction (point B in **Figure 4**). Ultimately, the family now chooses to purchase more of the expensive insurance and less of the inexpensive insurance—a decrease in price caused a decrease in demand for the good.

Conversely, take this same family, but the price of the inexpensive insurance increases. This increase in price then causes the family to increase their demand for the inexpensive insurance. **Figure 5** represents the inverse of **Figure 4**, where the price of the inexpensive insurance increases while the expensive insurance remains unchanged. Using the point B in **Figure 4** as the starting point for **Figure 5**, an increase in in the price of inexpensive insurance will cause an increase in the demand for inexpensive insurance as the income effect (inexpensive insurance is now consuming more income leaving less for the more desirable good) again outweighs the substitution effect.

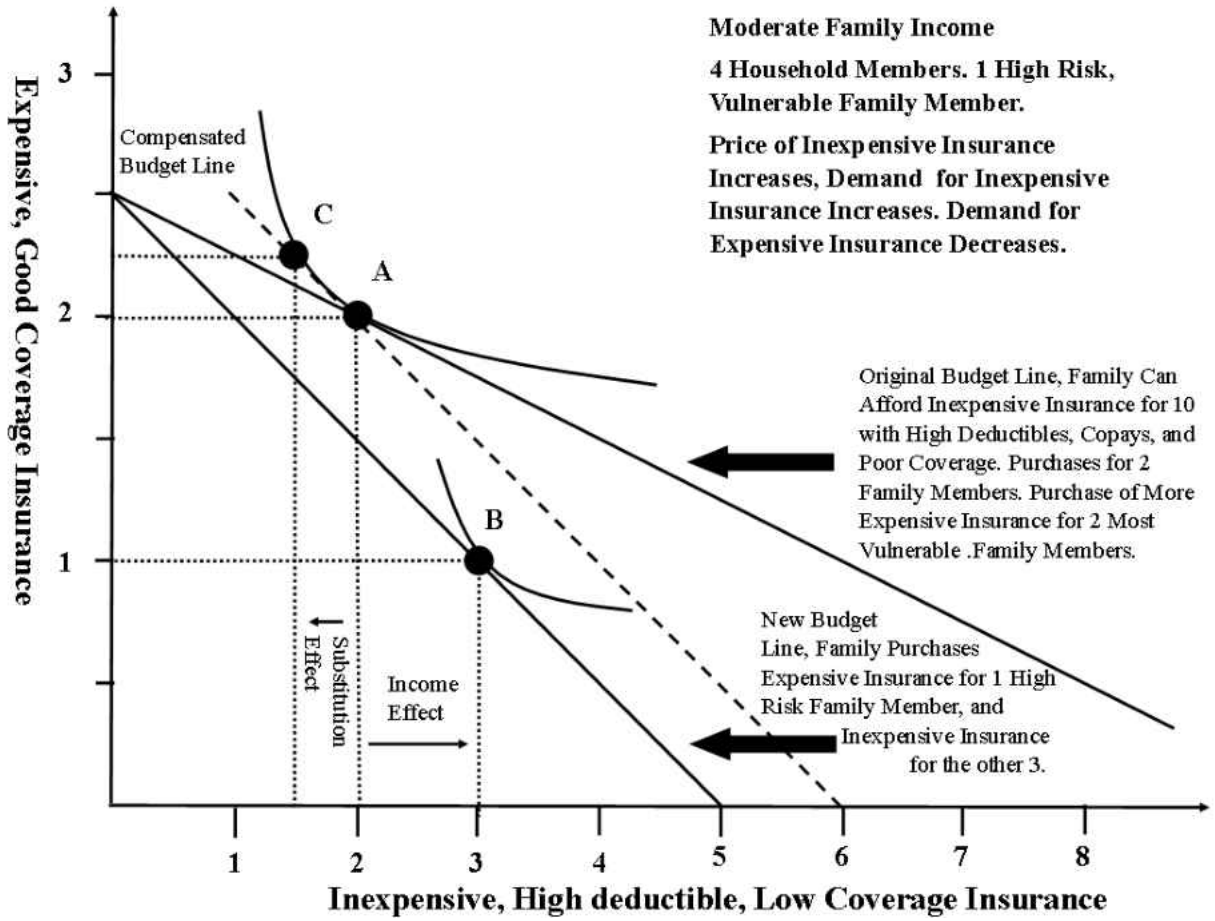


Figure 5: Budget Constraint for Moderate Income Family, Price Increase of Inexpensive Insurance

At moderate levels of income; as the price of inexpensive insurance increases the demand increases, and as the price of inexpensive insurance decreases the demand for inexpensive insurance decreases. Demand for insurance is functioning counterintuitively, and in opposition to the law of demand at moderate levels of income for a family with a high-risk family member. This is not a stand-alone case; this scenario represents a significant enough portion of the market to influence the overall demand within the market. It does not represent the entire market, though.

Case 2: The Upper-Middle Class American Family

Not every family has moderate levels of income or high-risk family members. Case 2 examines a wealthier family than case 1, with or without a high-risk family member. Risk is not as important of a factor for this family, because the family's income makes the risk of catastrophe decreased due to the family having enough money to cover events that a poorer family would still find catastrophic (a $10,000 medical event would be catastrophic for a poor family but would not be catastrophic for a wealthy family). This is the view of the family in an unrealistically idealized America, the America that most incorrectly assume, is how the "normal" American family and health care market functions—referred to now as "The Upper-Middle Class American Family". This is a somewhat unrealistic view of the "average" American's wealth and risk of catastrophe that many use as an example to discuss the "normal" American families—despite being above average, this family does occur within the market and provides insight into health care systems and markets. This is a family that is wealthy enough to afford good insurance for all family members, but not wealthy enough to pay out of pocket for seriously catastrophic events. This family desires good quality insurance, will make some sacrifices to attain the good insurance, but cannot sacrifice all its disposable income to do so. Unlike in case 1 where the price of inexpensive insurance changes, in case 2 the price of expensive, good quality insurance changes. The family has enough income to afford good insurance and will not purchase inexpensive insurance unless forced to do so due to income constraints. **Figure 6** demonstrates, that with a higher level of income, as the price of insurance increases the demand for insurance will decrease because the costs become prohibitive:

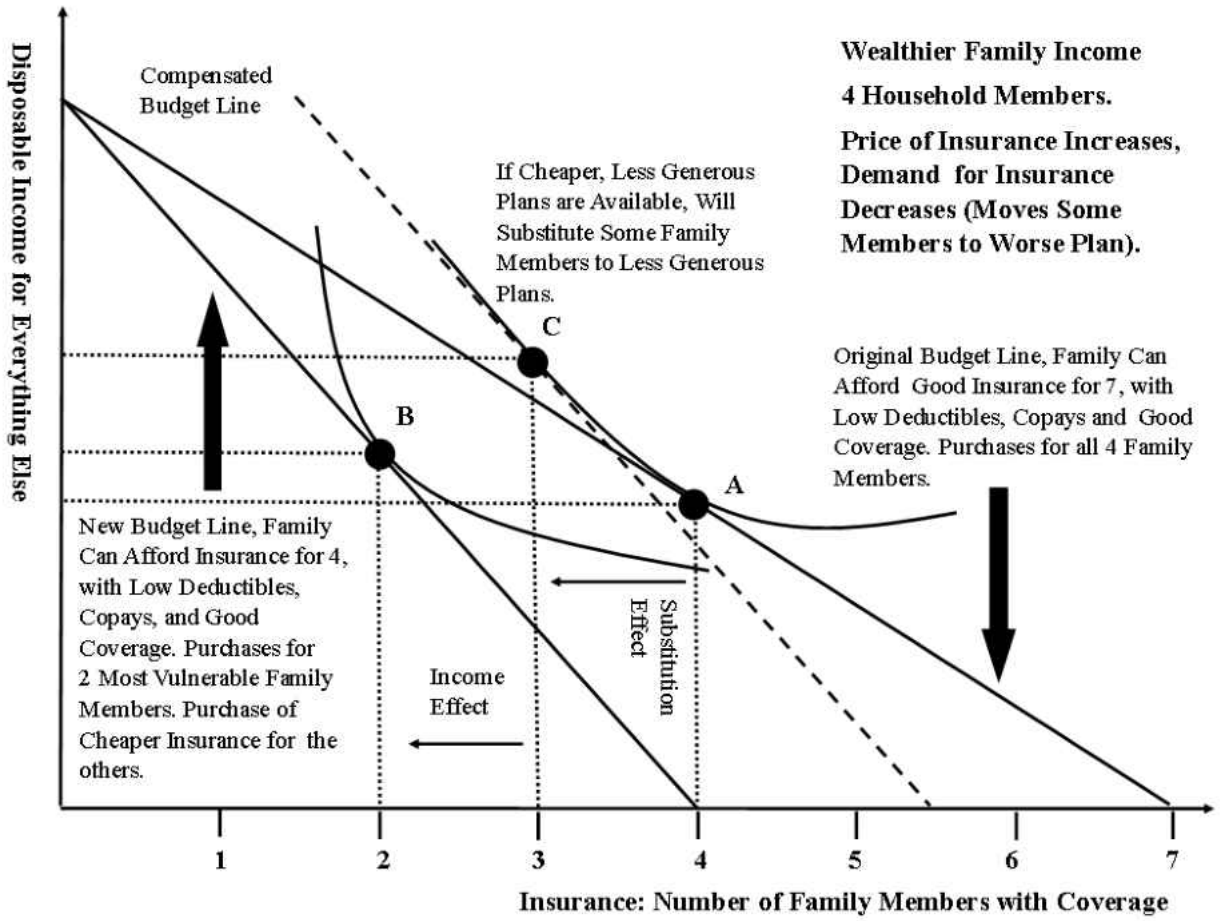


Figure 6: Budget Constraint for Wealthy Family Income, Price of Expensive Insurance Increases

The wealthier family's original budget line allows them to purchase expensive insurance for all 4 family members with excess money left over for their disposable income (point A in **Figure 6**). Both the income effect and the substitution effect reduce the number of family members covered under the expensive insurance plan. This family can no longer afford expensive insurance for all four family members and leave enough disposable income for other goods and services. This family will substitute less expensive insurance plans for some of the more expensive plans, which leads to an increased demand for moderate insurance plans through the substitution effect. This price for insurance is above the Max line for the demand for insurance in **Figure 3.** Beyond

this max line in **Figure 3**, insurance prices become prohibitive, and demand decreases as price increases due to a lack of income, not due to the utility for the consumers.

Health Insurance as an Inferior Good

As seen in the above scenarios, inexpensive health insurance is an inferior good. This argument can be further substantiated by comparing inexpensive insurance to expensive insurance based on various levels of income simultaneously:

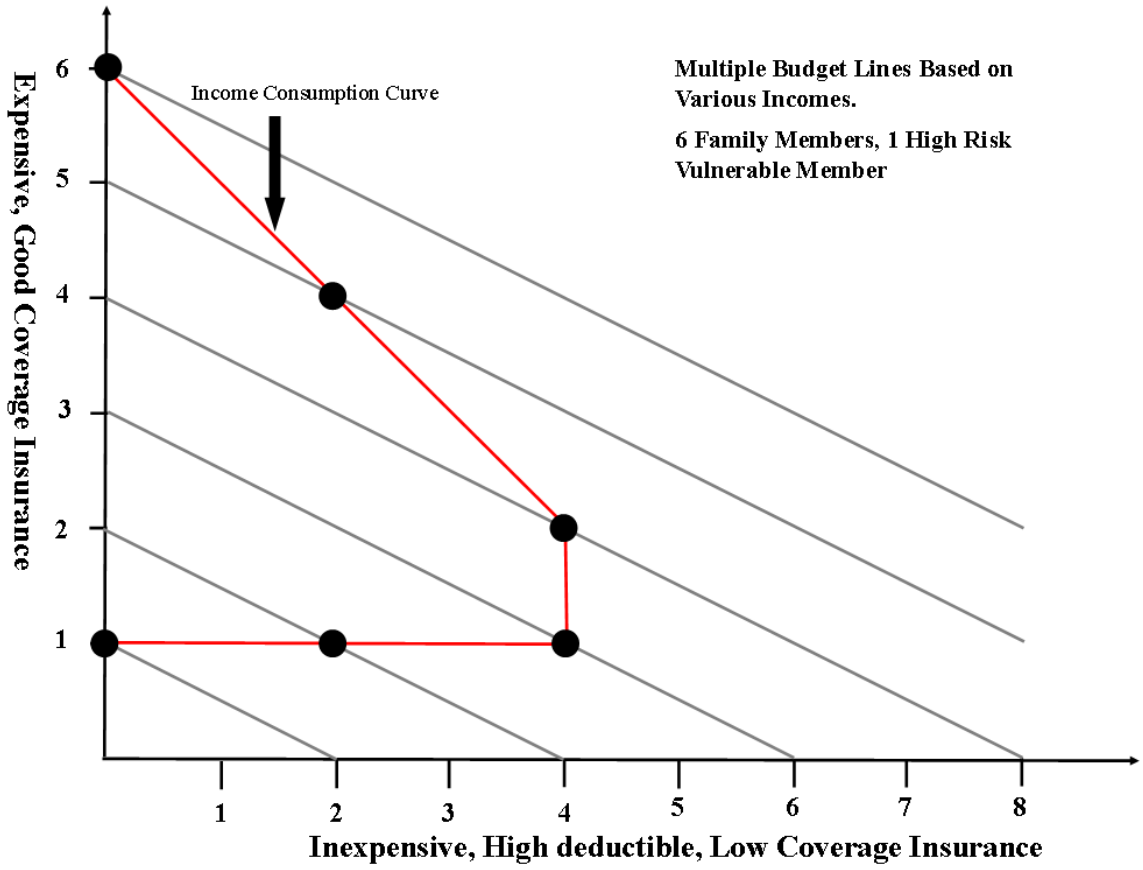


Figure 7: Inexpensive Insurance Demand Compared to Expensive Insurance, Multiple Budget Lines

Figure 7 shows that inexpensive insurance is an inferior good compared to expensive insurance (Bes et al., 2017). Each grey line represents a different income level. As incomes increase, the families are able to purchase more insurance. The fourth budget line shows that even though the

family could save money by purchasing the inexpensive insurance, they would purchase an extra expensive plan. At incomes beyond this point, the demand for expensive insurance continues to increase while the demand for inexpensive insurance decreases. Families only purchase inexpensive health insurance because they cannot afford expensive insurance. Expensive insurance is also an inferior good as wealth increases. For the very wealthy, health insurance is a needless expense in the sense that, as wealth increases, the willingness to purchase health insurance decreases as the price of insurance consumes more disposable income. An upper-middle class family may be willing to pay 10% of their disposable income to provide good quality insurance for all family members, but not 20% of their disposable income. Whereas, a middle-class family may be willing to pay 20% of disposable income to provide good quality insurance for all family members. An increase in wealth causes a decrease in demand for insurance based on the percent of disposable income consumed. The quantity demand for health insurance may be the same for both an upper-middle class family and a lower-middle class family at a given price, but the demand based on the percent of income consumed is drastically different.

Health Insurance Functioning as a Giffen Good

A Giffen Good (named after Sir Robert Giffen and first published by Alfred Marshall in Principles of Economics, 1895) is a good that violates the law of demand, in which the demand for the good increases as the price for the good increases, and usually only applies to the very poor (Jensen & Miller, 2007; Marshall, 1895). There is a debate as to whether Giffen Goods actually exist in reality, or are just theoretically possible (Jensen & Miller, 2007). For a Giffen good to exist it must meet certain criteria (Jensen & Miller, 2007):

1. The good must be an inferior good.

2. There must be a lack of substitute goods.
3. The expense of the good must consume a substantial portion of income, but not all of income.
4. A Giffen good will have a demand that increases when price increases in opposition to the law of demand.
5. The income effect will dominate the substitution effect for the good, causing this counterintuitive effect on demand.

Health insurance meets every criterion of a Giffen good:

1. As demonstrated in **Figure 4**, **Figure 5**, **Figure 6**, and **Figure 7**, inexpensive health insurance is an inferior good (Bes et al., 2017).
2. There are no substitutes available for health insurance.
3. Health care currently accounts for 17.8 percent of the U.S.'s GDP, representing roughly $9,900 per capita. The median household income in the U.S. is $56,156.
4. **Figure 4** and **Figure 5** clearly demonstrate that, at moderate levels of income, as the price of inexpensive health insurance increases the demand increases—and, as the price of inexpensive health insurance decreases the demand decreases.
5. **Figure 4** and **Figure 5** clearly show how the income effect dominates the substitution effect and that the two effects work in opposition to each other for inexpensive health insurance plans.

Despite the debate around whether Giffen Goods exist in reality, health insurance meets every criterion for a Giffen good, and demand follows the predictions of a Giffen Good including the role of the income and substitution effects as seen in **Figure 4** and **Figure 5**. A preliminary examination of the data available from the US Bureau of Labor Statistics, shown in **Table 3**:

Table 3: U.S. Health Care Spending by Decile

Source: The US Bureau of Labor Statistics, 2017

	All consumer units	Lowest 10 percent	Second 10 percent	Third 10 percent	Fourth 10 percent	Fifth 10 percent	Sixth 10 percent	Seventh 10 percent	Eighth 10 percent	Ninth 10 percent	Highest 10 percent
Income after taxes											
Mean	$64,175	$6,774	$16,841	$25,423	$33,404	$42,410	$52,949	$66,676	$83,424	$108,743	$205,391
Average annual expenditures											
Mean	$57,311	$23,588	$26,675	$34,221	$39,308	$43,975	$51,351	$59,395	$70,411	$87,432	$136,873
Healthcare											
Mean	$4,612	$1,742	$2,565	$3,136	$3,918	$4,144	$4,388	$5,160	$5,722	$6,772	$8,577
Share	8.0	7.4	9.6	9.2	10.0	9.4	8.5	8.7	8.1	7.7	6.3
Health insurance											
Mean	$3,160	$1,210	$1,752	$2,173	$2,759	$2,922	$3,102	$3,619	$3,963	$4,491	$5,614
Share	5.5	5.1	6.6	6.4	7.0	6.6	6.0	6.1	5.6	5.1	4.1

The Bureau of Labor Statistics separates health care spending by decile and uses only private spending data. Therefore, the private spending per capita is less than the total per capita expenditures on health care of roughly $9,900 per capita, this also includes the public expenditures and employer expenditures on health care and health insurance. As seen in **Table 3** as income level increases, spending on health care increases. However, the percent of spending used for health care fluctuates based on income with the middle class willing to spend more than either the poor or the wealthy. Spending on health insurance also follows the same pattern of increasing as incomes increase, and then decreases at higher income levels. Further analysis will use State level data from U.S. Centers for Medicare and Medicaid Services (CMS) on enrollment and insurance selection through the "Health Insurance Exchanges" (CMS, 2018). This preliminary examination of the data from the Bureau of Labor Statistics suggests that more expensive health insurance is more desirable than inexpensive insurance; demand is only limited by income (increasing spending based on income levels). Inferior goods have declining demand as incomes increase because the wealthy purchase less of the good, therefore if health insurance is an inferior good the wealthy should pay less for health insurance than the poor. However, the increased expenditures on health insurance do not represent an increased quantity of insurance being purchased. Rather, it represents the purchase of more expensive health insurance plans while the same quantity of health insurance plans is being purchased. In other words, as incomes rise, the quantity of inexpensive health insurance plans decreases, and consumers purchase more expensive insurance plans. Similar to the findings of Bes et al (2017), the only group willing to purchase inexpensive health insurance is the poor--these plans entail higher out of pocket expenses (shown by the lower level of spending for insurance premiums, and less proportion on expenditures being spent out of pocket in the lowest decile). And, the middle class is willing to

spend more for insurance as a percent of spending and income than any other group as would be predicted of a Giffen Good (Jensen & Miller, 2007).

To test the statistical significance of the data and demonstrate how a Giffen good should behave at different income levels, a preliminary regression analysis was performed using these deciles from the US Bureau of Labor Statistics.

Table *4* shows the results from this preliminary regression analysis based on income deciles from the Bureau of Labor Statistics:

Table 4: Preliminary Regression Results for Testing Insurance Demand as a Giffen Good

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Model R Square
		B	Std. Error	Beta			
1: Dependent Variable = Mean Insurance Expenditures	(Constant)	1994.98	241.445		8.263	0.000	0.852
	Mean Income for Decile	0.016	0.002	0.923	6.794	0.000	
2: Dependent Variable = Percent of Expenditures Spent on Insurance	(Constant)	4.828	0.413		11.678	0.000	0.878
	Decile	0.800	0.173	2.730	4.633	0.002	
	Decile Squared	-0.088	0.015	-3.370	-5.720	0.001	

Regression Model 1, in

Table 4, tests income's effects on the willingness to purchase more expensive health insurance (increasing demand, and thus spending, due to increases in income). As expected, the data is significant at the 0.001 level, and shows that, as wealth increases, private spending on health insurance increases. The purchase of health insurance is limited by income level, and more expensive health insurance plans are more desirable than less expensive health insurance

(inexpensive health insurance is an inferior good). That said, the wealthy spend more on most basic goods and services in general, but they spend a significantly smaller portion of their incomes on these goods (Engel's Law). For example, the wealthy spend slightly more on food than the poor, but this increased spending on food represents a smaller percent of their expenditures than it does for the poor. **Figure 8** shows the differences in types of goods in relation to spending based on income level:

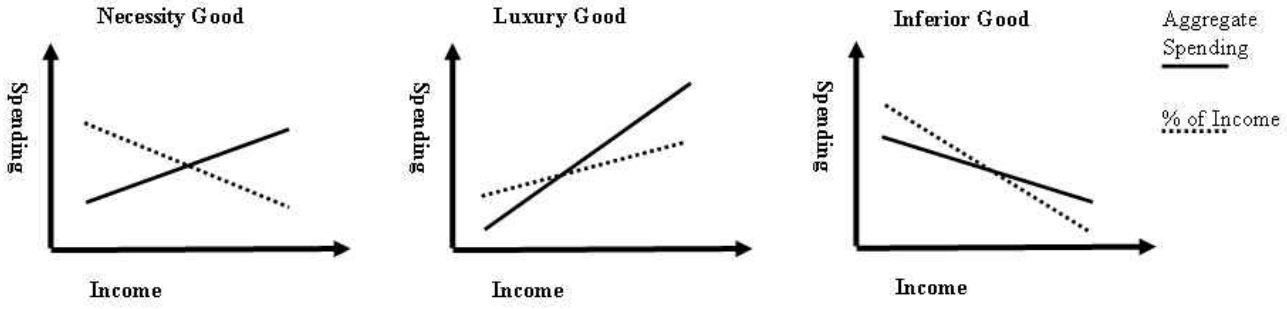


Figure 8: Relationship of Aggregate Spending, Proportional Spending, and Income for Types of Goods

Because insurance expenditures increase rather than decrease as incomes rise, it may lead people to believe that insurance is a necessity good, or a luxury good as seen in **Figure 8**. However, the increased expenditures are not due to increases in quantity demanded, but rather due to purchasing more expensive health insurance plans. Therefore, inexpensive health insurance plans should have decreased demand as income rises meaning it is an inferior good. To further test if health insurance spending is functioning like an inferior good, model 2 was created to test which group is willing to spend the largest portion of their expenditures on health insurance. As seen in model 2, percent of expenditures is used in place of percent of income because the lowest deciles spend more than their income, therefore to compare across deciles requires comparing proportion of expenditures in place of proportion of incomes. The model shows that as income

increases, the willingness to spend a larger proportion of income on health insurance increases, with an R square of 0.878 and all variables significant at the 0.01 level. More expensive health insurance plans are preferred over less expensive insurance plans as income levels rise as a proportion of income; **Figure 9** graphically shows this concept:

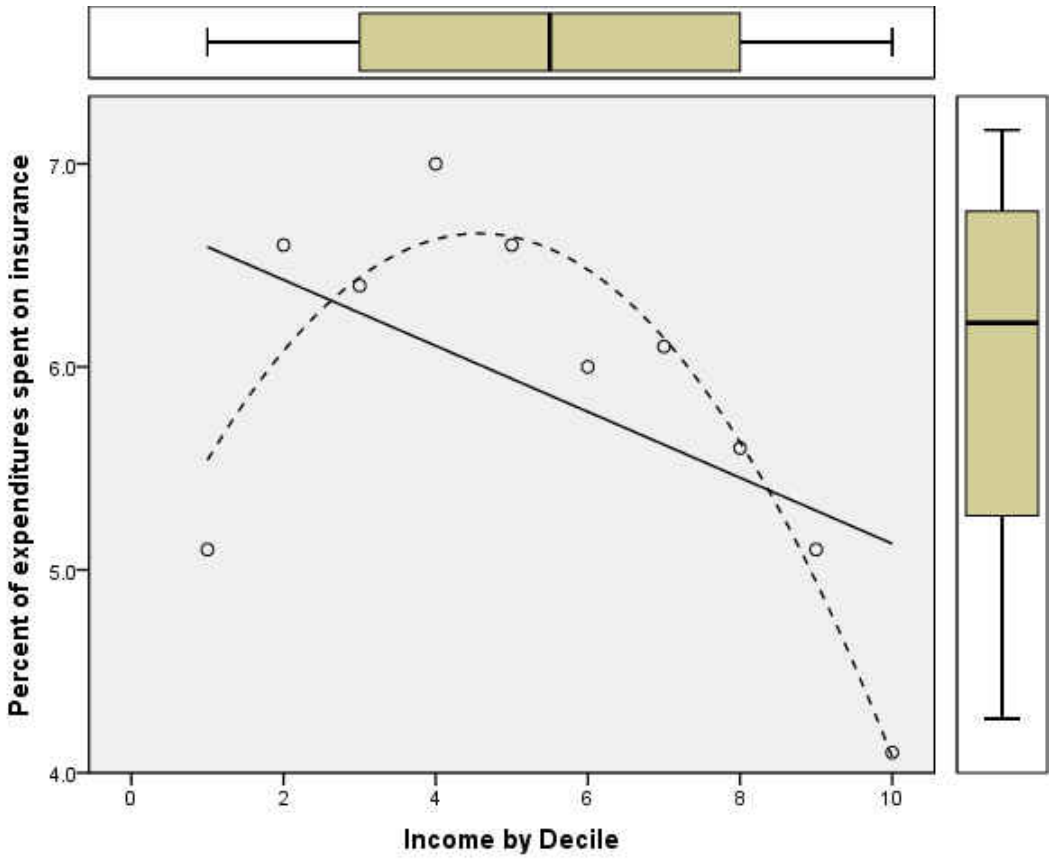


Figure 9: Quadratic Relationship Between Income and Insurance Expenditures as Portion of Expenditures

In **Figure 9** the linear regression line suggests (linear regression was not statistically significant, p=0.09) that; as income increases, the willingness to purchase more expensive insurance plans, which would take up a more significant portion of expenditures, does not increase. In fact, consumers become less willing to purchase more expensive health insurance as a proportion of their total spending under the linear model, thus making health insurance appear to be a necessity

good or inferior good. Despite this, health insurance cannot be viewed as a necessity good. The negative linear relationship is not statistically significant and, the increasing expenditures in model 1 represent purchasing more expensive health insurance plans, not increasing quantity of health insurance purchased. The quadratic model shows that, as incomes increase from the low end of the deciles to the middle decile income levels, the willingness to purchase more expensive health insurance policies increases. Consumers are willing to purchase more expensive health insurance in both total spending and as a higher proportion of their expenditures as incomes rise from the lowest decile toward the middle deciles. And, as income levels increase from the middle deciles toward the top decile the willingness to purchase more expensive health insurance as a proportion of expenditures decreases. This results in the creation of the "inverted-U pattern" similar to results found by Jensen and Miller (2007) which may be the only empirically documented Giffen behavior (Jensen & Miller, 2007). Another way to interpret this would be to say: as incomes rise from the lowest decile toward the middle deciles, the income elasticity of demand is positive (meaning more expensive health insurance plans are a luxury good for the very poor because they cannot afford better plans), but as incomes rise from the middle deciles to the top deciles, the income elasticity of demand is negative (meaning health insurance is an inferior good). The least expensive health insurance plans are not desirable to the middle incomes; they prefer more expensive health insurance, and all health insurance becomes less desirable as wealth reaches the highest deciles represented by the decreasing proportional spending. This mirrors the findings of Bes et al (2017), which found that more expensive, less restrictive health insurance plans, were more desirable than inexpensive, restrictive plans. This highly suggests that health insurance is acting as a Giffen Good; more expensive health insurance plans are more desirable than less expensive plans when controlling for level of

income (Jensen & Miller, 2007). Consumers prefer more expensive health insurance plans to less expensive health insurance plans if they can afford to purchase them up until a point where they will not purchase plans, as the prices become unreasonable and insurance becomes less desirable. This preliminary regression analysis shows health insurance spending behaving as an inferior good and a quadratic function (because the poor simply cannot afford to purchase insurance, and the wealthy decrease spending on the inferior good), as would be predicted of a Giffen Good (Jensen & Miller, 2007).

Aggregate Demand for Health Insurance

Based on the above discussions and models, the demand for health insurance will act as a Giffen good, or perhaps a new type of hybrid necessity/luxury/inferior good, depending on income level and prevalence of need based on health status (the insurance demand in red, **Di**, in **Figure 3**). Jensen and Miller (2007) also had to specify that Giffen behavior was only found at specific income levels. At the aggregate level, demand for health insurance will increase as the price of insurance increases until the point Max in **Figure 3**. After the Max point in **Figure 3**, the demand for health insurance will decrease as the price increases for two reasons: 1.) The price becomes prohibitively expensive, even though it is still desired at lower levels of income, and/or 2.) As wealth increases, the utility of health insurance decreases. Full demand for insurance (everyone in society having coverage) will never be fully met due to the following logic:

Below the Max point in **Figure 3**

1. The price is too high, due to low income (as shown in **Figure 9** as a lower portion of expenditures going toward insurance) (Bes et al., 2017).

2. The demand for insurance is decreased due to a perceived low quality based on the low price (as shown in **Figure 9** as the increasing portion of expenditures for the middle class going toward insurance) (Bes et al., 2017).

Above the Max point in **Figure 3**

3. The demand is higher than the ability to pay for the insurance due to income levels versus the cost of insurance.
4. Insurance lacks utility due to high family income levels and a lack of utility (as shown in **Figure 9** as the decreasing proportion of expenditures going toward health insurance).

3.2: Public Policy: Health Care Systems

Currently, the United States, which relies on a free market health care system to provide services for the public, pays more for services than the rest of the developed world that provides health services for all of their citizens. Why is the United States paying more for health care than the rest of the developed world, while simultaneously averaging a lower life expectancy? To answer this question, the health care policies within these countries must be understood. As discussed in the previous Chapter, the demand for insurance is different than the demand for health care. Due to this difference between demand for care and demand for insurance, health care systems must be classified by the identity of the provider of care (the demand for care) and the identity of the insurer of the care (the demand for insurance). There are three different basic systems of health care (based on differences in public policy) that are currently used in advanced industrialized nations as previously discussed: 1) Free market Systems, where insurance is private, and the provision of care is private. 2) Socialized Systems, where both insurance and the provision of care are public. 3) Universal Systems, where insurance is public, but the provision

of care remains private. No system uses public provision of care with private insurance. Because free market health care relies on the demand for insurance, but the other two systems do not, the effects for the demand for insurance will differ between the systems. If demand for insurance functions as a Giffen good, it will have no effect on the two types of single payer systems (socialized and universal), as insurance purchase is required through taxation (which may be why health insurance has not been thought of as a Giffen good previously, as the only advanced industrial case is the United States). The previous Chapter discussed the role of economics on health care markets, and this Chapter discusses how health care policies interact with those markets.

Health care is a commodity that consumers need to live. Therefore, the optimal price (P_L) and quantity ($Q_{Full\ Care}$) for services would be the point where the supply of providers for profit in the short term equals the theoretical demand (the pink point L in **Figure 10**). Everyone that needs treatment would be able to receive treatment because there would be enough supply of providers in the short term to meet the demand for care. However, this price at point L is higher than what consumers can afford (the quantity at $Q_{Full\ Care}$ is higher than the quantity on **Da** at point L):

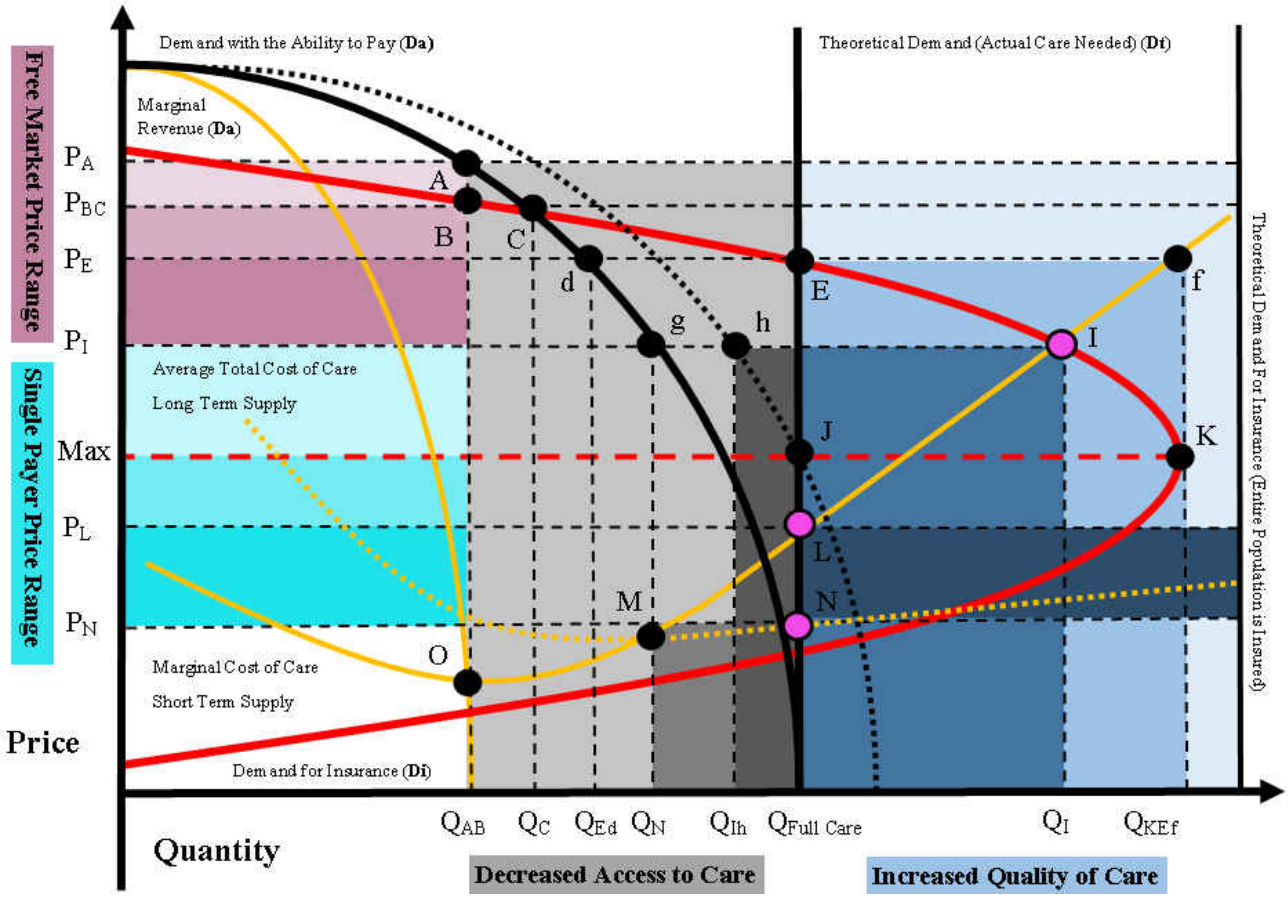


Figure 10: Integrative Model of Health Care Systems (Public Policies) Applied to the Supply and Demand Model (Economics)

Figure 10 analyzes the three different systems based on supply and demand within the health care markets and will be discussed in depth in this Chapter beginning with the free market price range.

3.2.1: Free Market Health Care Systems

In a free market health care system, the provision of care and the financing of care are private (some insurance for the poor and elderly may be public, public clinics may also exist, but the majority for both is private). Within this system of private provision, providers can act as

regional monopolies or oligarchies (Crawford, 2010; Gaynor et al., 2017). Consumers do not negotiate prices up front, and lack information on the actual cost of care (Gaynor et al., 2014; Olsen, 2009). This information asymmetry allows providers to manipulate price (Batty & Ippolito, 2017; Olsen, 2009). In rural regions, there may be only one major hospital, and a limited number of primary care providers; thereby allowing rural medical providers to act as monopolies (Gaynor et al., 2017). In urban areas there is more competition (though still limited), and providers act as an oligarchy. Oligarchies can be competitive or operate in cartels. Providers in urban areas, through law, can use prevailing payments to set price (Batty & Ippolito, 2017). Providers do not conspire to manipulate price, but due to information sharing, know what their "competitors" charge, and the government uses these regional estimates to set Medicare and Medicaid reimbursement rates (Gaynor et al., 2014). Providers only marginally compete directly with each other within urban areas (Brekke et al., 2010; Gaynor et al., 2017). Insurance companies navigate their customers to certain providers and away from others based on provider networks, further decreasing direct competition in provision of care (Bes et al., 2017; Gaynor et al., 2017). Emergency care is provided by the closest provider, not the least expensive provider. Often, providers do not even know the costs associated with treatments, or reimbursement rates when ordering tests and treatments for patients as the provider is usually more concerned with treating their clients. As discussed in Chapter 2, the trend in the health care market is toward increasing consolidation of services with limited competition. Moreover, this competition does not necessarily lead to lower prices (Gaynor et al., 2017; Kyle & Williams, 2017; Propper et al., 2004; Volpp et al., 2003)

Whether acting as regional monopolies or cartelistic oligarchies, providers can be price setters rather than price takers (Crawford, 2010). Price setting allows providers to select the price where marginal costs meet marginal revenues (point K in **Figure 11**) (Crawford, 2010):

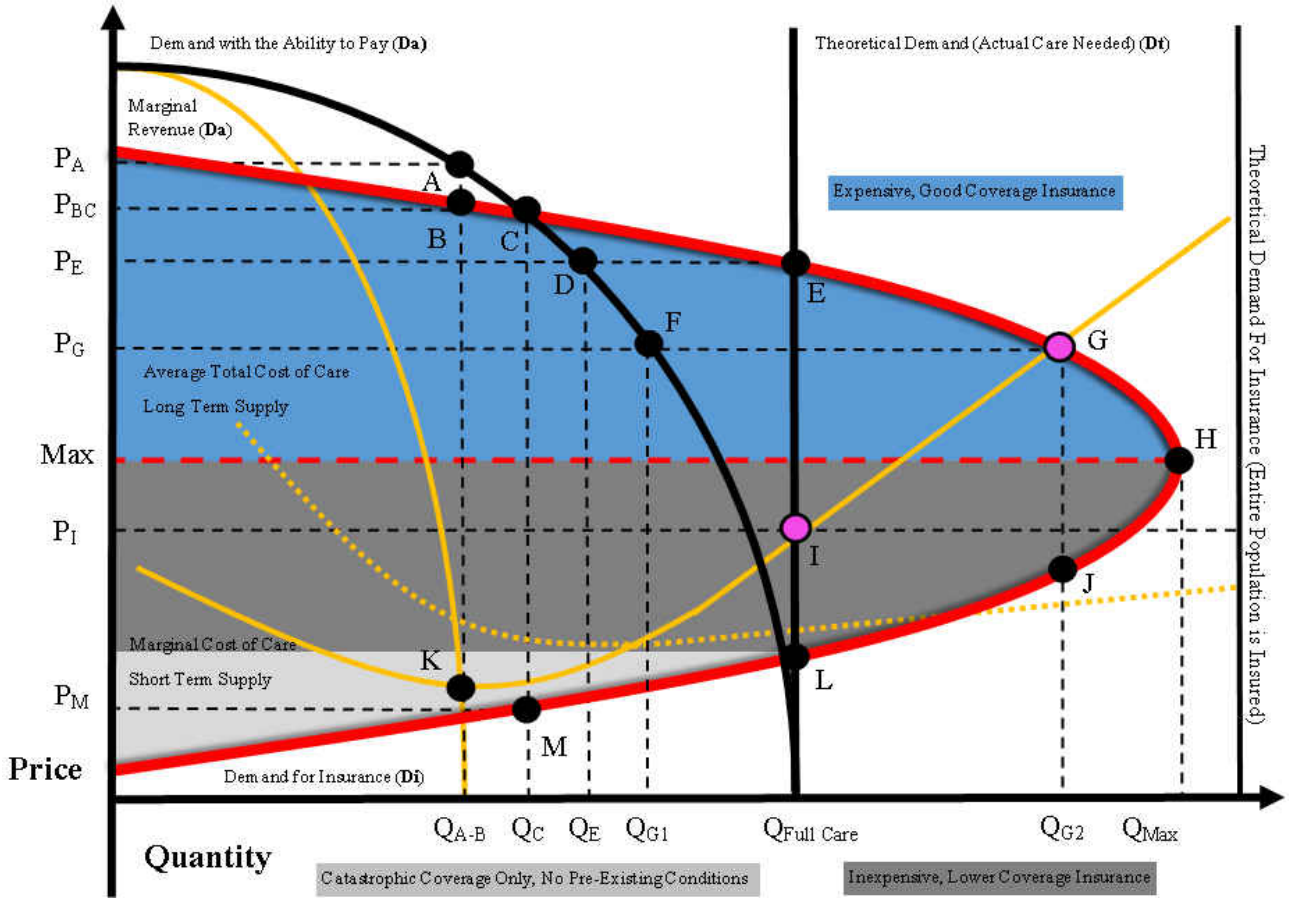


Figure 11: Free Market Health Care Systems, Insurance Costs and Coverage

In **Figure 11**, the area above the max line represented in blue represents the best coverage insurance price range, but at an overly expensive price that decreases demand; and the price range below the Max line represented in grey in **Figure 11** represents lower coverage plans; that represent declining demand as price decreases. For prices lower than point L, insurance companies would only offer catastrophic plans that do not cover pre-existing conditions,

otherwise every ill person would purchase these plans. As the price of expensive insurance decreases, the total demand for insurance increases. As the price of inexpensive insurance increases (thus offering better coverage), the total demand increases. Most consumers would not purchase catastrophic only insurance unless there were no other options available (Bes et al., 2017). This means that the individual mandate in the ACA has little to no effect on the demand for health insurance. The same number of consumers (or only a marginally increased number) will refuse to purchase health insurance without the individual mandate. However, the individual mandate has one method of increasing demand for insurance—some consumers that think they cannot afford good coverage, and that do not want inexpensive low coverage insurance, will check to see if the subsidies provided through the ACA alter their utilities to avoid paying the penalty. In other words, the individual mandate may scare some consumers into looking at their insurance options in the health care exchanges that would not have looked into them before. Another benefit of the individual mandate is economically punishing those that miscalculate their risk (underestimate their risk of a catastrophic event when choosing whether to purchase insurance, often younger consumers that believe they are invincible) (Bes et al., 2017) by forcing them to reimburse some of the costs of their care without insurance. However, the subsidies within the ACA is what increases the demand and purchase of health insurance. The subsidy allows consumers that could not afford good coverage insurance to purchase good coverage insurance (Courtemanche, Marton, Ukert, Yelowitz, & Zapata, 2017; Ferreira & Gomes, 2017). These consumers would not purchase inexpensive plans prior to the subsidy due to the lack of benefits provided by the inexpensive plans based on their cost benefit analyses, but will purchase the better plans if they can afford them (Courtemanche et al., 2017;

Ferreira & Gomes, 2017). The ACA also expands coverage and reduces costs of care through the expansion of Medicaid (Simon et al., 2017).

Furthermore, **Figure 11** shows that consumers at point C are completely different consumers than those at point M. At point C, consumers purchase insurance due to health issues despite the high cost and are willing to sacrifice disposable income to attain this coverage (insurance is even too expensive for wealthier families not just poorer families). The same quantity of consumers purchase inexpensive, catastrophic only insurance plans at point M, as the quantity of high risk, wealthier families that purchased at point C, but the identity of the consumers differ. At point M, the consumers would have lower incomes; whereas, the consumers at point C would have higher incomes and most likely are still willing to pay this high price due to having high risk family members. Point C is dependent on price point P_{BC} and point M is dependent on price point P_M. Point M has no direct relationship to point C other than the spurious relationship of having the same quantity (dependent variable) demanded in the market based on their different prices.

Looking at **Figure 11**, price setting by providers leads to point A, price point P_A and quantity Q_A in **Figure 11**. This price creates a massive gap between the theoretical demand and the demand with the ability to pay. This gap reduces access to care and reduces aggregate health outcomes, as not all those that need care have access to care. This artificially elevated price also leads to an increase in competition in the supply of care due to the highly elevated economic profits. This increased competition in supply increases the quality of care through competition for consumers and willingness of providers to enter the field and invest in increasing quality (Brekke et al., 2010; Gaynor et al., 2014).

It is argued that health care prices would decline with more competition in the provision of health care, which would force providers to become price takers (Gaynor et al., 2014). However, even if providers became price takers through increased competition, the price and quantity would be point C, where the demand for insurance meets the demand for care. Another complication that increases costs within a free market health care system is that, due to inexpensive health insurance having high deductibles and copays, consumers put off preventative care and only seek care when absolutely necessary. This elevates the average cost of care, as costs increase due to increased complications that could have been less expensive to treat if they were treated earlier (Simon et al., 2017). **Figure 12** discusses the interaction of price negotiations occurring within **Figure 11**, between providers and insurance companies, with the effects on price on the Y axis, and the effects on quantity on the X axis:

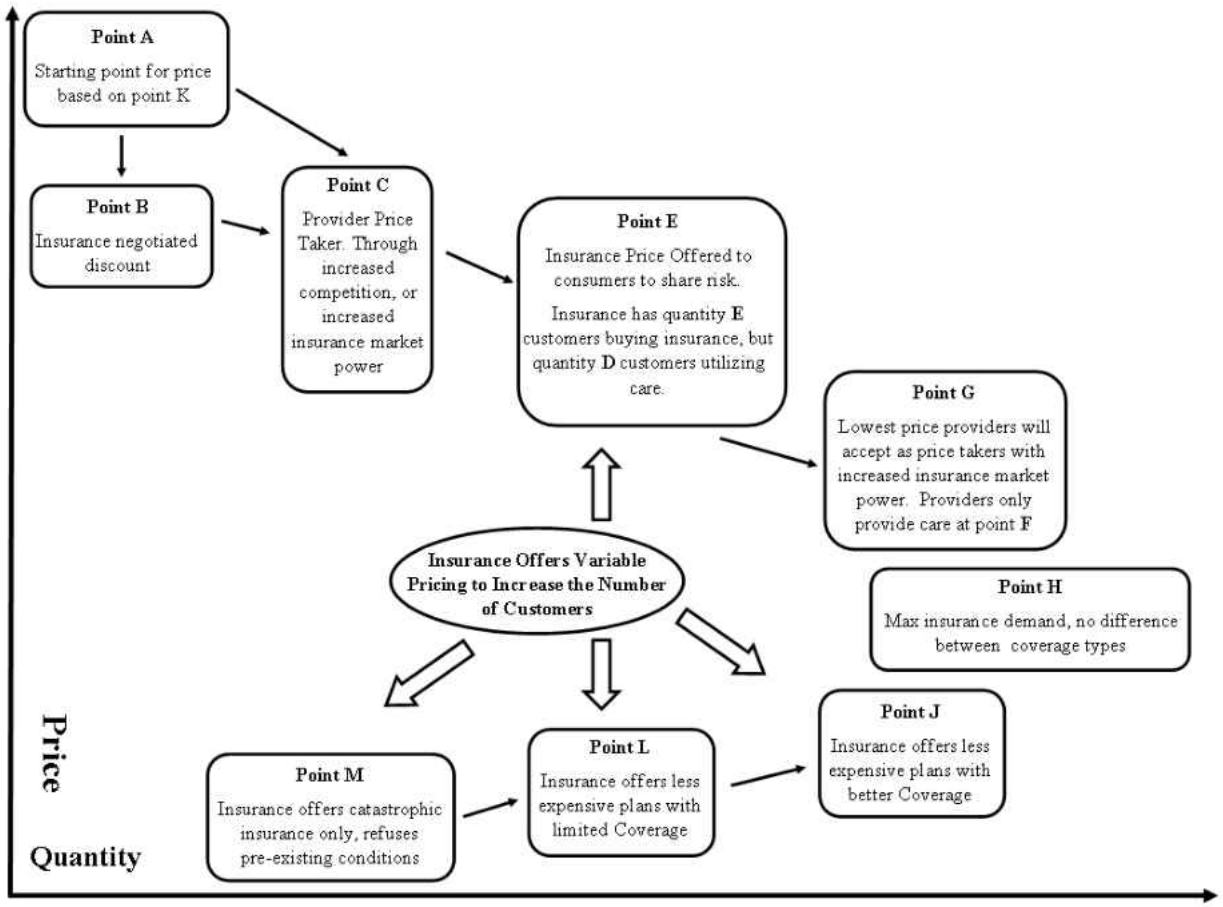


Figure 12: Free Market Health Care Flow Chart for Price Negotiation

Figure 12 shows that starting point for price negotiation in **Figure 11** is point A. From point A, price is negotiated downward (Batty & Ippolito, 2017). There are two prices that need to be discussed (Batty & Ippolito, 2017): 1.) The price providers charge (reimbursement rates), and 2.) The price of insurance offered to customers (Dunn & Shapiro, 2012; Gaynor et al., 2014; Ho & Lee, 2017). Health insurance companies will attempt to negotiate for a lower reimbursement rate to avoid demand for care exceeding the demand for insurance (the difference between point A and point B in **Figure 11**). In an attempt to offer lower insurance prices to their customers, insurance companies will push to reduce this reimbursement rate further. Consequently, this would increase the demand for insurance because the demand for insurance is above the Max

point at this price (point C in **Figure 11**) (Ho & Lee, 2017). At point C, only those that need treatment and can afford insurance at this price would be treated. Insurance companies only negotiate these discounts for their customers; those without insurance will still pay the elevated price (reimbursement rate) at point A or go without insurance and care (Batty & Ippolito, 2017). Insurance companies will create insurance plans at point E in **Figure 11**. The price of insurance offered by insurance companies is reduced to this point to attract more consumers which results in slightly lower costs, and access to care is increased (Ho & Lee, 2017). Consumers pay price P_E for insurance which increases the quantity of care provided to Q_E. However, this does not change the price of care that providers are charging (P_{BC}) unless the insurance company has enough market power to force the reimbursement rate down even lower to point D (Ho & Lee, 2017; Scheffler & Arnold, 2017). What this means though, is that to increase access to care and reduce reimbursement rates, it is better to have fewer insurance companies to force providers to become price takers and to increase competition in the provision of care enough to force them to become price takers (Ho & Lee, 2017; Scheffler & Arnold, 2017). Whether increasing competition in provision of care, or increasing the market power of insurance companies through a reduction in competition, will have a similar effect—access will be increased (to quantity Q_E), and costs to health insurance consumers will be decreased to P_E in **Figure 11**, whether health care providers are being reimbursed at the prices at point C or point D. Note that as the price of expensive insurance is decreasing, the price of inexpensive insurance offered by insurance companies is increasing. These two prices, however, are independent variables, and are independent of each other as demonstrated in **Figure 11**. Insurance companies can further maximize profits by offering expensive insurance plans with good coverage, and inexpensive insurance plans with poor coverage for those that cannot afford the expensive plan (Ho & Lee,

2017). Insurance companies will sell catastrophic only insurance plans with an exclusion of pre-existing conditions prior to point L in **Figure 11**, otherwise poorer customers that are high risk would be purchasing the inexpensive insurance plans and would bankrupt the insurance company as their expenditures would exceed their revenues. Above price point L, insurance companies would offer inexpensive insurance that has coverage beyond just catastrophic coverage without exclusions to pre-existing conditions. Insurance companies will use this variable pricing to maximize their profits (Ho & Lee, 2017). Overly expensive plans will be offered due to a perceived benefit to consumers, and less expensive options will be offered for those that cannot afford the expensive plans (Ho & Lee, 2017). In other words, insurance companies will offer plans at point E, J, and point L in **Figure 11**. The plans at point E produce greater revenues than the insurance company pays out because more customers purchase the plans than use the plans (the difference between quantity $Q_{\text{Full Care}}$ and Q_E), and the quantity purchased at point J exceeds demand for care (quantity Q_{G2} is greater than $Q_{\text{Full Care}}$). To make sure that consumers do not take advantage of the insurance at point J, copays and deductibles will be inflated. Insurance companies have no incentive to reduce expensive plans below point E unless the total profits are increased by providing more insurance $((Q_{G2} * P_G) - (Q_{G1} * \text{Negotiated reimbursement rate})) \geq ((Q_{\text{Full Care}} * P_E) - (Q_E * \text{Negotiated reimbursement rate}))$. This means that the U.S. would be paying more for insurance and health care to cover fewer people than if there were one price (and reimbursement rate) that covered everyone (based on income rather than demand) (Crawford, 2010) even with the ACA helping to subsidize premiums (Ferreira & Gomes, 2017). Providers still get to set an artificially inflated price based on point K under the ACA, then negotiate a slight decrease for those insured due to market power of the insurance companies (point C, D or point F with increased insurance market power)—and the number of people

insured will increase with subsidies and variable pricing. However, the ACA does nothing to decrease the costs of care that providers charge through changing the mechanisms of price negotiation with providers and reimbursement rates; it only increases the number of people purchasing insurance through government subsidies (Courtemanche et al., 2017; Ferreira & Gomes, 2017).

Insurance companies also make a higher profit, as medical providers charge a higher price. This makes logical sense under the ACA as well, even though the ACA limits insurance profits to 15%; 15% of $3 trillion is higher than 15% of $2 trillion. Insurance companies will increase the quantity of consumers with insurance coverage through reductions in prices to attract consumers, variable pricing and government subsidies, but are not incentivized to negotiate provider discounts because doing so would cause a reduction in insurance profits.

Free Market Systems Conclusions

Free market systems will have elevated price through higher reimbursement rates due to provider price setting (Crawford, 2010) despite insurance negotiated reimbursement rate discounts. The quantity of insurance coverage will be greater than the demand with the ability to pay for care at this elevated price through the use of variable pricing of insurance. These different priced insurance plans will offer a range of coverage, from catastrophic only to good coverage with low deductibles and copays. The best-case scenario for price and access to insurance would be point I in **Figure 10**, with price P_I and quantity Q_{I1} receiving care, and Q_{I2} competition for providers. This increased price will increase economic profits to providers, which in turn, increases competition (Gaynor et al., 2014). Increased competition for entrance in to the provision of medical services will increase investments into the quality of care (the blue

area in **Figure 10**) (Brekke et al., 2010; Gaynor et al., 2014; Kleiner et al., 2015; Kyle & Williams, 2017; Romano & Balan, 2010). Therefore, free market systems will have an average elevated price (the purple area in **Figure 10**), decreased access to care (the grey area in **Figure 10**), and increased quality of care (the blue area in **Figure 10**). Free market systems would be characterized as economically inefficient (extremely expensive), with low access to care (those that need care go without), but a very high quality of care.

3.2.2: Single Payer Health Care Systems

Single payer systems differ in provision of care and funding mechanisms for insurance but cover all citizens universally. Whether a socialized system or a universal system, generally both provide public funding of insurance for all citizens. Insurance is often funded through a progressive taxation system in which those with more income pay a higher percent than those with lower income (Ellis et al., 2014; OECD, 2010). This functions as a forced variable pricing system. However, the high-end price for insurance is far lower than the free market expensive insurance price (points L and N are lower than point I in **Figure 10**, which is the lowest reimbursement rate that health care providers would accept). This is not the only form of public provision of insurance; there is great variation between the two systems and within the two systems (Ellis et al., 2014; OECD, 2010).

In both systems, the government is often the sole provider of insurance, which means that the health care provider monopoly is offset by the government consumer monopoly and allows the government to force health care providers to become price takers. Because the government is controlling prices (Gaynor et al., 2014), and mandating health insurance, the demand for insurance (**Di**) has no effect on their health care markets. And, because everyone is insured

through the government, the demand with the ability to pay (**Da**) has no effect on the market. The only demand that has an effect on the market is the theoretical demand (**Dt**), which is known by the government in the case of socialized systems, as all those that need care seek and receive care. This allows the government and providers to estimate future utilization of health care services.

Socialized systems know the average total cost of care because they control the provision of care. This means they know the projected long-term costs of providing care. Whereas, universal systems do not know the average total cost of care because they do not provide the care directly themselves. In a universal system the average total cost of care is determined by the private health care providers creating an information asymmetry. Providers know the average total cost, and the government must utilize provider expertise while setting budgets in the universal system. This allows providers to negotiate reimbursement rates based on the marginal cost of care (the short-term supply) (Brekke et al., 2010; Gaynor et al., 2014) thus, allowing providers to negotiate a higher price in a universal system than the price set in a socialized system. This means that socialized systems, in general, will push the price closer to the long-term supply than the short-term supply and universal systems will negotiate a price closer to the short-term supply. In **Figure 10**, socialized systems will push the costs toward point N, whereas universal systems will negotiate a price closer to point L.

Universal Health Care

As described above, in universal systems the government does not control the provision of health care, only the funding. This gives health care providers an information advantage. Health care providers are often forced into provider unions (OECD, 2010), and have more

knowledge about the average total cost of care and the marginal cost of care than the government (Brekke et al., 2010). These health provider unions meet directly with the government to negotiate yearly budgets based on current costs and projected quantities of care (OECD, 2010). This information asymmetry allows for health care providers to negotiate a higher price than the average total cost of care meaning that universal systems will spend more on health care than is necessary to provide care for everyone that needs care. This increased price creates economic inefficiency, but also increases the quality of care through competition. As noted by Gaynor, Ho, and Town (2014),

> A standard result in models with administered prices is that non-price (quality) competition gets tougher in the number of firms so long as the regulated price is set above marginal cost. Firms facing tougher competition will increase their quality in order to attract (and retain) consumers. (pg.8)

Point L being higher than point N in **Figure 10** means that there is increased economic profit. Increased economic profit causes competition which will lead to a higher quality of care (Gaynor et al., 2014). More providers will attempt to enter the supply of care to earn this elevated economic profit while existing providers will compete for consumers by increasing quality of care compared to their competitors.

Socialized Health Care

Controlling both the funding of health care and a large portion of the provision of care allows socialized systems to select a price point closer to point N in **Figure 10**. Because socialized systems have public provision of care, the government has a better understanding of the average total cost of care, and thus the long-term costs. At point N in **Figure 10**, the long-term supply meets the theoretical demand for care. This means that everyone that needs care

will get care. However, because this price is based on the long-term supply and not the current, short term supply, waitlists can be possible because supply has not yet increased to meet demand. Even though normal economic profit is included in the long-term supply, there is no incentive to increase supply due to economic profit, which means a lower level of competition (Gaynor et al., 2014). With normal economic profit, suppliers are neutral on whether to enter or leave the market, meaning there is little incentive to increase supply and that means these waitlists may be durable. Even though there is enough funding to provide care for all, this decreased competition will lead to a lower quality of care than a universal system and possible waitlist.

Variation Within Single Payer Systems

Not all Universal and Socialized systems are set up identically (Ellis et al., 2014; Gaynor et al., 2014; OECD, 2010). Collectively, they are viewed as single payer systems, however some have multiple payers that may or may not compete for clients. Collecting data on variation within system types was previously a difficult task. In 2009 the OECD began a new method to collect this data by sending surveys to the OECD member nations directly and published the results (OECD, 2010). They currently have the results of these surveys available to the public for the years 2012 and 2016. In their 2010 report based on their first survey in 2009, "Health Care Systems: Efficiency and Policy Settings", they found that there were six different groupings of policies used in the OECD (excluding the United States which did not reply to the initial

survey). **Figure 13** is taken from that seminal report (OECD, 2010):

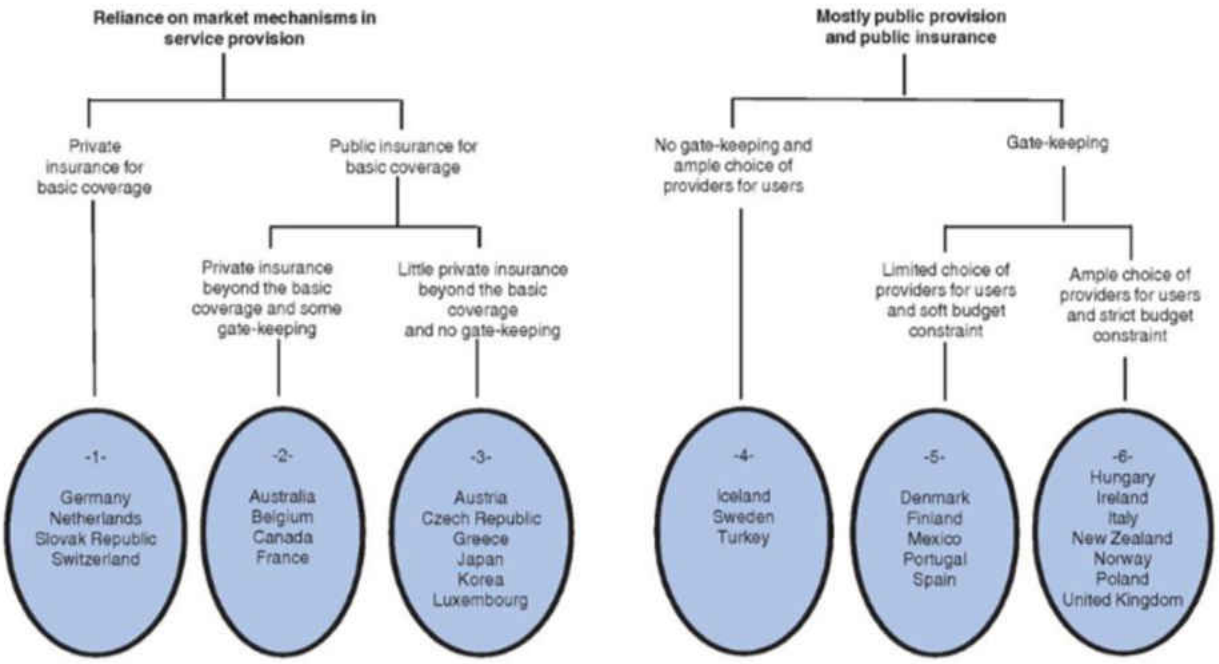


Figure 13: Groups of Countries Sharing Broadly Similar Institutions
Source: (OECD, 2010)

Figure 13 first creates two groups based on public versus private provision of care. The group on the left represents Universal systems and the group on the right represents Socialized systems. The OECD used cluster analysis to differentiate the groups statistically (OECD, 2010). Moving from left to right in **Figure 13** shows decreasing reliance on market forces. Group 1 is labeled as "private insurance for basic coverage." This does not mean that citizens choose to buy insurance of their own free will, or that these insurance companies are for-profit, instead they are mandated to be non-profit and purchase is required and prices are often mandated through government regulation (Gaynor et al., 2014; OECD, 2010). The ACA's individual mandate was pushing the United States toward group 1, but does not require health insurance to be non-profit. Conversely, profits are capped at 15%. These are countries that rely on contracting out health

insurance services, where the government mandates insurance purchase by citizens through a choice of non-profit partners that are given power to set reimbursement rates to health care providers (Ellis et al., 2014). These are not true Free Market systems as the insurers do not have a profit motive, insurers are given broad authority to set reimbursement rates (within networks or regions), and can be viewed as competing local health insurance authorities (Ellis et al., 2014). They are also not true Universal systems as there is not a national or regional single payer. Groups 2 and 3 are more aligned with Universal systems and differ from each other based on the availability of secondary private insurance and requirements on gatekeeping (primary care providers refer clients to specialists). Groups 4, 5, and 6 are all socialized systems that differ based on clients' choice of providers, level of gatekeeping and strength of budget constraints.

Single Payer Systems Conclusions

In single payer systems, access to care is guaranteed. However, this does not mean that the supply of care meets the demand for care. If too little money is spent, supply will be limited thereby creating waitlists (reflected in **Figure 10** by the difference between Q_N and $Q_{Full\ Care}$). If the reimbursement rate to providers is too high, care may have to be rationed, or money will be wasted without providing a corresponding increase in health outcomes. This rationing is reflected in the shifted demand with the ability to pay curve in **Figure 10**. Because care is guaranteed through the government, full insurance demand is met, but there may still not be enough money within the system to pay for everyone's care if health care providers negotiate a reimbursement rate that is too costly for the public to afford. To reflect this concept, the demand with the ability to pay curve was shifted to the right (represented in a dashed line in **Figure 10**). This is reflected as a shift in demand due to the guaranteed access rather than a shift along the

demand curve due to changes in price. The new demand with the ability to pay curve (dashed curve in **Figure 10**) was shifted to point J where the Max insurance line meets the theoretical demand (because theoretically, everyone is covered and therefore have the ability to pay for care). However, looking at the demand for insurance (**Di**) shows that consumers cannot afford this price, which means the government would theoretically also not be able to afford this price. Any reimbursement rate above point J will cause a decrease in access to care along the shifted ability demand curve, as the government must ration its limited resources. For example, if the reimbursement price is P_I, the quality of care will be elevated due to competition to Q_I, but the government can only afford to treat quantity Q_{Ih}. This leads to a reduction in care from the theoretical demand to point h (reflected in dark grey in **Figure 10**). If single payer systems spend too much money on health care reimbursements, they will see a reduction in outcomes due to this decrease in access. A second possibility is that this elevated price does not cause a rationing of care, but instead reflects economic waste as more money is spent without going toward the care of patients. Either way, the elevated spending will not be reflected in an increase to health outcomes.

Socialized systems may have decreased access to care compared to universal systems due to waitlists created through using long term supply instead of short term supply for price setting. Universal systems will have more competition in supply of care due to this same difference in price setting, which would lead to better quality of care (Brekke et al., 2010; Gaynor et al., 2014) in a universal system over a socialized system. This higher price in universal systems means that socialized systems are more economically efficient. Not all socialized systems or universal systems are equal, and prices will differ within each system, and between systems. This price range is reflected in teal in **Figure 10**. Socialized systems should congregate around P_N and

universal systems should congregate around P_L. At P_N, even though access to care is guaranteed, there could be waitlist reflected in the difference between point N and point M (where long-term supply and short-term supply are equal). This decrease in access caused by waitlists is reflected by the difference between $Q_{Full\ Care}$ and Q_N. Price P_L, in a universal system, increases economic profit, which leads to increased supply of providers, and subsequently increases the quality of care (represented in dark blue in **Figure 10**). Therefore, socialized systems will be characterized as economically efficient, moderate quality of care, and slightly decreased access due to some waitlists. Universal systems would be characterized as slightly economically inefficient, full access to care, and a high quality of care.

3.3: Final Simplified Model of Health Care Systems and Market Forces

Discussing health care systems and markets requires complex models of economic behavior and effects of policy. As was seen in **Figure 10**, many interconnected concepts need to be analyzed simultaneously. In an attempt to simplify and declutter the model in **Figure 10**, **Figure 14** was created:

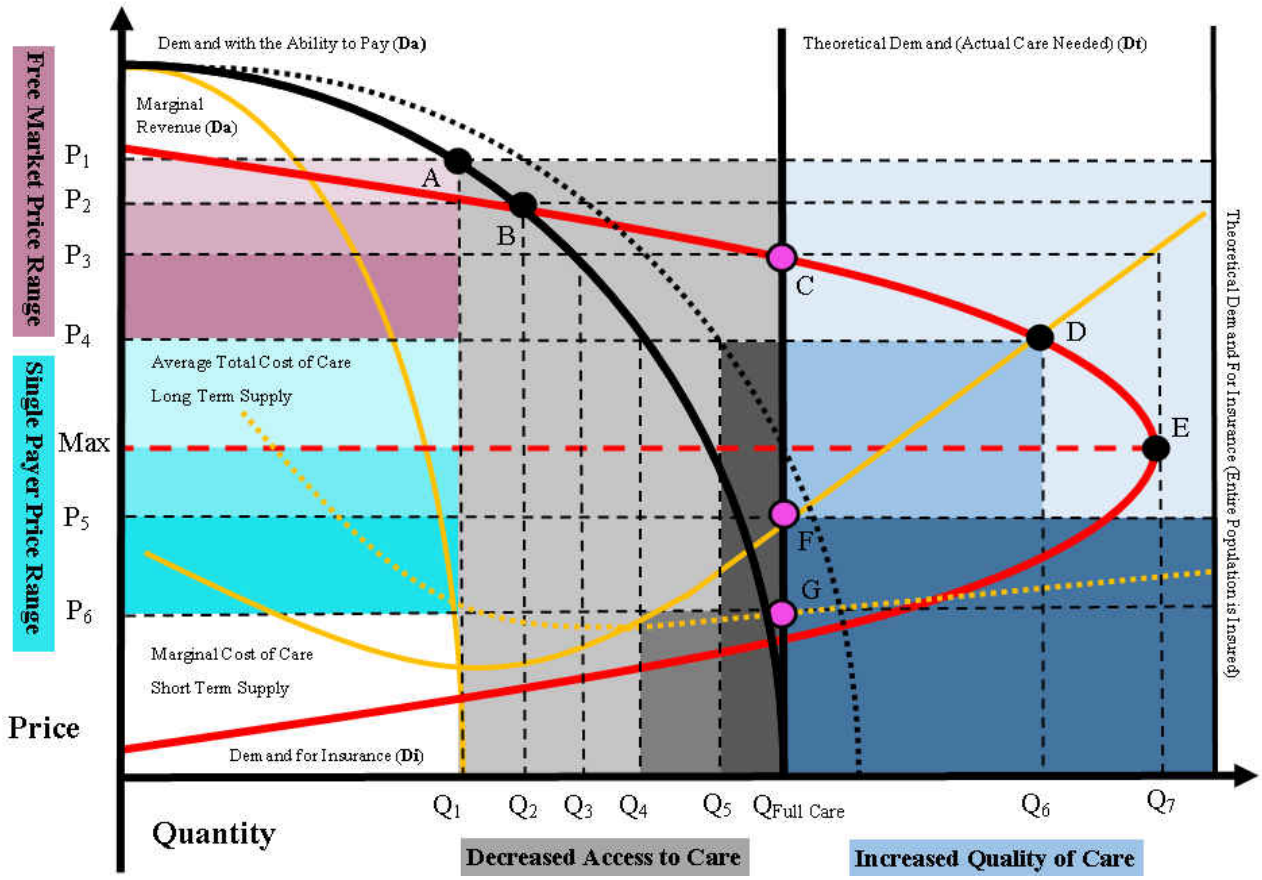


Figure 14: Simplified Integrative Health Care Systems Market Model

In **Figure 14**, the price for free market health care systems is P_3, which would be the price of good quality health insurance based on the demand for insurance meeting the theoretical demand for care (point C). The free market price would be a range, with those without insurance paying price P_1; a reimbursement rate at price P_3, and access limited to Q_2 for those with insurance and a further decrease in access for those without insurance to Q_1. The quantity supplied (or rather, competing to supply care) would be Q_7. Point D represents the lowest theoretical point for price (P_4) that would exist in a free market system if insurance companies had enough market power to reduce reimbursement rates to P_4, which would still have decreased access at quantity Q_4. Because providers are negotiating based on short term costs, short term cost meet the insurance demand at point D, which would represent the negotiated reimbursement rate.

Universal systems should congregate around point F in **Figure 14**, with an average price of P_5, and a quantity of full insurance coverage. This price is significantly lower than points C and D, has no decrease in access, and has a high quality of care. Some single payer systems, whether universal or socialized, may have higher prices reflected in point D if medical providers are able to negotiate a higher reimbursement rate, which would lead to rationing of care to quantity Q_5. This would be a high-quality system, but would have decreased access to care due to rationing caused by an artificially inflated reimbursement rate negotiated by medical providers. Socialized systems would congregate around point G with price P_6, and a quantity Q_4. There could be waitlists for care, decreased quality compared to the other two systems, but would also be the most economically efficient system of the three.

Wan (2002) recommends that researchers must use multilevel analysis to test the between-group and within-group variation in health care systems. He specifies that data bases need to be organized by context (System level data, demographics etc.) – Design (policy interventions) – Performance (efficiency, effectiveness, productivity) – Outcomes (health outcomes) (Wan, 2002). Under this model of health care evaluation, the wealth of a country (GDP per capita) and life style factors affect the context of health care systems. The interventions (design) of the system is determined by the policies dealing with health care funding and provision (free market provision and free market insurance). The performance would be the expenditures per capita on health care, the levels of access to care, and the quality of care. The outcomes would be life expectancy and infant mortality rates as shown in **Table 1** in Chapter 1. As discussed in Chapter 2, within each system type there will be variations in performance and health outcomes. Some countries with free market, universal, or socialized systems will perform better than other countries depending on differences in levels of market

mechanisms within the provision of care and the insurance of care. A systems framework allows for testing this within system variation and between system variation. **Table 5**, shows the systems framework applied to the market model based on system type created in Chapter 3:

Table 5 lays out the interaction between markets and system type in terms of performance and health outcomes. Each system works within the context of market forces. Within each system type, variation in efficiency will occur across countries based on the levels of market mechanisms within the system type. Some universal systems will perform better than others, some socialized systems will perform better than others, and some free market systems will perform better than others based on this within system variation. These differences in within system variation will lead to measurable differences in health outcomes within each system type and across system types.

Table 5: Applied Systems Framework and Testable Hypotheses

Context				Design →		Performance →	Outcomes
Market Forces	**Demand for Care**	**Supply of Care**	**Demand for Insurance**	**System Type**	**Description**	**Combined Effects (Within System Variation Occurs)**	**Combined Effects (Within System Variation Occurs)**
Description	There are 2 separate demands for health care; the theoretical demand based on need, and the demand for care based on the ability to pay	Health care providers compete for consumers using investments in quality, not through price competition	Inexpensive health insurance is an inferior good; Consumers prefer more expensive health insurance plans that provide better coverage	**Free Market**	Providers are private, Insurance is private; Differing levels of market mechanisms will cause differences in within system performance	No changes to market forces; Access to care is reduced, Quality of care increased, Extremely expensive per capita price of care	Decreased per capita life expectancy due to decreased access; Individuals with good insurance increase individual life expectancy due to quality increases
Effects	Not all those that need care can afford care. Access to care is reduced and health outcomes are reduced	Prices are inflated through provider price setting; high prices increase competition; competition increases quality of care without a corresponding reduction in prices	Health insurance functions as a Giffen Good; More expensive insurance is more desirable than less expensive insurance, but the demand for insurance is limited by income, poor coverage for the poor and good coverage for the wealthy	**Universal**	Providers are private, Insurance is public; Differing levels of market mechanisms will cause differences in within system performance	Access to care is guaranteed and income has no effect on access; Price is mandated, and is slightly elevated; Providers compete based on quality causing an increase in the quality of care	Increased per capita life expectancy due to full access, and investments in quality
				Socialized	Providers are public, Insurers are public; Differing levels of market mechanisms will cause differences in within system performance	Access to care is guaranteed and income has no effect on access; price is mandated, and reduced to lowest level; providers do not compete which does not increase quality of care	Increased per capita life expectancy due to full access; decreased per capita life expectancy due to lack of investments in quality, and possible waitlists

CHAPTER 4: RESEARCH DESIGN AND ANALYSIS

Measuring economic efficiency, quality, and access to care is a difficult endeavor. To illustrate this difficulty: life expectancy is a function of access to care, quality of care, lifestyle factors, rates of occurrence of disease, and genetics. Disaggregating the effects of access to care and quality of care on life expectancy is challenging. Data on health care systems are also limited to an aggregate, annual level for use in comparison. To properly tackle this difficulty requires specialized statistical methods and models.

According to the health care system market model in the previous Chapter, a free-market health care system will have the lowest access to care of all three systems, the highest cost of all three systems, and the highest quality of care of all three systems. A socialized health care system will have more access to care than a free-market system, but less than a universal system, the lowest quality of all three systems, and the lowest cost of all three systems. A universal system will have a higher quality of care than a socialized system, but lower than a free-market system, less economic efficiency than a socialized system, but more economic efficiency than a free-market system and will have the highest access to care of all three systems. The system type should determine the health care reimbursement rates, which determines the per capita expenditures on health care. The expenditures on health care will affect the access to care and the quality of care. Increased access to care will increase health outcomes, and increased quality of care will decrease adverse health outcomes or events. As shown, most countries use a wide variety of free market and government controls in the practice of health insurance coverage and health care provision. Statistical models are needed to account for these variations.

4.1: Data Sources

The OECD provides health care data on all member nations for public use. They are available online at http://www.oecd.org/health/health-data.htm. The majority of health and economic data were attained from the OECD's most recent data sets. The most recent available year for each variable for each country was used in regression analysis. Data on system type were attained from the OECD's Health Systems Characteristics Survey available at https://qdd.oecd.org/subject.aspx?Subject=hsc, for years 2012 and 2016 (description of Survey questions in Appendix). There are 35 countries in the OECD which gives an "n" of 35 for the regression analyses, but the Slovak Republic had to be dropped from the data set leaving 34 countries in the final data set due to large quantities of missing data. The OECD also reports economic data in $U.S. Purchasing Power Parity to standardize cost comparisons.

For Structural Equation Modelling the most recent 5 years of data available for all countries were pooled together and used: 2012 through 2016. There are 35 countries in the OECD; 35 countries times 5 years equals 175 observations. Unfortunately, the Slovak Republic inconsistently reported yearly data and also had to be dropped from the data set for SEM leaving only 34 cases times 5 years for a total of 170 observations for use in SEM.

The U.S. Centers for Medicare and Medicaid Services (CMS) data were used to analyze the demand for private health insurance in the United States through the "Health Insurance Exchanges". Data on U.S. health care spending by income through the Health Insurance Exchanges are available from the U.S. CMS available at https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/Marketplace-Products/2018_Open_Enrollment.html. Average prices of insurance plans and price caps for income levels is available from the Kaiser Family Foundation (KFF.org, 2018) available at

https://www.kff.org/health-reform/state-indicator/change-in-average-marketplace-premiums-by-metal-tier/?currentTimeframe=0&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D. All data were analyzed using IBM SPSS Statistics version 24 (IBM, 2016), and IBM SPSS AMOS version 24 for all graphic interfaces (path analysis, and SEM models).

4.2: Health Insurance as a Giffen Good

To test the effects of income and price on the demand for health insurance data from the Health Insurance Exchanges in the United States for 2018 were collected and analyzed using ordinary least squares regression and path analysis. If health insurance functions as a Giffen Good, the data should show that as income increases the demand for more expensive insurance plans increases, and that as the price of less desirable plans increases the demand for the less desirable plans should also increase. Unfortunately, the data attainable from the government only relates aggregate level data by State and income level based on 5 ranges. The data set includes information for all States that use the Federal Exchange at healthcare.gov and a couple of other States that use their own exchanges, for a total of 39 out of 50 U.S. States. States that did not report the necessary data to the Federal Government from their State Exchanges were California, Colorado, Connecticut, Idaho, Maryland, Massachusetts, Minnesota, New York, Rhode Island, Vermont, and Washington (these States did report some data to the Federal Government but did not include data on plan metal by income level). There are three "metal" levels for health insurance plans offered on the exchanges under the Affordable Care Act (ACA). "Bronze" plans cover 60% of costs, "Silver" plans cover 70% of costs, and "Gold" plans cover 80% of costs (some states also have "platinum" plans that cover 90% of costs but this data was also not available for all States). Federal Poverty Level ($12,140 for families with 1 individuals) was

taken from the U.S. Department of Health and Human Services at HHS.gov. The data from CMS only includes income information for those receiving subsidies through the government, so income levels are represented as 100% to 150% of FPL, 150% to 200% of FPL, 200% to 250% of FPL, 250% to 300% FPL and 300% to 400% FPL as only these groups receive the subsidy. Lower incomes are qualified for Medicaid and higher income levels receive no subsidy. Taking the highest percentage from these income levels gives a maximum income based on 2018 poverty income for each income rank, $18,210, $24,280, $30,350, $36,420, and $48,560 for families of 1 individuals, respectively.

Table *6: Variable Description and Sources for Giffen Good Analysis*

shows the variables available for the analysis and their sources for the information:

Table 6: Variable Description and Sources for Giffen Good Analysis

Variable Name	Variable Description	Source	Notes
State	State	CMS.gov	Name of State
IncomeRank	Income Rank	CMS.gov	Income Rank 1-5 based on FPL ($12,140), 1=100% to 150%, 2=150% to 200%, 3=200% to 250%, 4=250% to 300%, 5=300 to 400%
BrzPlanPerc	% of Bronze Plan Purchasers	CMS.gov	% of Income Level as % of total plans purchased
slvPlanPerc	% of Silver Plan Purchasers	CMS.gov	% of Income Level as % of total plans purchased
GldPlanPerc	% of Gold Plan Purchasers	CMS.gov	% of Income Level as % of total plans purchased
BrzPlanNumb	Total Number of Bronze Plans Purchased	CMS.gov	Total number of plans purchased by Income Level
slvPlanNumb	Total Number of Silver Plans Purchased	CMS.gov	Total number of plans purchased by Income Level
GldPlanNumb	Total Number of Gold Plans Purchased	CMS.gov	Total number of plans purchased by Income Level
BrzPercIncome	% of Income Level Purchasing Bronze	CMS.gov	% of Income Level purchasing plan
slvPercIncome	% of Income Level Purchasing Silver	CMS.gov	% of Income Level purchasing plan
GldPercIncome	% of Income Level Purchasing Gold	CMS.gov	% of Income Level purchasing plan

Variable Name	Variable Description	Source	Notes
PriceCap	Price Cap on Benchmark Plan Premium as % of Income	KFF.org	Price Cap of benchmark plan as % of income level based on FPL
IncomePoverty	Income Rank as Top of Poverty Level	CMS.gov	1.5=100% to 150%, 2=150% to 200%, 2.5=200% to 250%, 3=250% to 300%, 4=300 to 400% FPL
Price100Poverty	Average Cost of Plan Based on Metal Level	KFF.org	$US, Nationwide average used
Price2018Poverty	Price of Benchmark Plan Based on 2018 Poverty Level	Computed	Out of pocket cost in $US computed for benchmark plan based on Price Cap, y = (Income Rank as Top of Poverty Level) * $12,140 * (Price Cap Based on Benchmark Plan) - (Average Cost of Plan Based on Metal Level)
Subsidy2018	2018 Subsidy Based on Benchmark Plan and Income Level	Computed	$US cash value of subsidy, y = (Price of Benchmark Plan) - (Price of Benchmark Plan) * (Price Cap of Benchmark for each income level)
BrzPrice	Price of Bronze Plan After Subsidy	Computed	y = - (Average Cost of Plan Based on Metal Level) - (2018 Subsidy Based on Benchmark Plan and Income Level)
SlvPrice	Price of Silver Plan After Subsidy	Computed	y = - (Average Cost of Plan Based on Metal Level) - (2018 Subsidy Based on Benchmark Plan and Income Level)
GldPrice	Price of Gold Plan After Subsidy	Computed	y = - (Average Cost of Plan Based on Metal Level) - (2018 Subsidy Based on Benchmark Plan and Income Level)
PercIncomePrice	Price of Chosen Plan as Percent of Income	Computed	y = Price of Plan / Income in $US based on FPL

4.2.1: Statistical Analysis of U.S. Health Insurance Exchanges

According to the above market model and discussion in Chapter 3, as the price of insurance increases the demand for insurance should increase until a point where the price is prohibitive, and the demand should then decrease. Bronze plans cover 60% of costs on average, silver plans cover 70% of costs on average, and gold plans cover 80% of costs on average. Bronze plans cost less than silver plans which cost less than gold plans, therefore the demand for

silver plans should be higher than the demand for silver plans, and the demand for gold plans should be the highest unless the cost is above the point where it becomes prohibitive. **Figure 15** examines these concepts based on the ACA data on aggregate number of plans purchased, price of the plan, metal level, and income level:

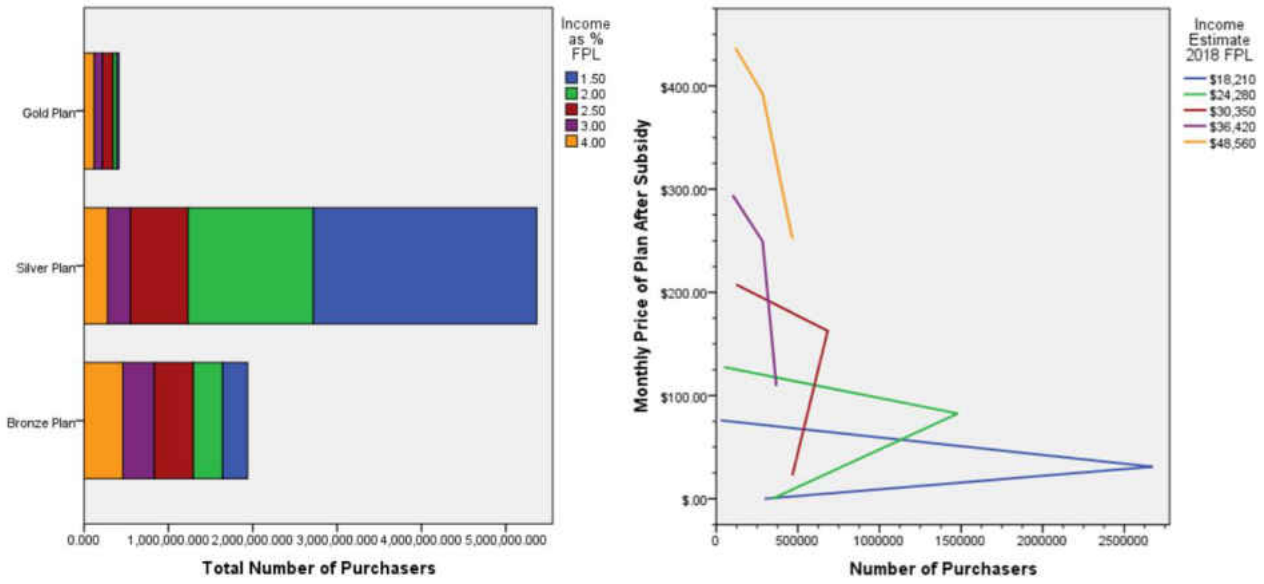


Figure 15: Total Number of Plan Purchasers Based on Metal Level, Income and Monthly Price of Plan

Figure 15 clearly shows that, on the aggregate level, as price increases from bronze to silver plans, the total number of consumers increases and the total number of gold plans decreases as it becomes unaffordable across all income levels and controlling for income level exactly as predicted if health insurance functions as a Giffen Good. Note that when given the option to receive Bronze level plans for free, the two lowest income levels both prefer to pay for silver plans instead.

As is also clear from **Figure 15**, the number of consumers in each income level is not equal and the prices that they pay after the subsidy are not equal. To compare these subgroups, and to test the statistical significance of these apparent correlations, percent of income level purchasing each plan is used in place of total number of consumers to control for the different

number in each income level. The percentage of income each price point represents is used instead of monthly price to control for the fact that these differing prices represent vastly different costs compared to income. A monthly price of $100 represents a drastically different percent of the monthly income of each income level. **Figure 16** shows the relationship between price after the subsidy (as a percent of income) and quantity (as the percent of consumers in each income level choosing to purchase the plan):

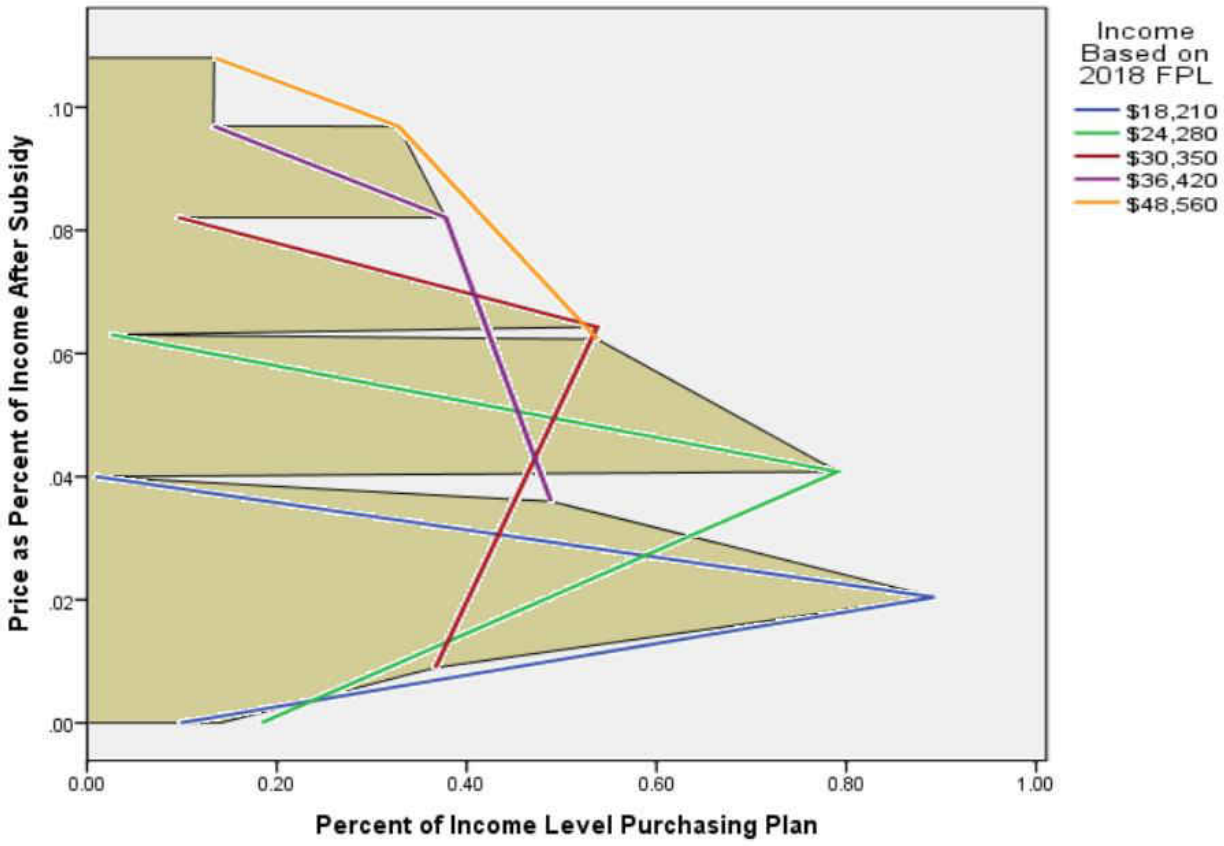


Figure 16: Percentage of Income Level Purchasing Plan Based on the Price of the Plan as a Percent of Income

The dips in quantity in **Figure 16** represent the gold level prices for income levels 1, 2, and 3, and the less desirable bronze plan for income level 4 as can be seen by overlaying income levels. These dips in demand do not represent aggregate dips in demand but represent the dips in demand based on income level. To control for this fact, data points for income levels 1 through

3 that purchase gold plans and for income level 4 for bronze plans was dropped from the data set to run regression analysis for the group as a whole. Price as percent of income after subsidy was squared to account for the decrease in demand caused by the price becoming prohibitive. **Table 7** shows regression analysis of the percentage of income level purchasing each plan a portion of spending to develop the aggregate demand curve for health insurance controlling for income level and price as a percent of income for those receiving a subsidy from the U.S. government:

Table 7: Quadratic Regression for Price and Quantity for Health Insurance (Health Insurance Demand Curve)

	Unstandardized Coefficients	Standardized Coefficients	t	Sig.	R Square
(Constant)	0.242		2.386	0.044	0.682
Price as Percent of Income	18.782	2.862	3.684	0.006	
Price Squared	-193.883	-3.142	-4.046	0.004	
Dependent Variable: Percent of Income Level Purchasing Plan					

The regression in **Table 7** shows as the price of health insurance increases as a percent of income the demand for insurance increases, until the point where the price becomes prohibitive (around 5%, with an R-square of 0.682. The demand for health insurance can be defined as:

Equation 3: Demand Curve for Health Insurance

Quantity Demanded (as percent of purchasers in income level) = 0.242 + 18.782 (Price as Percent of Income) – 193.883 (Price as Percent of Income)^2.

Figure 17 graphically displays the demand curve created through the regression with areas for reference for plan type and income level:

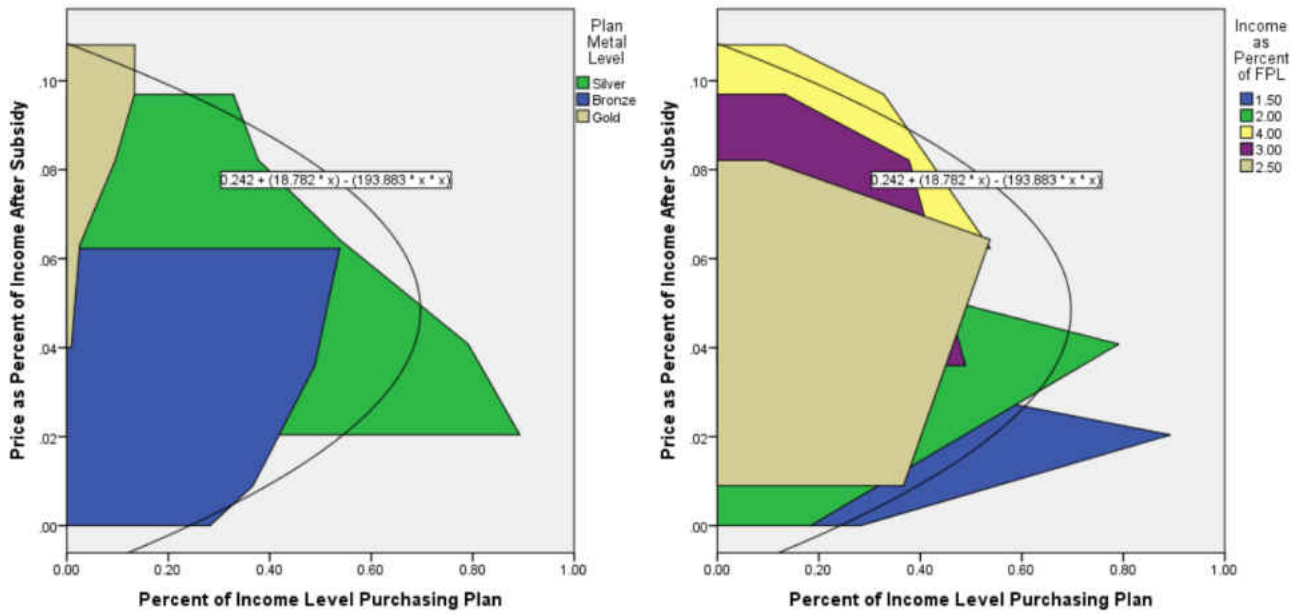


Figure 17: Demand Curve for Health Insurance Across All Income Levels and Plan Metals

The demand curve in **Figure 17** encompasses roughly 68% of the variation in the data, and clearly shows that, for those receiving the subsidy to purchase health insurance from the U.S. government, the demand for health insurance is functioning like a Giffen Good. The graph also suggests that if the top three income levels were offered Silver insurance plans for roughly 5% of income, the demand would significantly increase.

To further test these connections, a path analysis was performed using the percent of each income level purchasing the three different plans. Because the percentages add up to 100%, the percentage of any two plans can be used to directly predict the value of the third plan which creates a non-positive definite correlation matrix when all three percentages are included simultaneously in the path analysis. This means a path analysis had to be built in steps to test for statistical significance and goodness of fit. **Figure 18** shows a path analysis for income, the level of the 2018 subsidy and the choice of consumers between plans:

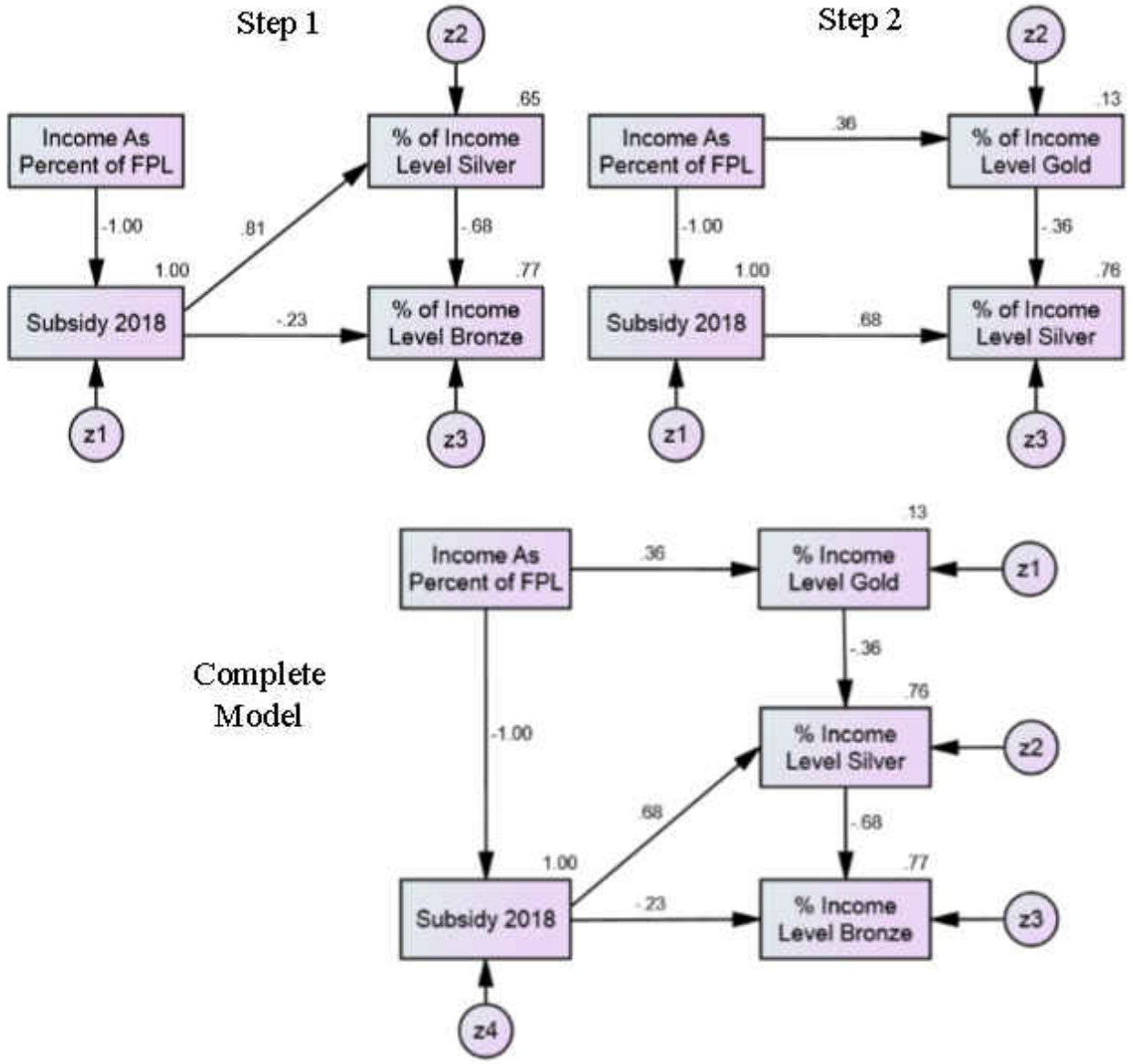


Figure 18: Path Analysis for Health Insurance Choice

Figure 18 shows that as income increases, consumers become more likely to purchase gold plans. As consumers choose gold plans, the number of silver plans correspondingly decreases. The subsidy that consumers receive is dependent on their income through law and applies equally to all metal plans. As the subsidy decreases, it correspondingly increases the cost of all three metal plans. The path analysis shows that consumers prefer silver plans over bronze plans and the demand for bronze plans increases only because the cost of all plans are increasing. This suggests that consumers are only moving from silver to bronze plans due to financial limitations

caused by the price increasing, not because they prefer bronze over silver plans. **Table 8** shows the estimates for the path analysis in **Figure 18**:

Table 8: Path Analysis Estimates and Goodness of Fit

Step/ Goodness of Fit	Dependent Variable	Independent Variable	Unstand. Estimate	Standard. Estimate	Sig.	Model RMSEA	LO 90	HI 90
1	Subsidy2018	IncomePoverty	-1779.872	-0.998	0.000	0.000	0.000	0.000
CMIN/DF = .002	SlvPercIncome	Subsidy2018	0.000	0.808	0.000	PCLOSE	0.999	
GFI = 1.000	BrzPercIncome	Subsidy2018	0.000	-0.229	0.000			
	BrzPercIncome	SlvPercIncome	-0.547	-0.681	0.000			
2	Subsidy2018	IncomePoverty	-1779.872	-0.998	0.000	0.000	0.000	0.036
CMIN/DF = .066	GldPercIncome	IncomePoverty	0.053	0.360	0.000	PCLOSE	0.960	
GFI = 1.000	SlvPercIncome	Subsidy2018	0.000	0.679	0.000			
	SlvPercIncome	GldPercIncome	-0.712	-0.359	0.000			
Complete Model	GldPercIncome	IncomePoverty	0.053	0.360	0.000			
	Subsidy2018	IncomePoverty	-1779.872	-0.998	0.000			
	SlvPercIncome	GldPercIncome	-0.712	-0.359	0.000			
	SlvPercIncome	Subsidy2018	0.000	0.679	0.000			
	BrzPercIncome	SlvPercIncome	-0.547	-0.681	0.000			
	BrzPercIncome	Subsidy2018	0.000	-0.229	0.000			

All variables are statistically significant at the 0.001 level in path analysis; step 1 and step 2 both have RMSEA estimates of 0.000 meaning the model is a perfectly good fit to the data.

4.2.2: Giffen Good Conclusions

The data fully supports the argument that health insurance is a Giffen Good. Gold plans are more desirable than silver plans, which are more desirable than bronze plans limited only by income. As the price of less desirable plans increases, the demand for the plans also increases. **Figure 4** and **Figure 5** show how the income effect outweighs the substitution effect and path analysis in **Figure 18** confirms this to be true. **Figure 15**,**Figure 16** and **Figure 17** all show that silver plans are preferable even when bronze plans are offered free of charge, and that as the price of bronze insurance plans increases the aggregate demand and the demand as a percent of income increases for the bronze plans.

One limitation to the regression analysis of health insurance is that the data are limited. The publicly available ACA data only includes information on income level for those receiving subsidies from the government and not those not receiving subsidies. The data also only includes regional level data and not personal level and State level data only includes income ranges. Personal level data could allow for a more accurate measure of the demand for insurance based on price. The price increases are also dependent on the changes in income level; further analysis should examine how price fluctuations not caused by increases in income directly increase or decrease individual demand. To definitively prove that health insurance is a Giffen Good would require the ability to measure the change in price directly on individuals without income changes causing the fluctuation in price through subsidy differences. However, the currently available data fully supports the argument that health insurance is a Giffen Good. Bronze insurance plans are an inferior, necessity good whose demand increases as the price increases, thereby causing the demand for the luxury good (silver plans) to decrease. The closest method for testing the change in demand based solely on price is to test the increase in prices from 2017 to 2018 against the changes in demand. Data on the number of consumers purchasing each insurance plan from CMS are also available for 2017 (CMS, 2018), and the average price change from 2017 to 2018 was taken from the Kaiser Family Foundation (KFF.org, 2018). **Figure 19** examines the changes in demand based on the changes in premium prices from the years 2017 to 2018:

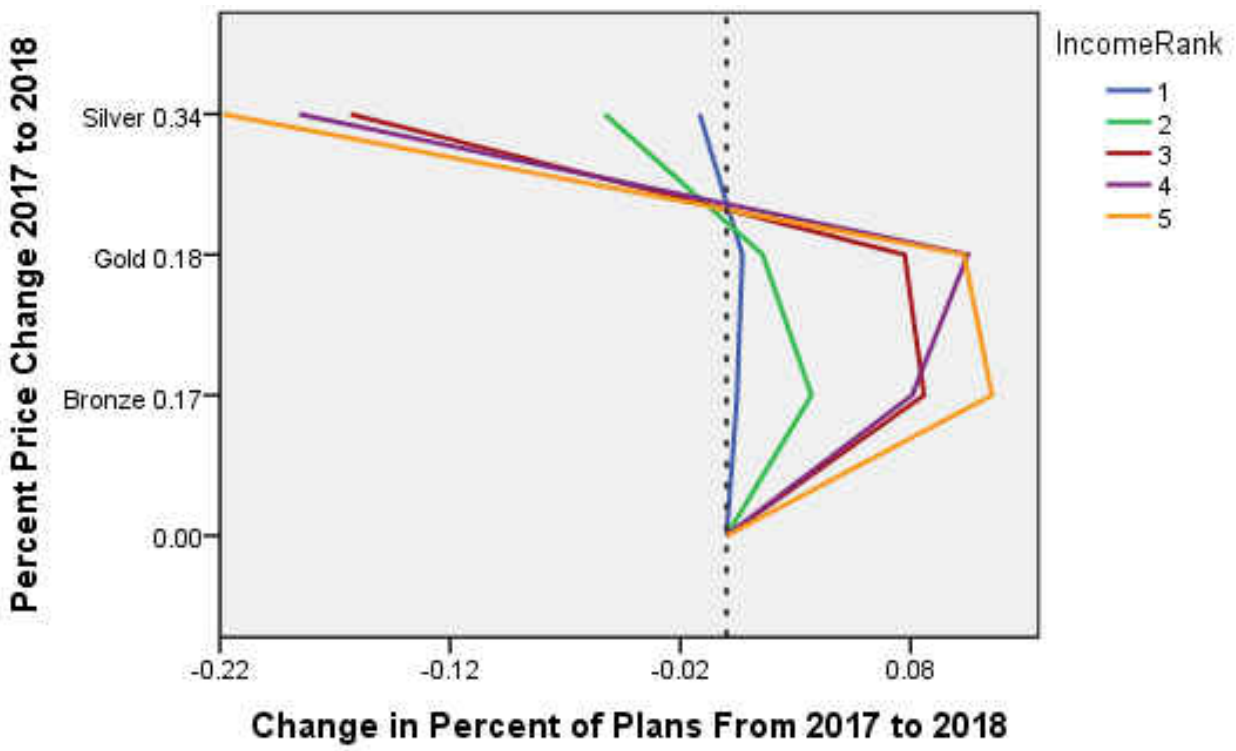


Figure 19: Change in Demand Due to Change in Price from 2017 to 2018

As the price of both the bronze and gold plans increases, the demand for both plans increases at the expense of consumers of silver plans. This price change is not due to differences in income levels and subsidies, but due to price changes between years. Subsidies and income levels remain constant and the demand for bronze and gold plans increases as the price of both increases. Because all three plans are health insurance, this may cause confusion. To address this confusion, an analogy may be used: think of the three plans as three different types of food, which is the goods Sir Giffen was analyzing when he came up with his theory (Marshall, 1895). Bronze plans are potatoes (can meet basic caloric requirements for humans to live) with no other direct substitutes (no other inexpensive plans), silver plans are chicken, and gold plans are steak. As the price of potatoes and chicken increase, consumers must spend more on potatoes and less on chicken. As the price of chicken increases faster than the price increase of steak, many wealthier consumers substitute steak for chicken. Under this analogy, the demand for bronze

plans increases as the price increases just to meet basic health care needs. And, the demand for gold plans increases even though the price increased because the relative increase for silver plans was even higher (if you can afford to purchase meat, and chicken costs almost as much as steak, why not eat steak?). **Figure 20** was created to visually demonstrate this analogy further using the path analysis in **Figure 18**. The variable "subsidy" in **Figure 18** (which effects all plan metals and is therefore a more accurate measure) was replaced with the price of bronze insurance plans for the purpose of carrying the analogy over:

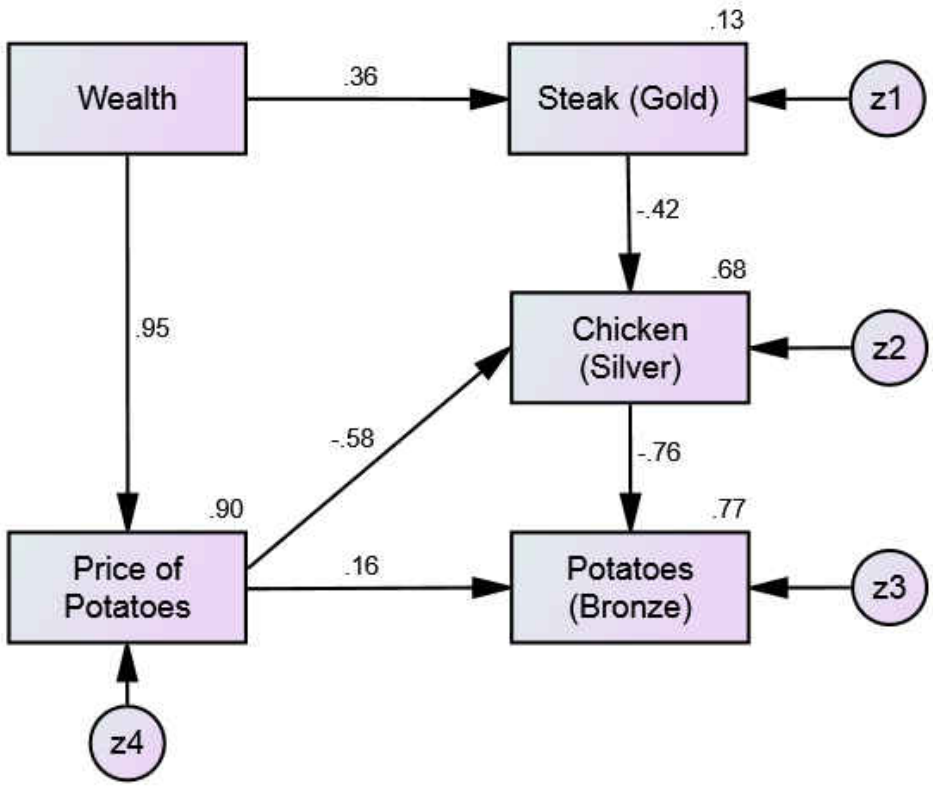


Figure 20: Analogy Applied to Health Insurance Market

Figure 20 shows that as the price of potatoes (bronze plans) increases the demand also increases and the demand for chicken (silver plans) decreases, both are statistically significant at the 0.001 level. Regression analysis of the effects of the price of bronze plans and the percent of each income level choosing bronze and silver plans was presented in **Table 9**:

Table 9: Regression Analysis, Bronze Price Effects on Demand

Model	Independent Variable	Unstandardized Coefficients	Standardized Coefficients	t	Sig.	R Square
1	(Constant)	0.213		15.932	0.000	0.481
Dependent Variable: BrzPercIncome	BrzPrice	0.000	0.693	13.367	0.000	
2	(Constant)	0.729		44.881	0.000	0.506
Dependent Variable: SlvPercIncome	BrzPrice	0.000	-0.711	-14.066	0.000	

As the analogy makes clearer, the data fully supports that bronze health insurance plans are a Giffen Good. The regression shows that as the price of bronze plans increases the demand increases with an R-Square of 0.481 and statistically significant at the 0.001 level based on demand within 39 States. Better access to personal level data should be able to further substantiate that increases in price of bronze plans increase the demand for bronze health insurance plans. However, despite the limited data, the current data analysis demonstrates that inexpensive health insurance is, in fact, a Giffen Good as hypothesized.

4.3: Comparative Analysis of Health Care Systems (Regression Analysis)

The data from the OECD cover a variety of aspects of health care systems and provides the data in standardized forms using uniform reporting and $U.S. Purchasing Power Parity. This means the data from the OECD allow for easy comparison between countries. The data from the OECD also represent a sort of natural experiment to test the effects of health care systems on health care markets and health outcomes. Most countries within the OECD are advanced industrial nations, but the data also include some poor and/or developing nations (Chile, Estonia, Greece, Hungary, Latvia, Mexico, Poland and Turkey) which allows for application to poor and/or developing countries, as well as providing recommendations to the developed world. **Figure 21** shows the distribution of countries in the OECD based on wealth:

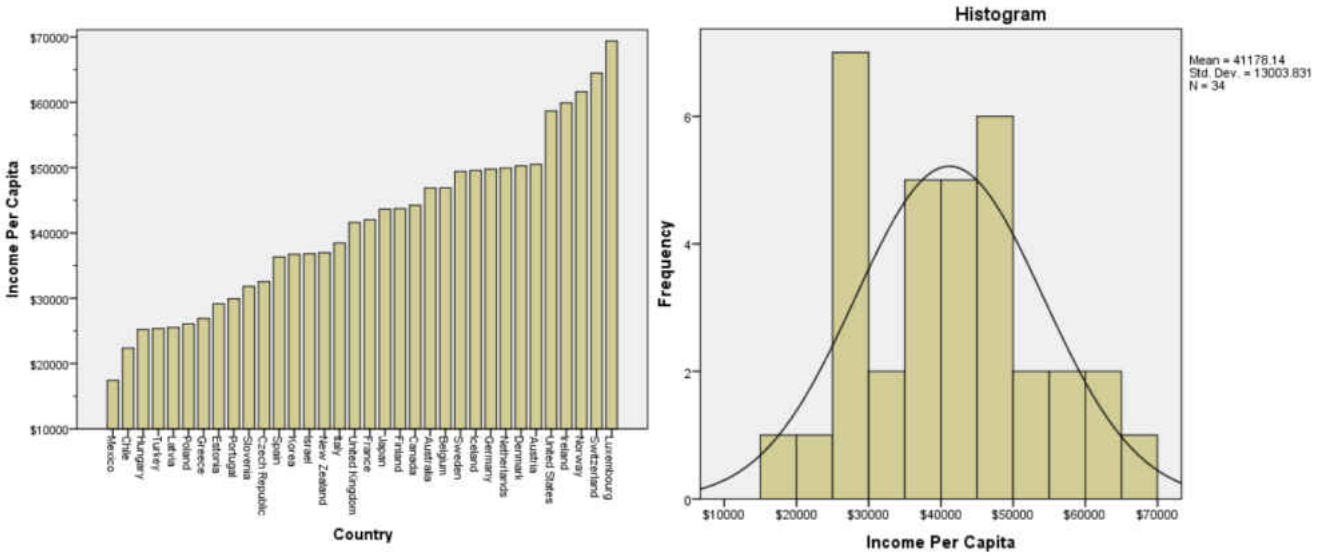


Figure 21: OECD Distribution of Countries Based on Income

As can be seen in **Figure 21**, not only is the income range within OECD countries relatively normally distributed, but the data also contains a wide range of wealth between countries. The OECD data were chosen for analysis due to the quality of data, range of countries, the natural experimental aspect of the data, and the standardization that allowed for easy comparison across variables.

The original data set compiled for analysis had around 150 variables over the five-year period. However, many years had missing data. In the end the data set analyzed contains over 100 variables. Statistically insignificant variables were not used in this analysis. A description of all the variables available along with an explanation of missing cases are detailed in Appendix B, including those not used because they were found to be insignificant as a point of reference for future research and to dissuade arguments about other important variables missing from this analysis. For regression analysis the most recent data (2016) available were used; SEM used data from 2012 through 2016. **Table 10** shows the variables that were found to be statistically significant used in the final regression and SEM analyses:

Table 10: Description of Variables for Analysis of HealthCare Systems

Variable Name	Variable Description and Measure	% Miss	Remedy of Missing	% Miss After
Country	Name of Country	0.00		
Year	Year	0.00		
OECDSysType	System Type based on Insurance, Primary care and Hospitals	0.00		
GDPperCap	GDP Per Capita in US$ PPP	0.00		
GDPGrowth	Real GDP Growth	0.00		
IncomePerCapita	National Income Per Capita in US$	0.00		
GINIoecd	GINI at disposable income post taxes and transfers, 0-1 scale	0.34	Inferred from Previous and/or following survey years	0.02
ExpPerCapCurrent	Per capita, current prices, current PPPs	0.00		
PercentPop65up	Percent of population over 65	0.00		
LifeExpectancy	Total Population at Birth in years	0.00		
LEFemale65	Life Expectancy of Females 65+ in years	0.00		
LEMale65	Life Expectancy of Males 65+ in years	0.00		
InfantNoMin	Infant mortality, No minimum threshold of gestation period or birthweight	0.04	Inferred from Previous and/or following survey years	0.00
NeonatalNoMin	Neonatal mortality, No minimum threshold of gestation period or birthweight	0.08	Inferred from Previous and/or following survey years	0.00
PerinatalMortality	Perinatal mortality per 1000 total Births	0.10	Averaged from Previous and/or following survey years	0.00
MaternalMortality	Maternal mortality per 100,000 live births	0.12	Iceland only had 2 years reported, US did not report, input data from the US CDC; all other missing averaged	0.00
PhysicianDensity	Number of Practicing Physicians, Per 1000 Population	0.11	Used most recent year to fill in random missing, computed by sum of GeneralPractice and SpecialPractice if available	0.00
GeneralPractice	Generalist Practitioners, Density Per 1000 Population	0.02	Used most recent year to fill in random missing	0.00
NurseDensity	Practicing Nurses, Density per 1000 Population	0.22	Used most recent year to fill in random missing, or used "professionally active nurses" when available (overestimates number of nurses, may be in administrative positions)	0.00
EXP1000s	Expenditures in $1000s of US PPP	0.00		
EXP1000Squared	Expenditures in $1000s of US PPP Squared	0.00		
Income1000s	Income per capita in $1000s of US PPP	0.00		
Access	Latent variable, measure of Access	0.00		

Variable Name	Variable Description and Measure	% Miss	Remedy of Missing	% Miss After
Quality	Latent variable, measure of Quality	0.00		
LnGeneralPractice	Natural Log of GeneralPractice	0.00		
LnInfant	Natural Log of InfantNoMin	0.00		
LnMaternal	Natural Log of MaternalMortality	0.00		
FreeDum	Free Market dummy 1=Private insurance and provision	0.00		
SocialDum	Socialized dummy 1=public insurance and provision	0.00		

4.3.1: Health Systems Framework

According to the health care market model presented in Chapter 3, wealth plus system should determine expenditures, with free market systems spending the most, and socialized systems spending the least on health care. Expenditures minus expenditures squared should determine quality and access to care. Increasing expenditures will increase access to care as more resources become available, but when expenditures are too high (as represented by expenditures squared), access to care should decrease as the cost becomes prohibitive and reduces access. Increasing expenditures will increase competition for consumers and thus increase the quality of care. When expenditures are too high (as represented by expenditures squared), quality will not increase and the excess expenditures represent wasted resources (expenditures that do not add quality and therefore represent economic waste within the system).

According to the previous discussion, a systems framework for specifying the causal relationships of the system components can be beneficial for guiding the analysis of health care systems and analyzing the complexity of contextual effects and policy effects on performance and health outcomes. **Figure 22** shows a path diagram used to build regression models:

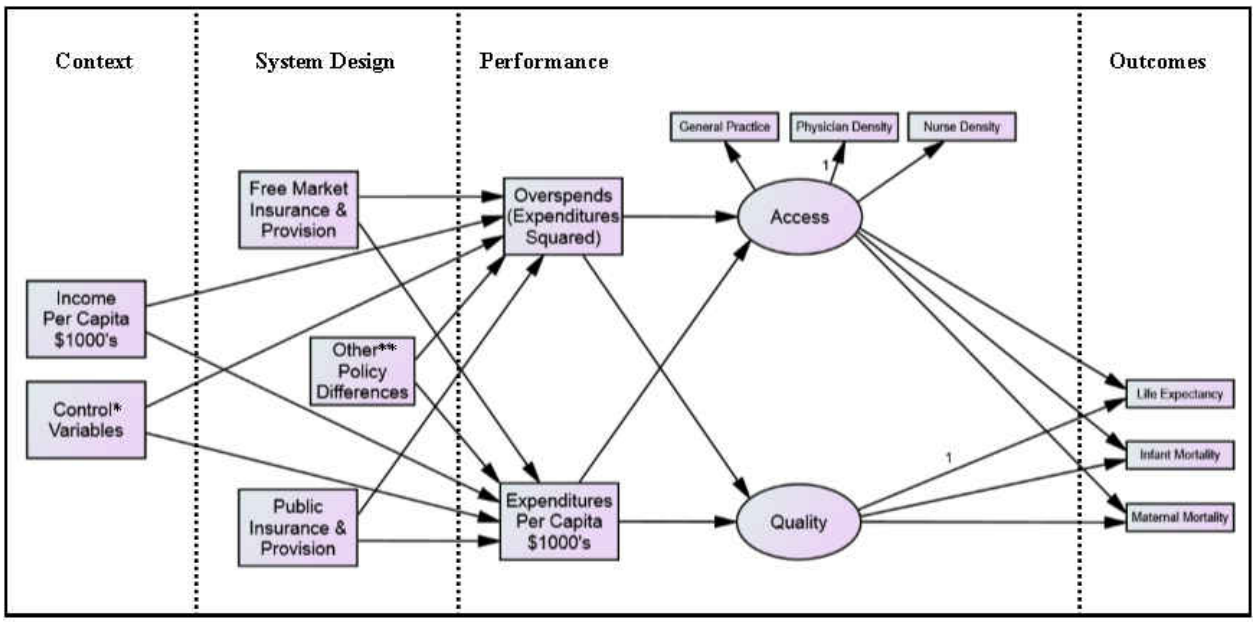


Figure 22: Path Diagram and Systems Framework for Analysis of Health Care

Figure 22 only shows the variables found to be significant through regression and structural equation modelling. Many other variables were analyzed and found to be insignificant. The contextual (C) variables tested in this analysis include how wealthy a country is, as well as other possible control variables that could affect performance and health outcomes. Control variables tested included life style factors (obesity, alcohol use, and tobacco use), poverty rates and inequality (GINI scores), and the age of population above 65 and 80 (a larger elderly population) that could increase expenditures and decrease health outcomes.

The system (S) design variables include dummy variables for system type (Free Market, Universal and Socialized) as well as other policy differences within each system type. Within system variables tested include the use of global budgeting, whether consumers have a choice of insurers and/or providers, requirements for referrals, the use of copays, pay for performance, and the use of exemptions of copays for the poor.

Performance (P) variables include expenditures per capita, expenditures squared (measures the decrease in access caused by overspending and economic waste in terms of quality from overspending), and the levels of health care resources (numbers of providers, hospitals, and access to technology).

Outcome (O) variables analyzed included life expectancy, infant mortality, maternal mortality, perinatal mortality, neonatal mortality, and population age (models that include population age must be non-recursive as an aging population is a sign of good quality and access to care and also should increase expenditures).

4.3.2: Step 1: Determinants of Expenditures

For the first step in this analysis, the causes of health care expenditures were analyzed. **Table 11** Shows the results of the statistically significant models used to predict health care expenditures per capita:

Table 11: Expenditures Per Capita Regression Models

		Dependent Variable	Independent Variable	Unstandardized Coefficient	Coefficient S.E.	Standardized Coefficient	t	P Value	Model R^2
**	1	Expenditures Per Capita	Constant	-1941.567	424.692		-4.572	0.000	0.872
			Income Per Capita	0.146	0.01	0.934	14.793	0.000	
*	2	Expenditures Per Capita	Constant	-1154.37	310.915		-3.713	0.001	0.965
			Income Per Capita	0.129	0.006	0.828	21.294	0.000	
			Free Market Dummy	3473.701	421.576	0.294	8.24	0.000	
			Socialized Dummy	-335.225	159.208	-0.082	-2.106	0.044	
*	3	Expenditures Per Capita	Constant	-4490.966	995.228		-4.512	0.000	0.971
			Income Per Capita	0.143	0.006	0.897	22.372	0.000	
			Free Market Dummy	3296.086	433.999	0.288	7.595	0.000	
			%Pop 65 Up	77.737	22.87	0.127	3.399	0.002	
			GINI	3944.322	1891.067	0.093	2.086	0.047	

** Model Significant at the 0.001 Level

* Model Significant at the 0.05 Level

Models 1 through 3 in **Table 11** predict expenditures per capita using the available data to find the best fitting model. Income per capita was found to be a better predictor of expenditures than GDP per capita, so model 1 shows the effects of income per capita on health expenditures rather than GDP per capita.

Wealthier countries spend more per capita on health care than poorer countries with an R-Square of 0.872 and significant at the 0.001 level. Model 2 adds the system dummies to Model 1 and shows an improved R-Square of 0.965, an increase in predictive power of roughly 9% more of the variation in expenditures with all variables significant at the 0.05 level. Model 3 was created by adding in multiple control variables into Model 2 and reducing insignificant variables until only significant variables remained. When GINI and the % of population 65 and up were included the socialized dummy was statistically insignificant. Variables included but found to be insignificant included: 1.) lifestyle factors of alcohol consumption, tobacco use and obesity rates, 2.) access to medical technology (MRI units and CTE scanners), and 3.) research and development expenditures. In Model 3, the percent of population 65 and up is only statistically significant if the GINI coefficient is included and vice versa. Models 2 and 3 are very similar because socialized countries tend to be poorer. And countries with higher inequality (GINI coefficients) have a smaller population over the age of 65. Countries with more wealth inequality (higher GINI coefficients) are also poorer but neither the population over 65 or GINI coefficients are directly related to expenditures. Model 3 shows a spurious relationship exists between the GINI, population over 65 and expenditures according to the correlation matrix presented in **Table 12**:

Table 12: Correlation Matrix for Expenditure Predictors

		PecentPop65up	GINIoecd	IncomePer Capita	ExpPerCap Current	SocialDum
PecentPop65up	Pearson Correlation	1				
	Sig. (2-tailed)					
	N	34				
GINIoecd	Pearson Correlation	-.421*	1			
	Sig. (2-tailed)	0.016				
	N	32	32			
IncomePerCapita	Pearson Correlation	0.151	-.387*	1		
	Sig. (2-tailed)	0.394	0.029			
	N	34	32	34		
ExpPerCapCurrent	Pearson Correlation	0.171	-0.221	.934**	1	
	Sig. (2-tailed)	0.333	0.224	0		
	N	34	32	34	34	
SocialDum	Pearson Correlation	-0.217	0.072	-.447**	-.517**	1
	Sig. (2-tailed)	0.218	0.693	0.008	0.002	
	N	34	32	34	34	34

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

The socialized system dummy appears to be a more direct cause of expenditures and a better predictor of expenditures than using the GINI coefficient and the percent of population over 65. When GINI is included in Model 2 without the percent of population over 65, it has a P value of 0.684 while the socialized dummy remains statistically significant at the 0.05 level. Model 2 is a better predictive model than Model 3. Expenditures are determined by income (wealth) and system dummies (system type) as predicted by the integrative market model in Chapter 3.

4.3.3: Step 2: Determinants of Health Care Resources

The second step to affirm the health care market model created in Chapter 3 is to examine the determinants of health care resources as partial measures of access to care:

Table 13: Regression Models for Determinants of Health Care Resources

	Model	Dependent Variable	Independent Variable	Unstandard. Coefficient	S.E.	Standardized Coefficient	t	P Value	Model R^2
	1	Physician Density	Constant	2.131	0.553		3.854	0.001	0.144
			Expenditures Per Capita	0.001	0.000	1.306	2.176	0.037	
			Expenditures Squared	-4.69E-08	0.000	-1.140	-1.900	0.067	
	2	Physician Density	Constant	2.692	0.474		5.679	0.000	0.062
			Income Per Capita	1.61E-05	0.000	0.250	1.460	0.154	
*	3	General Practice Density	Constant	0.215	0.302		0.712	0.482	0.035
			Expenditures Per Capita	0.0004	0.000	1.569	2.686	0.012	
			Expenditures Squared	-3.50E-08	0.000	-1.512	-2.588	0.015	
	4	General Practice Density	Constant	0.696	0.270		2.577	0.015	0.058
			Income Per Capita	6.73E-06	0.000	0.186	1.073	0.291	
**	5	Nurse Density	Constant	-2.179	1.623		-1.343	0.189	0.717
			Expenditures Per Capita	0.004	0.001	1.975	5.647	0.000	
			Expenditures Squared	-2.61E-07	0.000	-1.257	-3.595	0.001	
**	6	Nurse Density	Constant	-1.879	1.393		-1.349	0.187	0.680
			Income Per Capita	0	0.000	0.825	8.256	0.000	

** Model significant at the 0.001 level

* Model significant at the 0.05 level

Table 13 shows the results of regression analyses to determine the levels of health care resources. Other variables were tested for statistical significance and found to be insignificant: specialty practice, number of hospitals, and number of hospital beds. **Table 13** includes two different models for predicting the levels of health care resources: 1.) Income per capita, and 2.) expenditures per capita plus expenditures squared (reduction in access, therefore a reduction in demand and a reduction in supply). Models 1 and 2 test the effects of income and expenditures on total physician density. Model 2 is statistically insignificant, but Model 1 is on the edge of the 0.05 significance level and has twice the explanatory power. Models 3 and 4 test the effects on general practice density. Model 4 is not statistically significant. Models 5 and 6 test the effects on nurse density. Both models are statistically significant, but Model 5 explains more of

the variation than Model 6. In all three measures of health care resources, expenditures plus expenditures squared, represent a more accurate measure than income per capita. This suggests that the path diagram is accurate, and that income determines expenditures but does not directly determine levels of health care resources used.

4.3.4: Step 3: Determinants of Health Outcomes

The third step to affirm the causal model examines how health outcomes are affected by expenditures per capita and expenditures squared in comparison with other possible models presented in **Table 14**:

Table 14: Regression Models for Determinants of Health Outcomes

	Model	Dependent Variable	Independent Variable	Unstandardized Coefficient	S.E.	Standardized Coefficient	t	P Value	Model R^2
**	1	Life Expectancy	Constant	77.806	0.975		79.763	0.000	0.263
			GDP Per Capita	7.11E-05	0.000	0.513	3.379	0.002	
**	2	Life Expectancy	Constant	76.271	1.098		69.443	0.000	0.376
			Income Per Capita	0.00011	0.000	0.613	4.391	0.000	
**	3	Life Expectancy	Constant	78.528	0.812		96.677	0.000	0.245
			Expenditures Per Capita	0.001	0.000	0.495	3.223	0.003	
*	4	Life Expectancy	Constant	75.811	1.034		73.333	0.000	0.481
			Income Per Capita	0.00013	0.000	0.693	5.200	0.000	
			Free Market Dummy	-4.62	1.842	-0.334	-2.509	0.018	
**	5	Life Expectancy	Constant	73.683	1.035		71.173	0.000	0.628
			Expenditures Per Capita	0.003	0.000	2.642	6.678	0.000	
			Expenditures Squared	-2.61E-07	0.000	-2.234	-5.647	0.000	
**	6	Infant Mortality	Constant	9.265	1.199		7.724	0.000	0.419
			Expenditures Per Capita	-0.002	0.001	-2.304	-4.660	0.000	
			Expenditures Squared	2.28E-07	0.000	2.104	4.257	0.000	
*	7	Infant Mortality	Constant	6.7	1.172		5.719	0.000	0.174
			Income Per Capita	-7.06E-05	0.000	-0.417	-2.598	0.014	
**	8	Neonatal Mortality	Constant	5.835	0.822		7.095	0.000	0.353
			Expenditures Per Capita	-0.002	0.000	-2.143	-4.109	0.000	
			Expenditures Squared	1.43E-07	0.000	2.028	3.888	0.000	

	Model	Dependent Variable	Independent Variable	Unstandardized Coefficient	S.E.	Standardized Coefficient	t	P Value	Model R^2
*	9	Neonatal Mortality	Constant	4.116	0.791		5.201	0.000	0.108
			Income Per Capita	-3.61E-05	0.000	-0.328	-1.967	0.058	
**	10	Maternal Mortality	Constant	27.899	3.748		7.444	0.000	0.498
			Expenditures Per Capita	-0.009	0.002	-2.514	-5.470	0.000	
			Expenditures Squared	8.38E-07	0.000	2.302	5.009	0.000	
*	11	Maternal Mortality	Constant	17.752	3.928		4.520	0.000	0.178
			Income Per Capita	-0.00024	0.000	-0.422	-2.633	0.013	

** Model significant at the 0.001 level

* Model significant at the 0.05 level

In **Table 14**, Models 1 through 5, test alternative models for predicting life expectancy. Models 1 and 2 test wealth as a function of GDP per capita versus income per capita. Income per capita is a superior model with an R-square of 0.378. Models 2 and 3 compare income per capita versus expenditures. Model 2 is a superior model and explains more variation than expenditures. Model 4 adds the system dummies to model 2 (Socialized systems and universal systems were not statistically significant. There is little variation between the two systems when examining life expectancy as a function of income per capita). The R-square of 0.481 in Model 4 represents an increase in explanatory ability of roughly 10%. Model 5 tests expenditures and expenditures squared versus the best alternative model (Model 4). Model 5 shows an increase of R-square from 0.481 to 0.628 and is statistically significant at the 0.001 level. Model 5 clearly shows a better fit and accounts for nearly two-thirds of the overall variation in life expectancy. The regression models fully support the path diagram in **Figure 22** and support the hypothesis that overspending decreases access to care and increases waste (increased spending that does not cause a corresponding increase in health outcomes).

Models 6 through 11 test income versus expenditures plus expenditures squared for three other measures of health care outcomes, infant mortality, neonatal mortality and maternal

mortality rates. For all three health care outcomes, expenditures plus expenditures squared represent better fits to the data, larger explanatory power (R-square), and are all significant at the 0.001 level whereas income per capita is only significant at the 0.05 level.

4.3.5: Regression Conclusions

Income per capita plus system dummies account for 96.5% of the variation in expenditures per capita. Expenditures per capita plus expenditures squared account for the different levels of health care resources and differences in health outcomes better than income per capita. The mathematical formulas for the path diagram, in **Figure 22**, are represented in **Equation 4**:

Equation 4: Path Diagram Formulas

Health Outcomes = $\beta_0 + \beta_1$Quality + β_2Access + ε.

Health Care Resources = $\beta_0 + \beta_1$Access + ε.

Quality = $\beta_0 + \beta_1$Expenditures (increased quality) - β_2Expenditures^2 (economic waste; expenditures that do not contribute to quality) + ζ.

Access = $\beta_0 + \beta_1$Expenditures (increased access) - β_2Expenditures^2 (Decreased access due to pricing consumers out of the market) + ζ.

Expenditures = $\beta_0 + \beta_1$Income Per Capita + β_2System Type + ζ.

Therefore;

Health Outcomes = $\beta_0 + \beta_1$Expenditures - β_2Expenditures^2+ ε.

Health Care Resources = $\beta_0 + \beta_1$Expenditures - β_2Expenditures^2 + ε.

As can be seen in **Equation 4**, the regression analyses fit the predicted formulas based on the path diagram. **Equation 5** shows the regression formulas applied to the path diagram:

Equation 5: Regression Formulas Applied to the Path Diagram

> **Expenditures Per Capita = -$1154 + $0.129 * (Income Per Capita) + $3474 * (Free Market Dummy) - $335 * (Socialized Dummy); R-Square 0.965.**
>
> **Health Care Resources (Nurse Density per 1000) = -2.378nurses + 0.004nurses * (Expenditures Per Capita) – 2.59E-7nurses * (Expenditures Squared); R-Square 0.717.**
>
> **Health Outcomes (Life Expectancy) = 73.7years + 0.003years * (Expenditures Per Capita) – 2.61E-7years * (Expenditures Squared); R-Square 0.628.**

With R-squares between 0.628 and 0.965 the models hold up very well and explain more variation than that of any alternative model. These results clearly show that the path diagram in **Figure 22**, based on the integrative market model in **Figure 14**, accurately describe market forces and effects of different health care systems on economic efficiency, quality, and access to care. Free market systems overspend (by at least $3474), decreasing access to care and waste money that does not increase the quality of care. Socialized systems underspend, decreasing access to care and quality of care (the amount is not measurable through regression analysis alone). It appears that the integrative market model created in Chapter 3 is fully supported. **Figure 23** shows a side-by-side comparison of the basic market model next to the quadratic regression of the OECD countries:

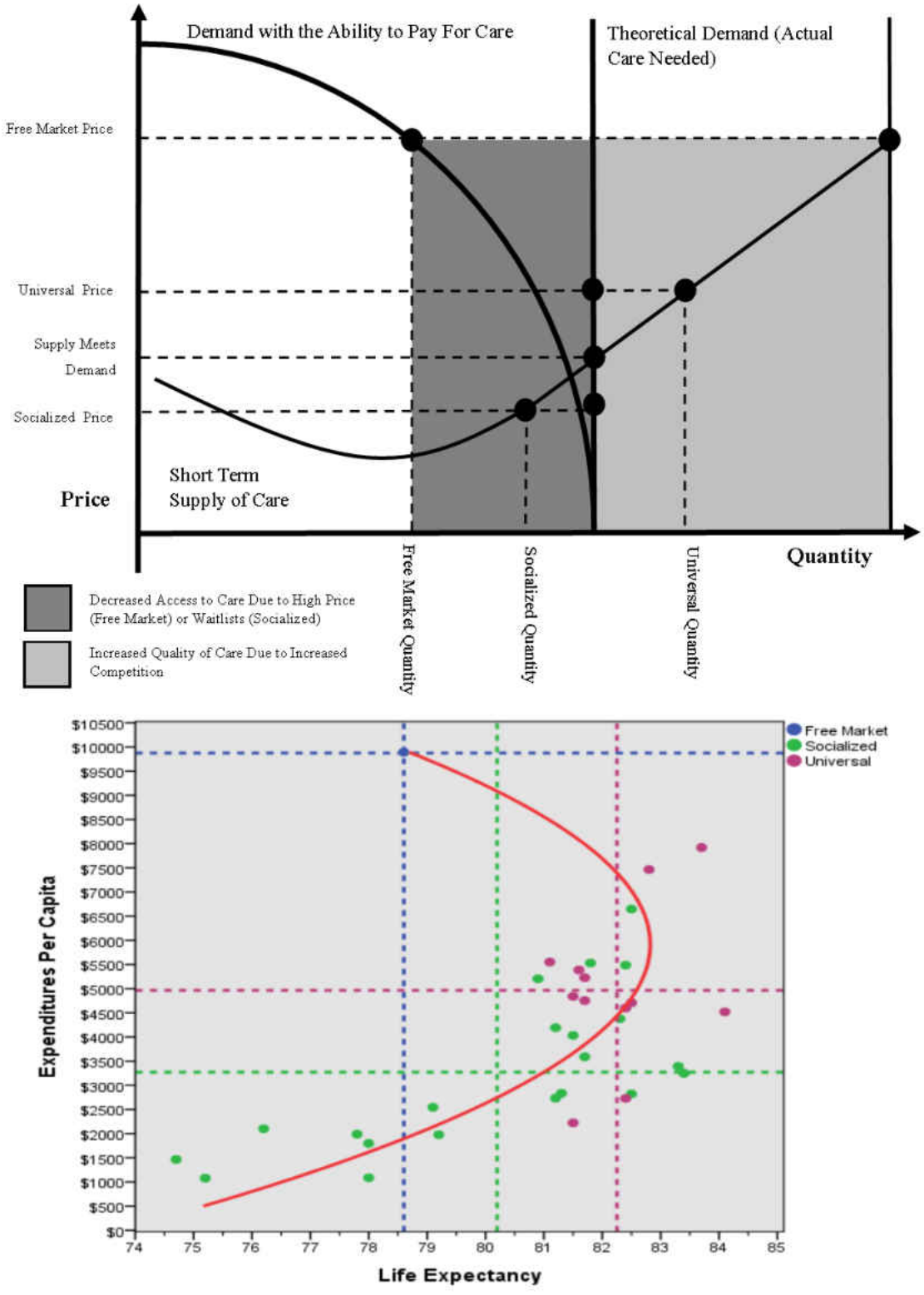


Figure 23: Comparison of Basic Market Model and Quadratic Regression

Figure 24 Overlays the quadratic regression results over the most simplistic market model:

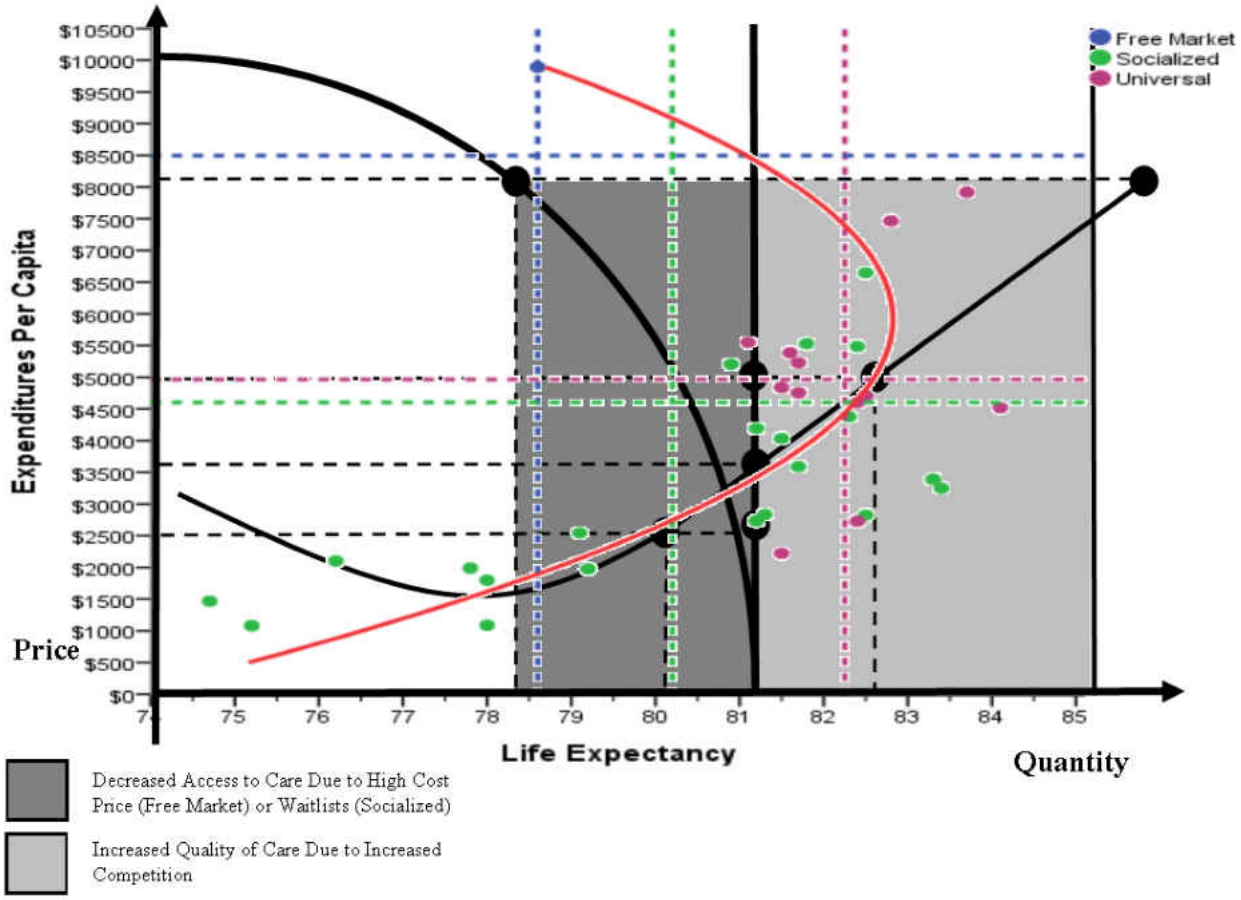


Figure 24: Quadratic Regression Overlaid on Basic Market Model

Figure 23 and **Figure 24** clearly show that the data fully supports the market model presented in Chapter 3. Reference lines for the three systems in **Figure 23** are set to the mean life expectancy and per capita expenditures of each system type but does not control for the wealth of countries. As shown earlier, poorer countries tend to also use socialized systems and therefore the mean expenditures for socialized systems is being driven lower than it should be when wealth is controlled for in the regression models and in **Equation 5**. Socialized systems spend $335 less than universal systems and free market systems spend $3474 more than universal systems according to **Equation 5** when controlling for income. **Figure 24** uses the results from the

regression models in **Table 11** and **Equation 5** to compare expenditures based on the mean of universal systems' per capita expenditures as a reference point instead of the mean expenditures for each individual system. Controlling for wealth creates a more accurate representation of differences between systems. **Figure 24** shows expenditures when controlling for wealth for socialized systems and free market systems are much closer to universal systems than using means of the systems for comparison. However, mean life expectancy for each system type still had to be used in the figure, as there is no statistically significant regression model that allows for the measurement in differences in life expectancies while controlling for wealth between the system types. Regression analysis was performed, despite being statistically insignificant, in an attempt to control for wealth and system type for life expectancy. The results suggest that socialized systems, when controlling for wealth, perform between 0.75 and 1 year worse than universal systems, and free market systems perform 3.5 to 4.2 years worse, when controlling for wealth, than universal systems.

There are a few limitations to the regression analysis that require more examination and further modelling, which are examined presently. The first limitation is caused by the variables multicollinearity within the regression models using expenditures and expenditures squared to predict health care resources and health outcomes. Clearly, expenditures and expenditures squared will create problems of multicollinearity as expenditures squared is created from expenditures. This means regression models have a difficult time estimating the coefficients for the variables because multicollinearity increases the standard errors. Higher standard errors lead to less accurate estimates of coefficients within regression. However, this has no effect on the predictive capabilities of the model or the significance of the model (Kline, 2011; PennState, 2018; Yoo et al., 2014). Scaling of variables also changes accuracy of estimates in quadratic

regression, as higher values increase at faster rates then lower values. To address this issue, expenditures was converted into $1000s (reducing the range of values), and "mean centering" was performed. Mean centering takes the mean expenditure and subtracts it from each value for each case in the data set (Kline, 2011; Moosbrugger, Schermelleh-Engel, Kelava, & G. Klein, 2009; PennState, 2018). This makes the mean value 0; cases are all then compared to the mean value. The mean expenditures in $1000s in the data set is $4.057. The mean centered data causes cases lower than the mean to be negative, which is then squared, which makes the values positive, decreasing the collinearity of expenditures and expenditures squared. This allows the regression model to more accurately measure the effects of the two variables independently without changing significance or any other aspect to the model. **Table 15** shows the comparison of the models for predicting life expectancy based on expenditures:

Table 15: Expenditure Conversion and Model Comparison

	Dependent Variable	Independent Variable	Unstand. Coefficient	S.E.	Standardized Coefficient	t	P Value	Tolerance	VIF	Model R^2
1	Life Expectancy	Constant	73.683	1.035		71.173	0.000			0.628
		Expenditures Per Capita	0.003	0.000	2.642	6.678	0.000	0.077	13.040	
		Expenditures Squared	0.000	0.000	-2.234	-5.647	0.000	0.077	13.040	
2	Life Expectancy	Constant	73.683	1.035		71.173	0.000			0.628
		Exp $1000s	3.089	0.463	2.642	6.678	0.000	0.077	13.040	
		Exp $1000s Squared	-0.261	0.046	-2.234	-5.647	0.000	0.077	13.040	
3	Life Expectancy	Constant	81.919	0.316		259.564	0.000			0.628
		Exp$1000s Centered	0.971	0.146	0.830	6.663	0.000	0.773	1.293	
		Exp $1000s Centered Squared	-0.261	0.046	-0.704	-5.647	0.000	0.773	1.293	

As seen in **Table 15** converting expenditures into expenditures in $1000s and mean centering have no effect on the significance of the relationships of the P values. The data conversions only reduce uncertainty within the estimates of the betas, therefore it allows regression to provide a more accurate estimate of the coefficients because regression estimates the coefficients using the standard errors (Moosbrugger et al., 2009; PennState, 2018). This uncertainty is reflected within the standardized coefficients. Comparing Models 1 and 2 there is no difference in the betas, but Model 3 shows Betas below 1. Standardized betas do not necessarily need to be within absolute value of 1, but betas outside of the unity range can cause confusion for interpretation of values (Deegan, 1978; Joreskog, 1999). In a quadratic regression, the coefficients must be interpreted simultaneously and cannot be interpreted independently, even though regression analysis computes them independently. Mean centering allows for more easily interpretable coefficients and more accurate estimates of coefficients. **Figure 25** shows that the conversion has no effect on the relationship between the variables:

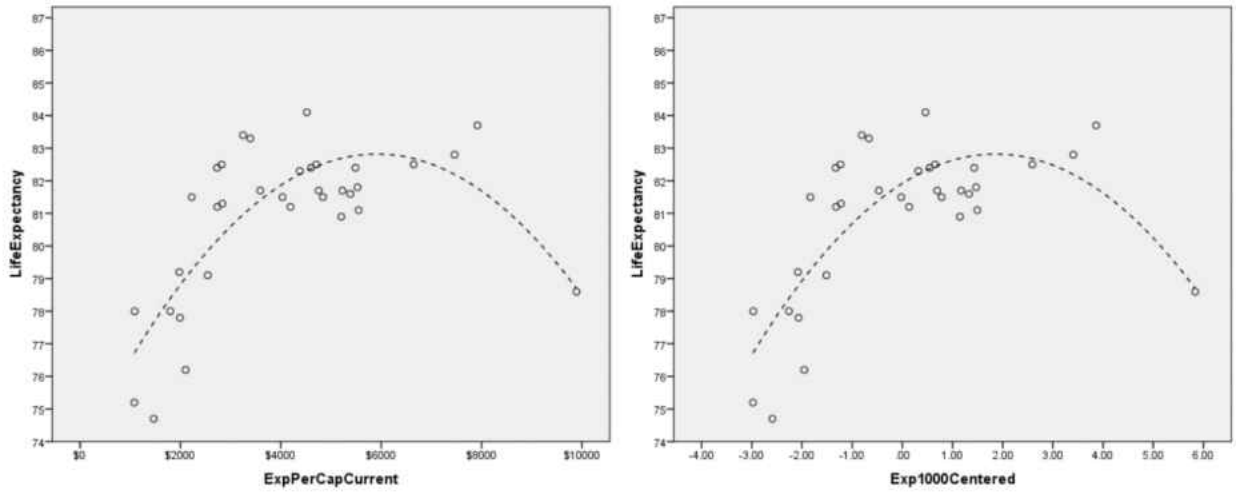


Figure 25: Quadratic Regression Comparison of Expenditure Conversion

Mathematically the results of the conversion are the same, but the estimates of the coefficients become more accurate. Model 2 estimates an increase of life expectancy of 3 years for every

$1000 increase in expenditures from $0 and a simultaneous decrease of 0.26 years for every increase of $1000 squared. Model 3 estimates that the increase is 1 year for every $1000 increase in expenditures above the mean expenditures and a simultaneous decrease of 0.26 years for every $1000 above the mean squared, or a 1 year decrease for every $1000 below the mean, plus a further decrease of 0.26 years for every $1000 squared under the mean expenditures. **Table 16** shows the regression results for the mean centered expenditures and all the previously analyzed health care resource and health outcome variables from **Table 13** and **Table 14**:

Table 16: Expenditures Mean Centered, Health Outcomes and Health Care Resources

Model	Dependent Variable	Independent Variable	Unstandardized Coefficient	S.E.	Standardized Coefficient	t	P Value	Model R^2
1	Infant Mortality	Constant	2.884	0.366		7.887	0.000	0.419
		Exp1000Centered	-0.648	0.169	-0.597	-3.837	0.001	
		Exp1000CenteredSquared	0.228	0.054	0.663	4.257	0.000	
2	Neonatal Mortality	Constant	2.059	0.251		8.214	0.000	0.353
		Exp1000Centered	-0.351	0.116	-0.499	-3.036	0.005	
		Exp1000CenteredSquared	0.143	0.037	0.639	3.888	0.000	
3	Maternal Mortality	Constant	4.529	1.143		3.964	0.000	0.498
		Exp1000Centered	-2.358	0.527	-0.647	-4.472	0.000	
		Exp1000CenteredSquared	0.838	0.167	0.725	5.009	0.000	
4	Physician Density	Constant	3.541	0.169		21.003	0.000	0.144
		Exp1000Centered	0.157	0.078	0.381	2.019	0.052	
		Exp1000CenteredSquared	-0.047	0.025	-0.359	-1.900	0.067	
5	General Practice Density	Constant	1.113	0.092		12.073	0.000	0.189
		Exp1000Centered	0.079	0.043	0.343	1.867	0.071	
		Exp1000CenteredSquared	-0.035	0.014	-0.476	-2.588	0.015	
6	Nurse Density	Constant	10.145	0.495		20.509	0.000	0.709
		Exp1000Centered	1.981	0.228	0.955	8.674	0.000	
		Exp1000CenteredSquared	-0.261	0.072	-0.396	-3.595	0.001	

Using the mean centered expenditures allows for the estimation of life expectancy controlling for wealth and system type by combining the regression formulas from **Table 15** and **Table 17**:

Table 17: Expenditures Mean Centered by System Type

Dependent Variable	Independent Variable	Unstandardized Coefficient	S.E.	Standardized Coefficient	t	P Value	Model R^2
Exp $1000s Centered	Constant	-5.212	0.311		-16.762	0.000	0.965
	IncomePerCapita	0.00013	0.000	0.828	21.294	0.000	
	FreeDum	3.474	0.422	0.294	8.240	0.000	
	SocialDum	-0.335	0.159	-0.082	-2.106	0.044	

Table 17 predicts the mean centered expenditures based on wealth and system type. This allows for the calculation of life expectancy, which is performed in **Equation 6**:

Equation 6: Between System Life Expectancy Holding Income Constant

Exp $1000s Centered = -5.212 + 0.00013 * (Income Per Capita) + $3.474 * (Free Market Dummy) - $0.335 * (Socialized Dummy); R-Square 0.965.

Health Outcomes (Life Expectancy) = 81.919 years + 0.971years * (Exp $1000s Centered) – 0.261 years * (Exp $1000s Centered Squared); R-Square 0.628.

Therefore, socialized systems spend $0.335 less than universal systems, and free market systems spend $3.474 more than universal systems in terms of means. Universal system has a mean expenditures mean centered = 0.9359 above the mean.

Therefore, holding all incomes constant:

Universal Life Expectancy = 81.919 years + 0.971 * 0.9359 – 0.261 * $(0.9359)^2$ = 82.599 years.

Free Market Life Expectancy = 81.919 years + 0.971 * (0.9359 + 3.474) – 0.261 * $(0.9359 + 3.474)^2$ = 81.125 years.

Socialized Life Expectancy = 81.919 years + 0.971 * (0.9359 – 0.335) – 0.261 * $(0.9359 – 0.335)^2$ = 82.408 years.

Holding all income per capita equal across system types, universal systems increase life expectancy over socialized systems by 0.191 years (or 2.3 months) and 1.474 years (or 17.7 months) over free market systems based on the regression estimates and **Equation 6**. Converting from a socialized system to a universal system, holding all other factors constant, theoretically should result in an increase in the average life expectancy by 2.3 months.

Converting from a free market system to a universal system, holding all other factors constant, theoretically should increase average life expectancy by 1.474 years.

Another limitation to this analysis is that regression analysis does not allow for connecting multiple steps within the process. Each correlation must be individually tested and therefore the aggregate measurable effects cannot be accurately measured with regression analysis alone. Path analysis could be beneficial to control for multiple interactions, but due to access and quality being latent variables, path analysis cannot be directly performed. To address these last two limitations, structural equation modelling has been added in the next section of this analysis, as it allows for the measurement of latent variables and the measurement of multiple correlations simultaneously allowing for more accurate measurement of direct and indirect effects and steps within the process while testing for the theoretical connections in Chapter 3.

4.4: Comparative Analysis of Health Care Systems (Structural Equation Modelling)

Structural equation modeling (SEM) allows for the testing of theory and is a powerful tool for measuring and analyzing latent variables. SEM was used to further test the models in an attempt to measure the independent effects on quality and access to care based on system type. SEM requires a larger sample size than there currently are countries in the OECD. Due to the limited number of countries in the OECD, Time-Series-Cross-Section (TSCS) analysis to pool yearly data together had to be added into the model. TSCS provides a method for pooling data, in which each country is observed based on a given year. Because this study is interested in the data based on system, not changes over time, "Time", a control variable, was treated as a subunit to "Country". Mathematically this relationship is expressed based on the above theories as **Equation 7**:

Equation 7: TSCS Example

$$\textbf{Life Expectancy}(\textbf{Country}_{\textbf{Time}}) = \textbf{Quality}(\textbf{Country}_{\textbf{Time}}) + \textbf{Access}(\textbf{Country}_{\textbf{Time}})$$

Therefore, each country is observed and regressed based on the year in which the observation occurred. This allows for an increased number of observations controlling for time (year) of the observation. There are currently 34 OECD member countries included in the data set. Starting with the most recent data year available (2016 for most variables), the previous 5 years data were added to the data set used in the analysis (2012 through 2016). There are 5 time specific observations that span across 34 cases with a total of 170 observations. ANOVA analysis was performed for all dependent variables found statistically significant in either regression or SEM, factored by year; no statistically significant differences were found. Latent growth curve models were also created to test the effects of time on all outcome variables. None of the models were found to be statistically significant. In other words, life expectancy in 2012 cannot be used to predict life expectancy in 2013—changes in life expectancy from one year to the next does not follow a linear pattern. Time has no direct effect on the variables tested and differences between years are random. Therefore, time does not need to be factored into the analysis or controlled for within the analysis (latent growth curve analysis is not necessary within the final SEM models).

4.4.1: Measurement Model

Access and quality of care are conceptualized as latent variables that cannot be directly measured. Because of this a measurement model for each of these latent variables had to be created and tested. The data set from the OECD is rather limited in terms of direct measures of access to care. However, the data set includes variables on health care resources across the 34 countries. Health care resources can be used as a partial measure of access to care. More resources mean that more patients can get the care they need and increases in demand cause

increases in supply. As more people have access to care through the ability to pay for care by increasing insurance, the supply of providers should increase to meet the demand, meaning that resources should be a partial function of access. Access also effects health outcomes. More access to care should lead to longer life expectancy. Therefore, health care resources, in combination with health outcomes (life expectancy), should be a reasonable measure of access to care, albeit imperfect. A more perfect measure would also include wait periods for non-elective procedures, wait times for consultations and specialists, and measures on delayed treatment due to prohibitive costs. The OECD does now collect these last variables, but reporting is inconsistent, and the data set has large quantities of missing data. The variables available on resources included nurse density, general practice density, total physician density, specialist density, hospital beds, number of hospitals, and measures of technology (CT scanners, MRI units, and PET scanners). There was little correlation with some of the measures and they were dropped from the model. The variables found significant and were included in the model are nurse density, general practice density, and total physician density.

Quality of care can partially be measured by health outcomes when controlling for access to care. When access to care is equal, differences in health outcomes should be a function of the quality of the care received. The data set from the OECD also includes data on aggregate health outcomes. The data from the OECD contains various measures of health outcomes, including life expectancy, infant mortality, and maternal mortality. Life expectancy is a function of both access to care and quality of care. Infant mortality and maternal mortality may be partial measures of access to care, but because every country guarantees emergency care, these two measures should be a bigger function of quality of care than a function of access to care. Patients are already at the hospital in the case of infant mortality and maternal mortality.

Previous access may have reduced the number of deaths, but once at the hospital, the number of deaths should be a function of the quality of the care, not access to care. Other measures of quality would be desirable, but once again, comparative, comprehensive data is limited. The data set from the OECD also contained data on perinatal mortality, and neonatal mortality. However, the data was not found to be statistically significant, most likely due to reporting errors as it appears different countries defined perinatal and neonatal mortality differently when reporting to the OECD.

General practice density, infant mortality rates, and maternal mortality rates were all relatively skewed. SEM assumes un-skewed data within the outcome variables so the natural log of the three variables were taken to perform the analysis. Infant mortality and maternal mortality were inverted to be consistent in measures; less infant and maternal deaths is "good", therefore the mortality rates were multiplied by -1 to make higher numbers reflect better quality of care and lower numbers representing lower quality of care. **Figure 26** shows the final measurement model used in this analysis for access to care and quality of care, with a CMIN/DF of 1.442, a GFI of 0.989, and an RMSEA of 0.051, LO 90=0.000, HI 90=0.135 and PCLOSE of 0.406:

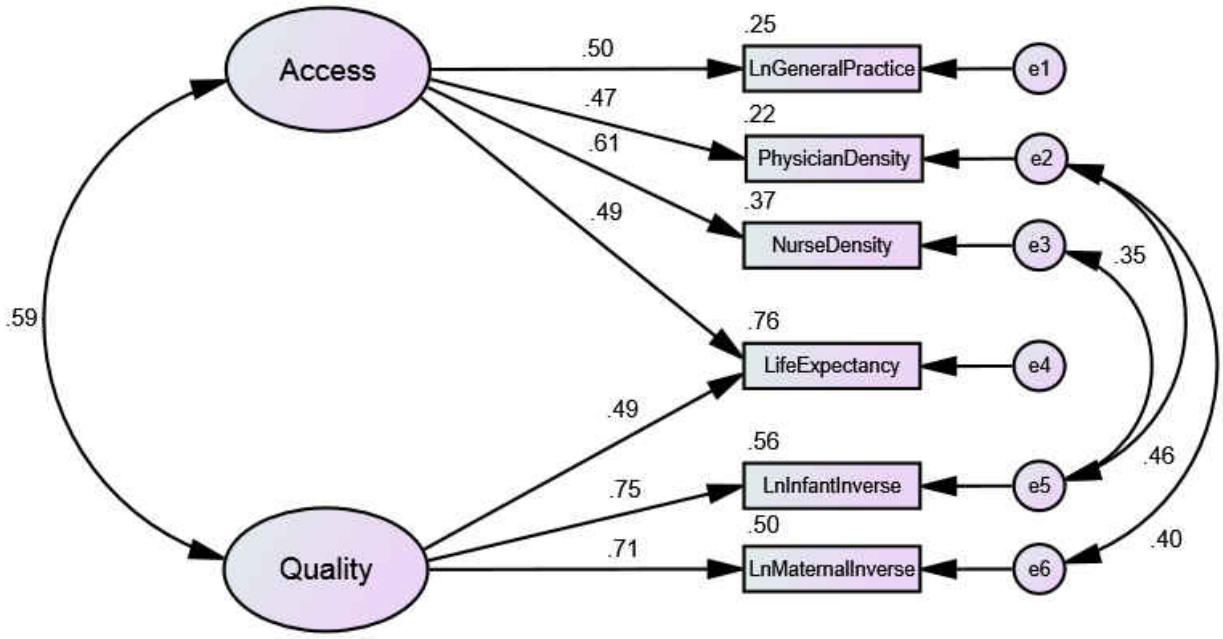


Figure 26: Access and Quality Measurement Model. Standardized Estimates

Access to care also affects health outcomes and the correlation of measurement errors between physician density, nurse density and the health outcomes of infant mortality and maternal mortality reflect this effect. Good quality systems should also have more health care resources than systems that are lower quality, therefore access and quality are also correlated within the measurement model in **Figure 26**. The model fit indices show a good fit to the data with all measures significant at the 0.001 level, however as previously stated, the data is limited and is, at best, only a partial measure of access and quality. Despite the limited data, the measurement model does represent a good fit to the data and a reasonable measurement model of access and quality.

4.4.2: Intersystem Structural Equation Model

With a significant measurement model created and validated, a structural equation model was then created. Regression analysis showed that income per capita plus the system dummies accounted for roughly 96.5% of the variation in health care expenditures per capita. The

structural equation model uses the system type dummies for free market and socialized systems. This means the base model assumes that the system is a universal system unless notified otherwise through the two dummy variables. This was done because a universal system uses public insurance and private provision and, therefore, the difference with a free market system is only in the private insurance, and the difference with the socialized system is only the public provision which allows for the comparison of changing either the provision or the insurance. The regression models also showed that expenditures plus expenditures squared accounted for variations in health care resources and health outcomes; the structural equation model takes both of these factors into account and their effects on access and quality. Increasing expenditures should increase access and quality of care, and over-expenditure should decrease access and increase economic waste (expenditures that do not increase quality). The SEM model has a CMIN/DF of 1.161 P=0.272, a GFI of 0.975 and an RMSEA of 0.031, LO 90=0.000, HI 90=0.074 and a PCLOSE of 0.721, which shows an excellent model fit. **Figure 27** shows the final SEM models with standardized estimates:

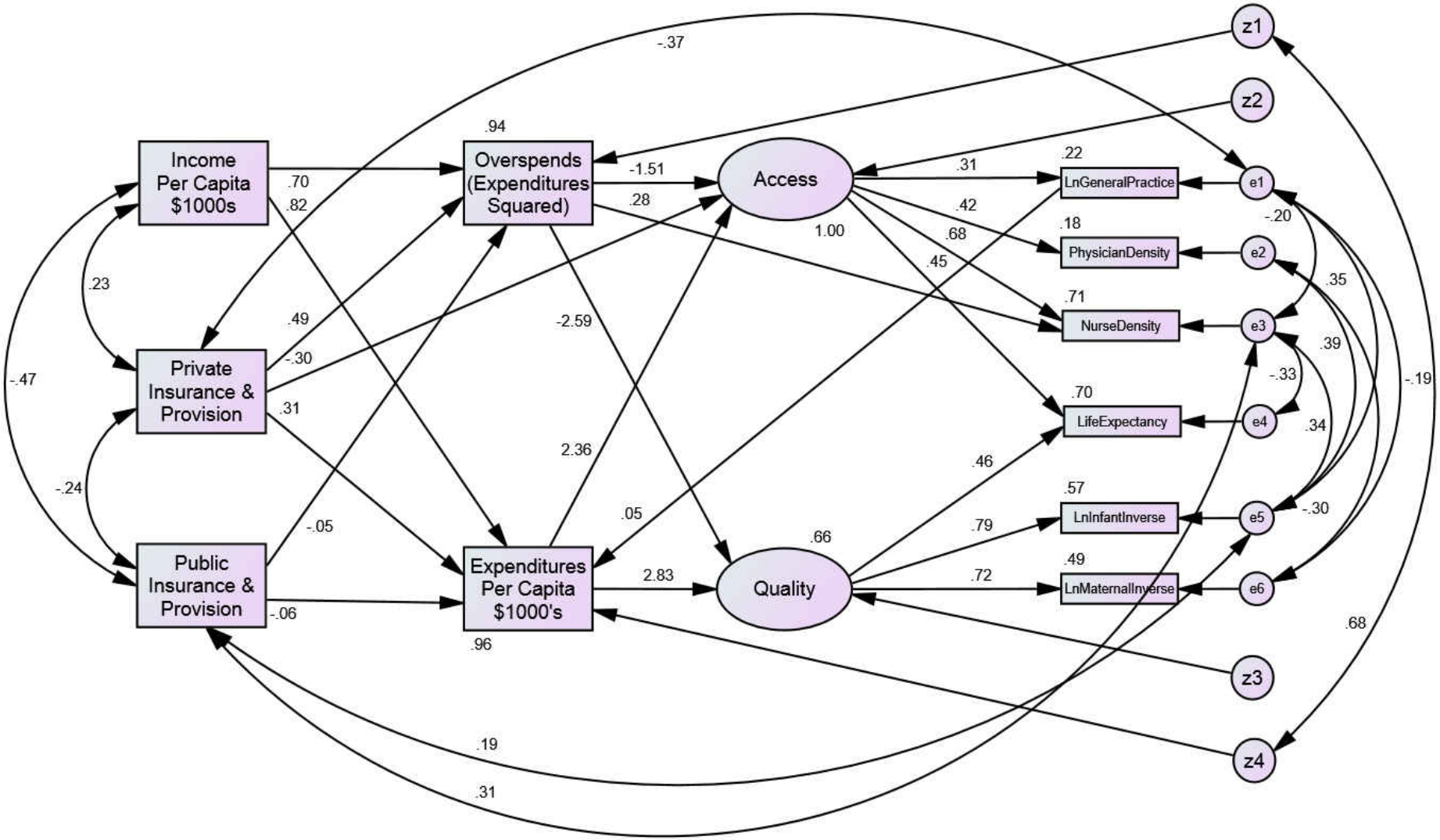


Figure 27: Intersystem SEM Standardized Estimate

Modification indices were consulted, and only logical correlations were added to the model which will be discussed below. **Table 18** provides the regression and covariance parameter estimates from the intersystem SEM model:

Table 18: Intersystem SEM Regression and Covariance Parameter Estimates

			Standardized Estimate	Unstandard. Estimate	S.E.	C.R.	P Value	Label
EXP1000Squared	<---	FreeDum	0.488	49.477	1.951	25.356	***	par_21
EXP1000Squared	<---	Income1000s	0.705	0.956	0.029	33.374	***	par_25
EXP1000Squared	<---	SocialDum	-0.051	-1.809	0.747	-2.422	0.015	par_29
EXP1000s	<---	FreeDum	0.313	3.452	0.193	17.850	***	par_6
Access	<---	EXP1000Squared	-1.509	-0.030	0.008	-3.950	***	par_22
Access	<---	FreeDum	-0.299	-0.600	0.161	-3.721	***	par_23
EXP1000s	<---	Income1000s	0.816	0.120	0.003	44.399	***	par_26
EXP1000s	<---	SocialDum	-0.062	-0.237	0.068	-3.479	***	par_28
Quality	<---	EXP1000s	2.832	1.672	0.402	4.159	***	par_4
Quality	<---	EXP1000Squared	-2.586	-0.166	0.040	-4.191	***	par_31
PhysicianDensity	<---	Access	0.419	1.000				
NurseDensity	<---	Access	0.680	8.484	1.661	5.109	***	par_1
LifeExpectancy	<---	Access	0.446	3.160	0.880	3.590	***	par_2
LnInfantInverse	<---	Quality	0.788	0.313	0.075	4.153	***	par_3
LifeExpectancy	<---	Quality	0.458	1.000				
LnMaternalInverse	<---	Quality	0.717	0.526	0.128	4.098	***	par_11
NurseDensity	<---	EXP1000Squared	0.278	0.069	0.025	2.746	0.006	par_20
Access	<---	EXP1000s	2.361	0.430	0.081	5.276	***	par_5
LnGeneralPractice	<---	Access	0.308	0.439	0.135	3.258	0.001	par_10
EXP1000s	<---	LnGeneralPractice	0.052	0.200	0.058	3.441	***	par_12
Income1000s	<-->	SocialDum	-0.469	-2.897	0.521	-5.558	***	par_7
FreeDum	<-->	Income1000s	0.231	0.497	0.169	2.935	0.003	par_8
FreeDum	<-->	SocialDum	-0.244	-0.020	0.006	-3.283	0.001	par_32
z4	<-->	z1	0.676	1.049	0.144	7.279	***	par_9
e1	<-->	FreeDum	-0.370	-0.027	0.006	-4.358	***	par_24
e2	<-->	e5	0.387	0.082	0.018	4.480	***	par_13
e2	<-->	e6	0.351	0.149	0.038	3.979	***	par_14
e3	<-->	e5	0.338	0.219	0.058	3.794	***	par_15
e5	<-->	e1	-0.302	-0.037	0.010	-3.679	***	par_16
e6	<-->	e1	-0.189	-0.047	0.019	-2.474	0.013	par_17
e3	<-->	e1	-0.204	-0.197	0.063	-3.114	0.002	par_18
e3	<-->	e4	-0.334	-0.991	0.237	-4.185	***	par_19
e5	<-->	SocialDum	0.186	0.026	0.010	2.548	0.011	par_27
e3	<-->	SocialDum	0.307	0.339	0.074	4.609	***	par_30

As **Table 18** shows, all variables and their correlations are significant at, at least the 0.01 level with most significant at the 0.001 level.

4.4.3: SEM Regression Parameters and Effects

As expected, income plus system type determines expenditures and expenditures squared. Free market systems are more likely to overspend than universal systems. Socialized systems are less likely to overspend and more likely to underspend than universal systems. SEM also allowed for the measure of the direct effect of private insurance on access to care while controlling for the indirect effects through overspending. Private insurance not only increased expenditures and made it more likely to overspend, but a secondary reduction in access is created by using private insurance. Using private insurance outpriced consumers from getting access to care and appears to further deny access for those with insurance. This supports the hypothesis and argument that private for-profit insurance maximizes revenues by *denying* services to consumers. Removing this fixed parameter increase the RMSEA to 0.077 and the modification indexes suggest there is a correlation in the residuals for expenditures squared and access suggesting that an important parameter is missing from the model when the decrease in access directly caused by private insurance is not accounted for in the model. In other words, the use of private insurance directly reduces access to care as insurers reduce benefits and deny treatments to increase revenues.

Increasing expenditures leads to better access and quality. Countries that overspend (represented by expenditures squared) reduce access to care by pricing consumers out of the market and decrease quality. The "decrease" in quality is best understood as wasted expenditures. This excess money is being spent without causing a corresponding increase in quality.

Lastly, the modification indices suggested that there was a correlation between the residuals for expenditures and the measurement error for general practitioners, reflecting an

unknown factor shared in common with the two endogenous variables. Logically, as expenditures increase, overall access increases. This overall access in terms of resources may have different identities: more hospital beds, nurses, nurse practitioners, nurses, general practitioners, specialist physicians, etc. There is a covariance correlation between general practitioners (e1) and nurses (e3). Systems with more general practitioners rely less on nurses and vice versa. Having more general practitioners or nurses both increase access to care. When controlling for this correlation, systems that rely less on nurses and more on general practitioners cost more. Therefore, increasing general practitioners increases costs, and thus increases expenditures. This relationship was added into the structural equation model which means the model in non-recursive with a stability index of 0.112 showing a stable relationship. Increasing expenditures increases access, increasing access increases the number of general practitioners, and increasing general practitioners in relation to the number of nurses increases costs (expenditures).

4.4.4: SEM Covariance Parameters and Estimates

Some parameters covary rather than have a directional relationship. This covariance needs to be controlled for so that the above SEM regression measures can be accurately estimated. As shown in subchapter 4.3, poorer countries tend to use socialized systems which is reflected in the covariance between Socialized Dummy and Income1000s (parameter 7). The connection between lower incomes and socialized systems is logical, as the government may be the only entity that has the resources to build and maintain advanced health care systems and hospitals. Controlling for this covariance allows for a less bias estimate of per capita expenditures. The United States is also a wealthy country and uses a free market health care system. These two variables are correlated but not causal as represented by parameter 8. Free

market systems are opposite to socialized system and therefore correlated but not causal as represented by parameter 32. Expenditures and expenditures squared are obviously correlated but measure different economic concepts, therefore the residuals are correlated represented by parameter 9. The modification indexes suggested that there is a negative correlation between Free Market Dummy and General Practice density, represented by parameter 24. Based on the theory discussed in Chapter 3, this correlation is logical demand for care is reduced and therefore the supply would be reduced; and private insurers, to save money, prefer the use of nurse practitioners which can charge less than general practitioners. The measurement error for physician density (e2) is correlated with maternal mortality (e6), parameter 14, and infant mortality (e5), parameter 13, and nurse density (e3) is correlated with infant mortality (e5), parameter 15, as discussed in the measurement model, as well as now adding a correlation between general practice density (e1) and infant mortality (e5), parameter 16, and maternal mortality (e6), parameter 17 under the same logic. Parameter 19 shows that increasing nurse density is associated with lower life expectancy, when controlling for the fact that general practitioners are being replaced by nurses, shown by parameter 18. The modification indexes also suggested a correlation between socialized systems and nurse density (e3), parameter 30, which implies that socialized systems also use more nurses compared to universal systems. However, socialized systems are also correlated with fewer infant mortalities (e5), parameter 27, when controlling for all other factors, suggesting that there is a benefit to using a socialized system. This is, again, logical considering that poorer systems tend to use socialized systems. Researchers have shown that poorer countries are able to increase life expectancy through the use of socialized systems more readily than relying on free markets (Cesur, Güneş, Tekin, & Ulker, 2017).

4.4.5: Intersystem SEM Discussion

The model represents an excellent fit to the data. Each system type directly affects expenditures and expenditures squared. Socialized systems are more likely to underfund their systems as predicted by the integrative market model, and less likely to overspend than universal systems while controlling for wealth. Private insurance increases cost and causes access limiting price increases, while also causing a direct reduction in access as for-profit insurance further decreases access to maximize profits. **Figure 27** fully supports the hypotheses in Chapter 3 and the integrative market model in **Figure 14**.

Like in the regression analysis, structural equation modelling assumes no multicollinearity and estimates coefficients using the standard errors. This mean the structural multicollinearity is causing the estimates for the effects of expenditures and expenditures squared to be inaccurate on the effects of access and quality. The same method of mean centering the data can also be used within structural equation modelling to limit the effects of the collinearity when it is structural to increase the estimation power of the model (Kline, 2011; Moosbrugger et al., 2009). However, unlike in regression, SEM allows for the estimation of a path analysis, which means that mean centering can cause estimation problems with exogenous variables when mean centering is used on endogenous variables. Mean centering causes lower values of x to become negative, squaring the negative values then become positive. If an exogenous variable is predicted to reduce the squared value, then squaring the negative value erases this previously measurable variation. **Figure 27** accurately represents the connections between the variables, but inaccurately estimates the coefficients for the effects of expenditures and expenditures squared. Despite the issue of reducing the ability to measure direct effects on expenditures squared at low values, mean centering was performed for expenditures and expenditures squared

in **Figure 28** to provide more accurate estimates of the coefficients for expenditures on access and quality by reducing the standard errors and thus removing uncertainty in the model:

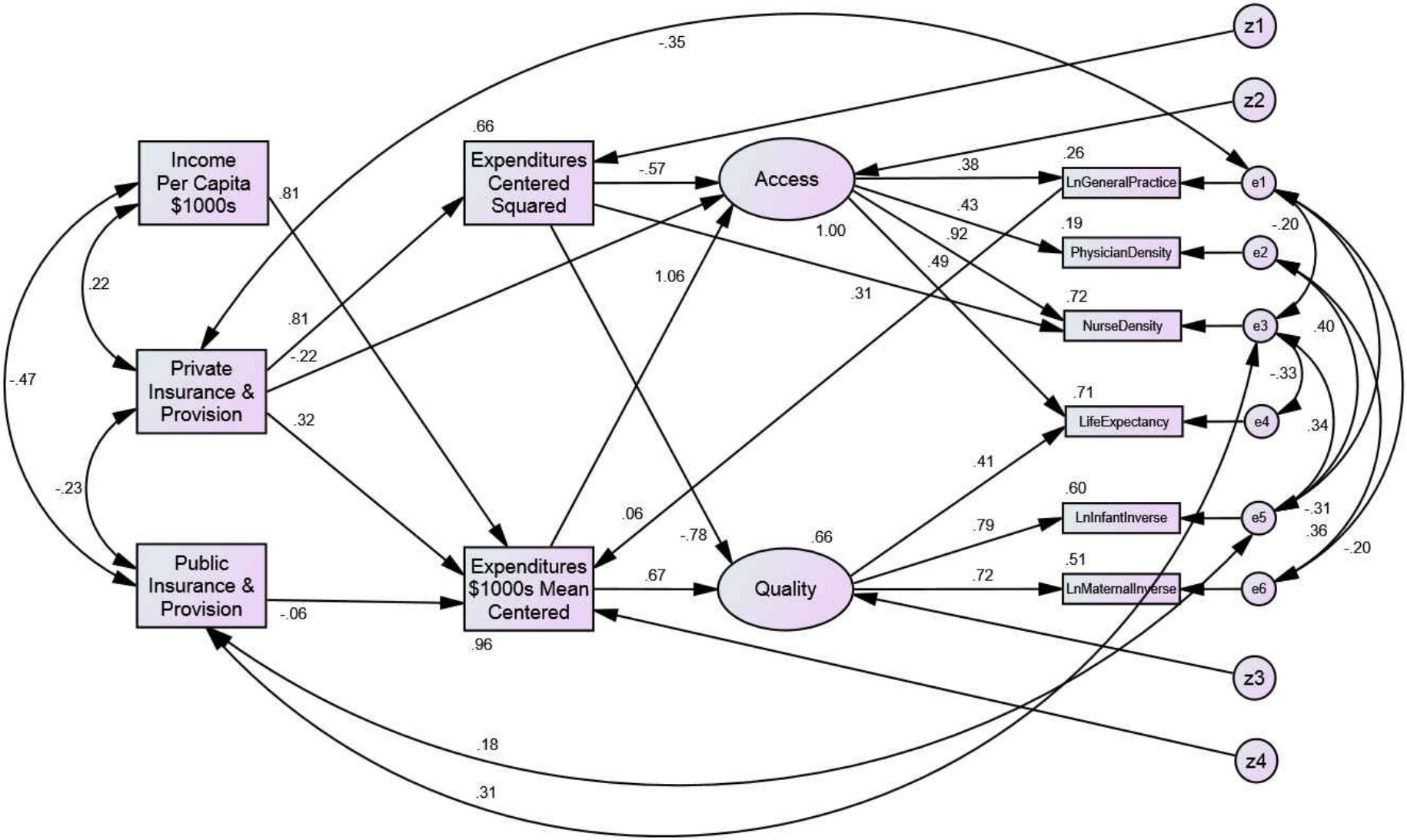


Figure 28: Mean Centered Intersystem SEM

Mean centering in **Figure 28** removes the correlation between the residuals of expenditures (z4) and expenditures squared (z1) by removing the structural multicollinearity. However, it also made the ability to predict expenditures squared by differences between universal and socialized systems impossible, as well as predicting the likelihood of over expenditure controlling for income. **Figure 28** has a CMIN/DF = 1.106, GFI = 0.973, and an RMSEA = 0.025, LO 90 = 0.000, HI 90 = 0.068, PCLOSE = 0.789, still representing an excellent fit to the data with all regressions and covariances statistically significant at, at least, the 0.05 level. The model fit in **Figure 28** is actually better than **Figure 27** because SEM penalizes complexity of models, with more simple models more easily achieving a good fit than complex models, even if the complex model may be a more accurate reflection of the data. Therefore, removing the three correlations from **Figure 27** that helped control for the multicollinearity in the variables, expenditures and expenditures squared, improved the model fit. **Figure 27** more accurately represents all of the correlations, but **Figure 28** allows for a more accurate estimate of the coefficients for expenditures and expenditures squared on access and quality. The standardized coefficient, in **Figure 28**, for the effects of expenditures on access is still greater than absolute value of 1, but should not be a cause for concern (Deegan, 1978) (Joreskog, 1999). **Table 19** provides the regression and covariance estimates for **Figure 28**:

Table 19: Mean Centered SEM Model Estimates

			Unstandard. Estimate	S.E.	Standardized Estimate	C.R.	P	Label
Exp1000CenteredSquared	<---	FreeDum	25.761	1.436	0.810	17.943	***	par_18
Exp1000Centered	<---	FreeDum	3.504	0.202	0.318	17.376	***	par_6
Access	<---	Exp1000CenteredSquared	-0.037	0.008	-0.567	-4.692	***	par_19
Access	<---	FreeDum	-0.459	0.127	-0.220	-3.606	***	par_20
Exp1000Centered	<---	Income1000s	0.120	0.003	0.815	42.794	***	par_22
Exp1000Centered	<---	SocialDum	-0.232	0.068	-0.061	-3.413	***	par_24
Quality	<---	Exp1000Centered	0.361	0.100	0.673	3.606	***	par_4
Quality	<---	Exp1000CenteredSquared	-0.146	0.038	-0.781	-3.824	***	par_26
PhysicianDensity	<---	Access	1.000		0.432			
NurseDensity	<---	Access	11.198	1.907	0.920	5.871	***	par_1
LifeExpectancy	<---	Access	3.458	0.886	0.494	3.903	***	par_2
LnInfantInverse	<---	Quality	0.352	0.092	0.787	3.850	***	par_3
LifeExpectancy	<---	Quality	1.000		0.406			
LnMaternalInverse	<---	Quality	0.595	0.156	0.722	3.826	***	par_10
NurseDensity	<---	Exp1000CenteredSquared	0.244	0.079	0.306	3.081	0.002	par_17
Access	<---	Exp1000Centered	0.200	0.033	1.058	6.128	***	par_5
LnGeneralPractice	<---	Access	0.524	0.131	0.378	4.002	***	par_9
Exp1000Centered	<---	LnGeneralPractice	0.239	0.073	0.063	3.270	0.001	par_11
Income1000s	<-->	SocialDum	-2.892	0.521	-0.468	-5.551	***	par_7
FreeDum	<-->	Income1000s	0.461	0.167	0.216	2.767	0.006	par_8
FreeDum	<-->	SocialDum	-0.019	0.006	-0.233	-3.139	0.002	par_27
e1	<-->	FreeDum	-0.025	0.006	-0.348	-4.101	***	par_21
e2	<-->	e5	0.083	0.018	0.399	4.510	***	par_12
e2	<-->	e6	0.154	0.038	0.363	4.033	***	par_13
e3	<-->	e5	0.220	0.057	0.343	3.831	***	par_14
e5	<-->	e1	-0.037	0.010	-0.312	-3.749	***	par_15
e6	<-->	e1	-0.047	0.019	-0.196	-2.537	0.011	par_16
e5	<-->	SocialDum	0.025	0.010	0.183	2.476	0.013	par_23
e3	<-->	SocialDum	0.338	0.074	0.306	4.590	***	par_25
e3	<-->	e1	-0.192	0.062	-0.202	-3.116	0.002	par_28
e3	<-->	e4	-0.998	0.236	-0.333	-4.227	***	par_29

Using the regression coefficients from **Table 19** the predicted life expectancy of countries using either free market or socialized systems converted to universal systems while controlling for wealth is presented in **Equation 8**:

Equation 8: Years of Life Lost Due to System Type Controlling for Income

Life Expectancy = 1 (Quality) + 3.46 (Access).
Quality = 0.36 (Exp1000Centered) – 0.15 (Exp1000Centered)^2.
Access = 0.20 (Exp1000Centered) – 0.04 (Exp1000Centered)^2 – 0.459 (FreeDum).
Exp1000Centered = 0.12 (Income1000s) + 3.5 (FreeDum) – 0.23 (SocialDum).
Free Market effect on Exp1000Centered^2 = 25.761.

Converting systems controlling for income to measure just the change in life expectancy in absolute value: Free Market Expenditures = 3.5, and Socialized Expenditures = -0.23.

Therefore;

Socialized System Converted to Universal:
Quality = 0.36 (-0.23) – 0.15 (-0.23)^2 = -0.0907 years.
Access = 0.20 (-0.23) – 0.04 (-0.23)^2 = 0.048 (3.46) = -0.16648 years.
Total Potential Life Expectancy Lost = 0.257 years per capita (3.08 months per capita).

Free Market System Converted to Universal:
Quality = 0.36 (3.5) – 0.15 (25.76) = -2.604 years.
Access = 0.20 (3.5) – 0.04 (25.76) – 0.459 = -0.7894 (3.46) = -2.731 years.
Total Potential Life Expectancy Lost = -5.327 years.

According to the regression estimates in **Table 19**, socialized systems would improve life expectancy by 3.08 months per capita if they converted to a universal health system. The lack of competition within the provision of care reduces quality of care by about 0.0907 years and access to care by 0.166 years. Free Market systems would increase life expectancy by converting to a universal system by 2.7 years per capita due to increased access to care and by 2.6 years due to increased quality of care. However, expenditures squared's effects on quality are best interpreted as economic waste that does not directly increase life expectancy. Therefore, the likely increase in life expectancy would only be the increase in access 2.7 years, and a decrease in economic inefficiency that should have resulted in 2.6 years of life expectancy but does not. In other words, based on the United States' current expenditures it should already be performing 2.6 years better for life expectancy than is currently taking place. The U.S. has a current life

expectancy of 78.8 years, should have a life expectancy of 81.4 based solely on "quality" due to expenditures, but is not realizing that potential due to the economic waste represented by expenditures squared. Additionally, the United States also has an added decrease in life expectancy of 2.7 years due to the decreased access to care. Converting to a universal system should remove the economic waste of 2.6 years and add 2.7 years due to access, resulting in a net gain of 2.7 years which yields a life expectancy of 81.5 years and a substantial reduction in economic waste.

4.4.6: Intra-System Structural Equation Model

The structural equation model for intersystem effects held up very well, so the next step was to test if within system variation in policies would have an effect on access and quality in an exploratory approach. The OECD Health Systems Survey provides data on within system variations in policy, including the use of global budgeting, pay for performance, choice of insurance, cost sharing, requirement of referrals, and requirement to register with a specific primary provider. In theory, the use of global budgets should decrease expenditures by keeping hospitals within given budget constraints. This could decrease expenditures and expenditures squared, but may also reduce quality and access. Pay for performance should decrease expenditures and/or increase quality of care, as the goal is to reduce redundancy and increase quality of care. Choice of insurance should increase expenditures and decrease access to care (according to Chapter 3) because the competition causes insurers to create limited networks of providers, and price negotiating power of insurers is decreased. Cost sharing should reduce access to care and/or reduce expenditures according to the theory of moral hazard (those that do not have to pay for services will be less careful and abuse the system). Primary registration should reduce redundancy and thus expenditures. Referrals should reduce expenditures and/or

access to care as unnecessary procedures are reduced through gatekeeping. These hypotheses were added into **Figure 27** and tested for significance and goodness of fit. All seven variables were added into the model correlating them to possible effects on expenditures, expenditures squared, access, and quality. Insignificant correlations were removed, and modification indexes were consulted to improve goodness of fit in an exploratory approach to discovering if these intra-system policy differences had measurable effects on expenditures, access and quality of care. The modification indexes were an important tool for correlating the use of combinations of policies within countries. The OECD found that policies were most often used in combination with each other (Joumard & Nicq; OECD, 2010). The final results of the exploratory analysis are presented in **Figure 29**:

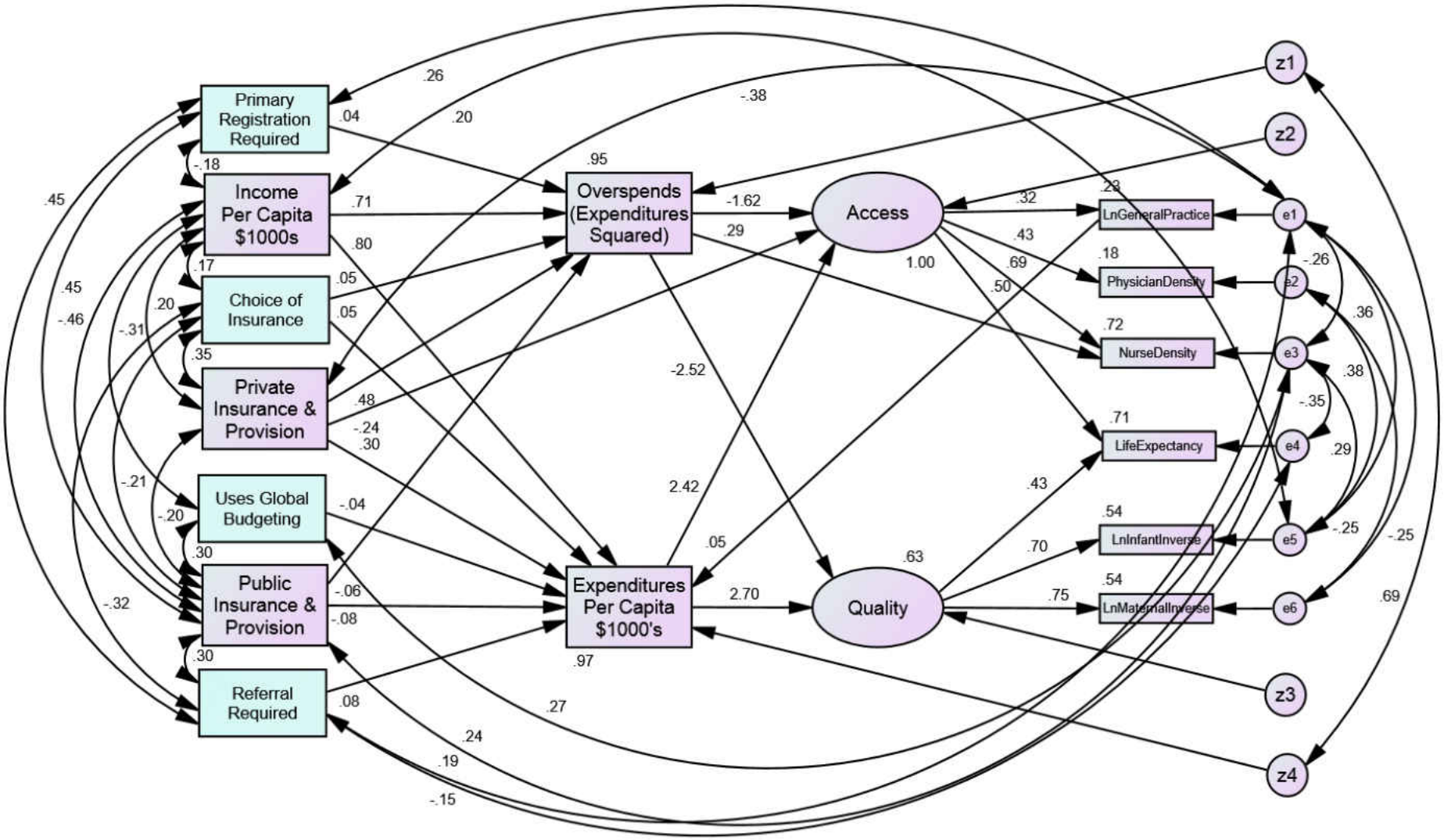


Figure 29: Intra-System Policy Variations SEM Standardized Estimates

Intra-system policies are represented in blue, as shown in **Figure 29**. The model has CMIN/DF = 1.156, GFI = 0.954, and an RMSEA = 0.030, LO 90 = 0.000, HI 90 0.060, and PCLOSE = 0.846 representing an excellent fit to the data. The stability index for the non-recursive model is 0.107. Pay for performance, cost sharing, and choice of primary provider were not found to be significant. Pay for performance may have an effect, but none could be determined by the model. Cost sharing had no effect for the same reason, or more likely, because moral hazard has no effect within the health insurance system, as predicted by the theory in Chapter 3. Moral hazard may exist within other economic markets, like investment markets, but according to this analysis, no effect can be found within the health insurance market. This argument has face validity to it, as it seems highly unlikely that people would risk their lives more because they have health insurance.

As seen by the correlation between exogenous policy variables in **Figure 29** many policies are used in combination with each other as represented within the model as the covariances between the different policies in blue. **Table 20** provides the regression and covariance parameter for **Figure 29**:

Table 20: Intra-system SEM Regression and Covariance Parameter Estimates

			Unstandard. Estimate	S.E.	Standardized Estimate	C.R.	P	Label
EXP1000Squared	<---	Income1000s	0.953	0.028	0.709	34.580	***	par_36
EXP1000Squared	<---	InsCompete	2.308	0.820	0.055	2.813	0.005	par_37
EXP1000Squared	<---	PrimaryRegister	1.492	0.626	0.038	2.384	0.017	par_39
EXP1000Squared	<---	SocialDum	-2.232	0.798	-0.062	-2.799	0.005	par_42
EXP1000Squared	<---	FreeDum	47.416	1.948	0.476	24.339	***	par_49
Access	<---	EXP1000Squared	-0.033	0.007	-1.618	-4.383	***	par_20
EXP1000s	<---	Referral	0.320	0.054	0.075	5.944	***	par_24
EXP1000s	<---	SocialDum	-0.299	0.067	-0.076	-4.488	***	par_29
EXP1000s	<---	InsCompete	0.240	0.073	0.052	3.270	0.001	par_35
EXP1000s	<---	Income1000s	0.117	0.002	0.803	47.741	***	par_44
EXP1000s	<---	Budget	-0.153	0.046	-0.037	-3.326	***	par_45
EXP1000s	<---	FreeDum	3.213	0.187	0.297	17.194	***	par_47

			Unstandard. Estimate	S.E.	Standardized Estimate	C.R.	P	Label
Access	<---	FreeDum	-0.486	0.142	-0.241	-3.413	***	par_48
Quality	<---	EXP1000s	1.542	0.366	2.701	4.217	***	par_4
Quality	<---	EXP1000Squared	-0.157	0.037	-2.524	-4.268	***	par_23
PhysicianDensity	<---	Access	1.000		0.425			
NurseDensity	<---	Access	8.517	1.615	0.688	5.273	***	par_1
LifeExpectancy	<---	Access	3.556	0.878	0.505	4.050	***	par_2
LnInfantInverse	<---	Quality	0.292	0.068	0.701	4.276	***	par_3
LifeExpectancy	<---	Quality	1.000		0.434			
LnMaternalInverse	<---	Quality	0.580	0.138	0.754	4.206	***	par_10
NurseDensity	<---	EXP1000Squared	0.073	0.024	0.29	3.049	0.002	par_19
Access	<---	EXP1000s	0.452	0.082	2.422	5.527	***	par_5
LnGeneralPractice	<---	Access	0.459	0.127	0.322	3.613	***	par_9
EXP1000s	<---	LnGeneralPractice	0.170	0.054	0.045	3.112	0.002	par_11
Income1000s	<-->	SocialDum	-2.776	0.466	-0.463	-5.960	***	par_6
Income1000s	<-->	FreeDum	0.431	0.154	0.198	2.807	0.005	par_7
Income1000s	<-->	Budget	-1.749	0.419	-0.31	-4.172	***	par_21
SocialDum	<-->	FreeDum	-0.016	0.005	-0.202	-3.217	0.001	par_22
Income1000s	<-->	InsCompete	0.884	0.351	0.171	2.520	0.012	par_25
Referral	<-->	PrimaryRegister	0.085	0.014	0.451	5.885	***	par_26
SocialDum	<-->	PrimaryRegister	0.092	0.015	0.453	6.136	***	par_27
Income1000s	<-->	PrimaryRegister	-0.990	0.348	-0.181	-2.843	0.004	par_28
FreeDum	<-->	InsCompete	0.025	0.005	0.354	4.938	***	par_31
SocialDum	<-->	Referral	0.061	0.013	0.296	4.555	***	par_32
Referral	<-->	InsCompete	-0.057	0.012	-0.323	-4.771	***	par_33
SocialDum	<-->	InsCompete	-0.041	0.012	-0.211	-3.326	***	par_34
SocialDum	<-->	Budget	0.064	0.014	0.304	4.476	***	par_41
z4	<-->	z1	0.935	0.127	0.69	7.379	***	par_8
e1	<-->	PrimaryRegister	0.049	0.011	0.261	4.266	***	par_38
e1	<-->	Referral	0.035	0.012	0.185	3.010	0.003	par_40
e1	<-->	FreeDum	-0.028	0.006	-0.381	-4.951	***	par_50
e2	<-->	e5	0.083	0.018	0.379	4.512	***	par_12
e2	<-->	e6	0.147	0.037	0.362	4.024	***	par_13
e3	<-->	e5	0.196	0.054	0.287	3.635	***	par_14
e5	<-->	e1	0.033	0.009	0.253	3.562	***	par_15
e6	<-->	e1	-0.060	0.017	-0.252	-3.540	***	par_16
e3	<-->	e1	-0.261	0.059	-0.265	-4.452	***	par_17
e3	<-->	e4	-1.031	0.228	-0.346	-4.524	***	par_18
e4	<-->	Referral	-0.085	0.035	-0.149	-2.397	0.017	par_30
e5	<-->	Income1000s	0.769	0.313	0.203	2.458	0.014	par_43
e3	<-->	SocialDum	0.261	0.060	0.242	4.376	***	par_46
e3	<-->	Budget	0.270	0.068	0.266	3.976	***	par_51

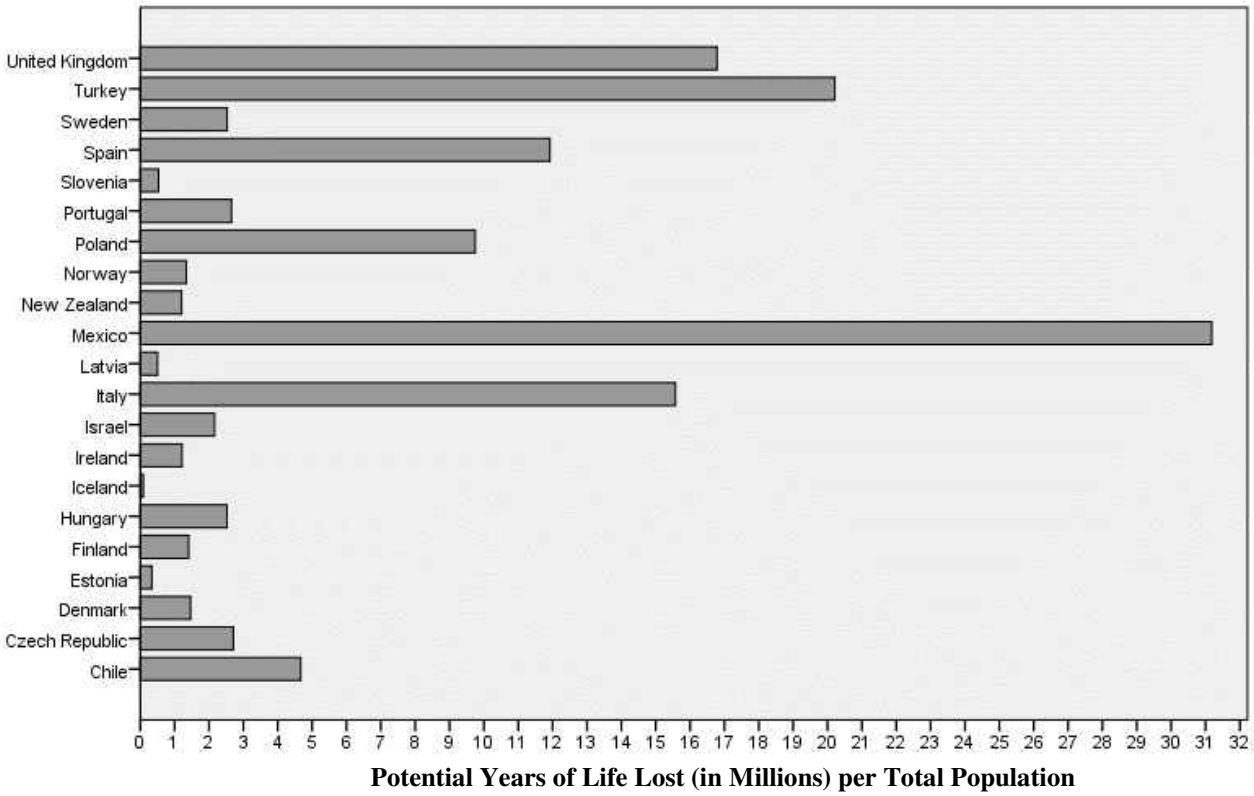
Requiring patients to register with a specific primary care provider (or financially incentivizing registration) increases expenditures squared, meaning that rather than reducing costs and redundancy, the requirement increased the likelihood to overspend and reduces access. Allowing

patients to see any available doctor when necessary appears to increase access and decrease over-expenditures. Choice of insurers, if there is more than one insurer, increases both expenditures and overspending (expenditures squared), as was predicted in Chapter 3 about insurance competition increasing costs (redundancy in administrative costs), reducing benefits, and limiting reimbursement negotiating power of the insurer. The use of global budgeting is associated with less expenditures, but not less expenditures squared. Global budgeting is also correlated with poorer countries. Combining these concepts means that poorer countries that already underspend on health care causing reductions in access and quality, are even more likely to underspend when using global budgeting, and that global budgeting does not decrease the likelihood of overspending. The requirement of getting referrals to see specialists increased expenditures but had no effect on expenditures squared. This suggests that referrals did not decrease access to care or quality of care (in fact it increases quality and access, most likely by reducing redundancy), but did increase costs, once again, showing that moral hazard is likely not a problem within the health insurance market. If moral hazard were a problem, referrals should reduce expenditures and expenditures squared by reducing unnecessary treatments, and cost sharing should have a measurable effect on reducing expenditures and expenditures squared. None of these are true, and like argued in Chapter 3, moral hazard in health care is in no way supported by the data and is refuted by these statistical models.

CHAPTER 5: IMPLICATIONS, LIMITATIONS, FUTURE ANALYSIS, AND CONCLUSIONS

5.1: Implications

The implications of this analysis are substantial and cannot easily be overstated as *hundreds of millions* of years of life expectancy are potentially lost depending on the system of health care chosen. Within just the 34 OECD countries examined, the estimates of potential life expectancy lost due to using a socialized or free market system compared to a universal system result in over *one billion* years are potentially lost as seen in **Figure 30**:



*Due to Scaling the U.S. is not Included in Figure: U.S Years of Life Lost = 872,444,250:
Total All Socialized Systems = 130,760,592 years

Figure 30: Potential Years of Life Lost Compared to Universal System (Total Population)

Multiplying the results of **Equation 8** by the population of each country that uses each system type created the results in **Figure 30**. Countries with larger populations will lose more than countries with smaller populations, but the math is stark: potentially over 130 million years of life expectancy lost within socialized systems just within the OECD, and over 870 million potential years of life expectancy lost in the United States due to its free market health insurance system with income per capita controlled. To place the potential years of life expectancy lost into context: according to a recent study by the U.S. National Institutes of Health, 13 years of life were lost compared to the average life expectancy due to all cancers in Norway (Brustugun, Møller, & Helland, 2014). The World Health Organization estimates that 1 in 6 people will die of cancer and the OECD reports mortality rates for cancer across the OECD countries (currently averaging 200 per 100,000 population for a total of 2,553,427 across all countries in the data set for 2016). If this holds true for all OECD countries, multiplying 13 years by the number of cancer deaths in the OECD results in 33,194,551 total potential years of life lost due to all cancers based on the current deaths from cancer in the OECD countries within the data set. Curing all cancer within these OECD countries would theoretically create an increase in total life expectancy by 33.2 million years per year for the current population included within the data set, whereas changing all health care systems from socialized and free market to universal systems would create a one-time increase in total life expectancy by 1 billion years for the population (this increase only applies to socialized and free market systems). It would take 30 years of no one, within the 34 countries in the data set, dying of cancer to yield the same one-time cumulative effects to total life expectancy as changing all system types over to a universal system—the equivalent cumulative effect on life expectancy is the same as curing all cancer over a 30-year period. Multiplying the economic saving per capita in that the United States would

produce from changing from a free market system to a universal system times the current population results in an annual saving of $1.12 Trillion in health care expenditures. This represents a savings of 35% which also is similar to the lower Medicare reimbursement rates compared to private insurance reimbursement rates (the Congressional Budget Office found that private health insurance pays 189% the rate of Medicare, a savings of 50%) (CBO, 2017).

This dissertation demonstrates the benefits of multivariate modeling strategies and the power of SEM modeling in developing and confirming theory. The integrative model shows that policy interventions will not be equivalent between health care system types, and that the market forces will also differ within health care system type. Research that shows individual policy effects within countries cannot be universally applied; policy differences will only have a given effect within a specified health care system type.

5.2: Limitations

In this dissertation, the data was previously collected and available to the public from the OECD. No surveys were required, and all data was standardized by the OECD using purchasing power parity, and uniform reporting of population level data and per capita data. A challenging complication of this study was that the integration of economic theory and public policy analysis that has not been systematically performed within the academic literature, and the availability of data to substantiate the integrative model. These limitations were overcome.

However, there are some other important limitations to this analysis. The available data only encompasses 34, mostly wealthy, advanced industrial nations. Fortunately, some of the countries within the data set are less economically advanced (i.e. Mexico) and the pattern still held strong. The World Health Organization (WHO) collects data on health care expenditures and many health outcomes like life expectancy and infant mortality. To test if the model and

theory built in this dissertation could be extrapolated to a wider variety of countries, the WHO data was collected and regressed. The 2015 data is available from WHO at http://www.who.int/gho/database/en/. **Figure 31** shows the quadratic relationship that also exists within the WHO data:

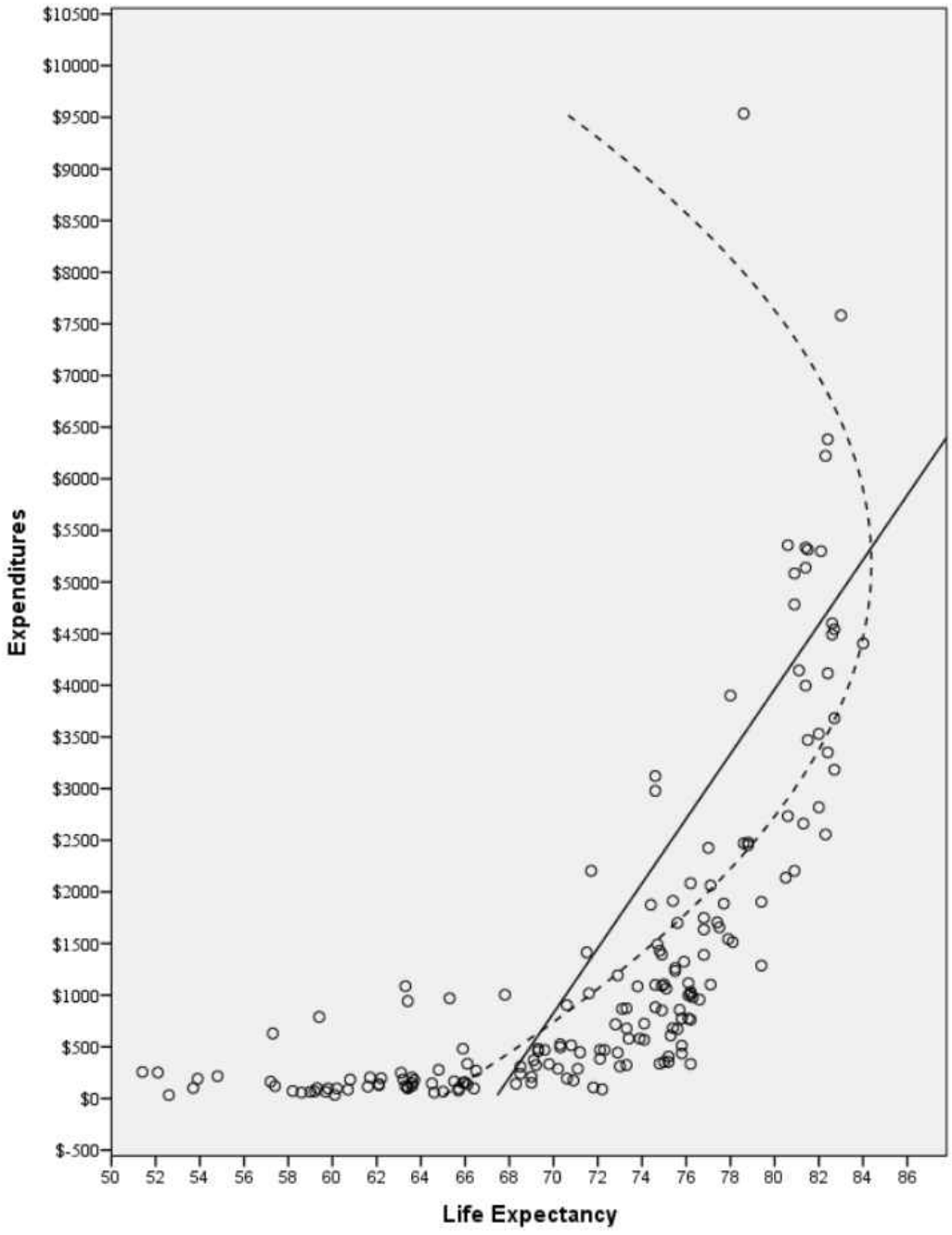


Figure 31: Quadratic Regression of WHO Data

Figure 31 shows that the pattern of expenditures and expenditures squared holds up across the 177 countries within the WHO data set that include information on expenditures and life expectancy. This implies that the integrative market model in Chapter 3 should apply across all countries. Unfortunately, the WHO data does not contain information of health care system type, so the WHO data could not be used in other models. **Table 21** presents the regression models for the WHO data for expenditures and life expectancy, as well as the mean centered regression:

Table 21: Quadratic Regression of WHO Data

	Dependent Variable	Independent Variable	Unstand. Coefficient	S.E.	Standardized Coefficient	t	P Value	Tolerance	VIF	Model R^2
1	Life Expectancy	Constant	64.805	0.551		117.560	0.000			0.622
		Expenditures Per Capita	0.008	0.001	1.617	13.506	0.000	0.151	6.630	
		Expenditures Squared	-7.289E-07	0.000	-1.013	-8.464	0.000	0.151	6.630	
2	Life Expectancy	(Constant)	73.747	0.432		170.690	0.000			0.622
		Expenditures Centered	0.006	0.000	1.192	15.687	0.000	0.375	2.669	
		Expenditures Centered Squared	-7.289E-07	0.000	-0.643	-8.464	0.000	0.375	2.669	

Once again, the mean centered data represents a more accurate estimate of coefficients, so it is also provided in model 2. The R Square for the WHO data (0.622) is strikingly similar to the R Square of the OECD data (0.628) suggesting that the integrative model should hold up very well and can be applied to countries outside of the OECD or the developed world. However, **Figure 27** suggested that there may a benefit to poorer countries choosing to use a socialized system of care over a universal system as there may be a lack of capital in the private sector necessary to develop the appropriate levels of health care resources.

Another limitation to the regression analysis performed in this study, is the number of countries sampled. Due to the small number of countries (34) other variables were not found to

be statistically significant but still may have an important effect. For example, other policy differences within system types may be significant, but the regression models could not detect them due to the small sample size. The data set included variables on the use of global budgeting, copays, pay for performance, and other policy differences between countries and within system types. None were found to be significant to expenditures, quality or access to care when included in regression analysis. This is not to say that these policy differences do not have an actual effect on economic efficiency, quality or access, but that due to the low number of countries, these differences could not be statistically measured within regression analysis. A larger data set (which is not necessarily possible as the data is based on country level) may lead to a better understanding of which policy differences lead to better outcomes and better nuance for comparison. Structural equation modelling helped to examine some of these within system policy differences.

Another limitation of this analysis is that it does not discuss the moral, or philosophical reasons for choosing one health care system over another system. This dissertation purposely did not examine the "morality" of health economics or denying care to the most vulnerable. However, it demonstrates that everyone benefits most when the system guarantees access to care to all. Prices are reduced for all and access is significantly increased for the most vulnerable without sacrificing quality of care for any when the system guarantees access to care through universal health insurance coverage. No moral or philosophical argument is necessary; we all benefit, or we are all harmed depending on the health care system chosen. In the case of health care systems; what we do to others, we do unto ourselves:

> [40] And the King shall answer and say unto them, Verily I say unto you, inasmuch as ye have done it unto one of the least of these my brethren, ye have done it unto me.

[41] Then shall he say also unto them on the left hand, depart from me, ye cursed, into everlasting fire, prepared for the devil and his angels:

[42] For I was an hungred, and ye gave me no meat: I was thirsty, and ye gave me no drink:

[43] I was a stranger, and ye took me not in: naked, and ye clothed me not: sick, and in prison, and ye visited me not.

[44] Then shall they also answer him, saying, Lord, when saw we thee an hungred, or athirst, or a stranger, or naked, or sick, or in prison, and did not minister unto thee?

[45] Then shall he answer them, saying, Verily I say unto you, inasmuch as ye did it not to one of the least of these, ye did it not to me. (Matthew 25:40-45, The New King James Version)

5.3: Future Research

Further research should be performed on health insurance as a Giffen good. Access to the individual level data from the Centers for Medicare and Medicaid Services would be invaluable. The OECD should collect system level data more frequently than every four years, and data on market concentration may allow for the use of the Herfindahl-Hirschmann Index which could not be incorporated into this analysis due to the lack of data. The index would be highly beneficial for determining the appropriate levels of provider non-price competition that leads to increased quality. Furthermore, the OECD should work to insure uniform reporting on health care systems by providing fewer choices within the survey by specifying more detail in the questions asked. Many questions were too open ended creating interpretation errors for those reporting the data.

This study offers numerous scientific and empirical benefits for future analysis of policy intervention in health care systems:

1. By integrating market forces, system type, and policy differences within system type, the benefits of individual interventions can be more accurately measured, analyzed, and predicted. Market forces and policy interventions will have different effects on quality,

access, price, and health outcomes depending on the health care system type. Increasing or decreasing competition within aspects of the health care system may increase or decrease the quality of care, access to care, or price of care dependent upon system type.

a. Provider Markets: Increasing or decreasing competition in health care provision will have different effects on health outcomes based on the health care system type.
    i. Free market systems: Decreasing competition of providers will increase costs to consumers despite increasing technical and economic efficiency for providers and causing an increases in the quality of care (Gaynor et al., 2014; Lee & Wan, 2002).
    ii. Universal systems: Increasing competition will increase non-price competition (quality competition) and thus the quality of care, without increasing prices to consumers or decreasing access to care which is guaranteed based on income (Gaynor et al., 2014; Krabbe-Alkemade et al., 2017).
    iii. Socialized systems: Increasing provider competition will increase access to care and quality of care with a corresponding increase in price to account for marginal costs (Gaynor et al., 2014).
b. Insurance Market Competition:
    i. Free market: Decreasing competition in the insurance market will increase insurance negotiating power. Increased negotiating power of insurance companies will decrease reimbursement rates to providers, will increase profits to insurers, but will not necessarily reduce insurance premiums (Dafny et al., 2012; Ho & Lee, 2017).

ii. Universal: Increasing competition within insurance may decrease prices of premiums but increase reimbursement rates to providers causing an aggregate increase in prices to consumers and thus premiums. Decreasing reimbursement rates will decrease the quality of care as providers are reimbursed at lower rates thus having less money to invest in quality of care.

iii. Socialized: The effects are unknown and illogical as no country uses private insurance and public provision of care.

c. Price has a quadratic relationship to access to care and health outcomes. As price increases, access to care increases until the price becomes prohibitive and then begins to reduce access to care. Furthermore, as price increases, quality increases until the point where the excess expenditures no longer increase the quality of care and begin to represent waste within the system. Low prices lead to decreased access, quality, and health outcomes. High prices lead to decreased access and health outcomes despite good quality of care due to the waste within the system.

2. Based on the above hypotheses, in Chapter 3, and fully supported by the statistical analysis in Chapter 4, increasing competition in health care provision or insurance cannot be assumed to increase quality and decrease price of care to consumers as assumed in economic theory of competitive markets. Researchers cannot assume that normal economic theory and principles apply to the health care system under investigation and must examine how the system alters the effects of competition when creating or analyzing policy interventions.

3. Health insurance is a Giffen Good, altering the way policy interventions, researchers, and economists must approach demand for care and the demand for insurance within health care markets.

5.4: Conclusions

The research questions laid out in Chapter 1 were all able to be answered:

1. Context: What are the market forces at work within health care and how do these forces differ from a competitive market (how does supply and demand in health care differ from supply and demand within competitive markets)?
    a. The demand for health insurance functions as a Giffen Good.
    b. Providers are able to act as price setters without a unitary insurer.
    c. There is no direct negotiation between consumers and providers in terms of price.
    d. Market forces cause the consolidation of health care provision.
    e. Market forces increase the costs of care, thus decreasing access to care.
    f. Poorer countries tend to use socialized systems in response to these market forces.
    g. The United States is an outlier, in the sense that, it does nothing to mediate the negative effects of these market forces.
2. Design: Based on these market forces and their effects on the overall health care market, what are the differences in health care policies and structures that lead to disparate health outcomes in terms of quality, access, and economic efficiency in advanced industrial nations (based on the supply and demand in health care, what are the different policies used in advanced industrial nations that lead to different outcomes in terms of quality, access and economic efficiency)?

How do the health care policies and structures in a country affect the market forces for health care within said country (how do different health care policies affect the supply and demand of care)?

   a. Free market systems have decreased have decreased access to care, increased quality of care, and the most economic inefficiency.
   b. Socialized systems have decreased access and quality of care, but the lowest costs.
   c. Universal systems have the best access to care, quality of care, are more economically efficient the free market systems, but less economically efficient than socialized systems.

3. Performance: What are the differences in price, quality, and access to care caused by these policy interventions?
   a. Socialized systems perform better than the other two systems in terms of economic efficiency, per capita expenditures are decreased. Socialized systems have better access to care, they have more health care resources, than free market systems, but decreased access, fewer resources, compared to universal systems. Socialized systems have the lowest quality of the three systems.
   b. Universal systems perform better in quality and access than the other two systems.
   c. Free market systems overspend compared to the other two systems and have the lowest access to care.
4. Outcomes: What are the individual effects of price, access, and quality of care to health outcomes based on these different policies and market forces?
   a. Improved access increases health outcomes.
   b. Improved quality increases health outcomes.

c. Expenditures have a quadratic relationship with health outcomes.

Health insurance is the first fully substantiated case of a Giffen good. As the price of low quality health insurance increases, the demand for the low-quality health insurance will increase. The income effect substantially outweighs the substitution effect causing the demand for health insurance to defy the law of demand as predicted in **Figure 4**, and **Figure 5**. The regression results showed that as subsidies decreased the demand for bronze level health plans increased showing that silver and gold plans are more desirable than the bronze plans. The subsidy decrease is the equivalent of a price increase, and therefore, as the price of bronze plans increased the demand for bronze plans increased. The comparison of prices between 2017 and 2018 also showed that as the price of bronze increased from 2017 to 2018 the demand for the bronze plans increased.

The integrative market model created in Chapter 3 is fully supported in both regression analysis and through the structural equation models. The models verify that the integrative market model has the causal relationships predicted. Price of care is not being determined by the demand for care, health care providers act as price setters without a unitary insurer (whether regional or national) to force price negotiation. Price negotiation that occurs between supply and demand do not function properly in the health care market and policy interventions must be made to compensate for these market failures. The regression models and structural equation models all show that the health care resources and health outcomes are a quadratic function of per capita expenditures when controlling for wealth.

As predicted by the integrative market model, free market systems overspend by $3460 per capita when controlling for the wealth of the country, have a reduced life expectancy of 2.7 years per capita due to the decreased access to care caused by the inflated price of care, and

another 2.6 years of life expectancy not realized, despite the expenditures, representing economic waste. Socialized systems reduce life expectancy by 0.17 years due to decreased access to care and 0.09 years due to decreased quality of care controlling for wealth of the country compared to a universal health care system. The difference between a universal system and a free market system is in the identity of the insurer, private versus public. The difference between a universal system and a socialized system is in the identity of the medical provider, private versus public. These results show that private insurance reduces both access to care and quality of care, as well as increasing the costs of care. Public provision of care reduces quality of care, access to care, and the costs of care.

According to the analysis of WHO data, the results of this analysis should apply universally, whether the country is wealthy or poor, industrializing or industrialized. Maximizing quality of care and access to care while keeping expenditures under control requires proper price negotiation between providers and insurers that is most easily accomplished through the use of a universal health care system.

Universal health care systems are superior to both socialized systems and free market systems in terms of quality and access to care. Competition and profit motives in the provision of care increase quality of care and access to care. Competition within the insurance market decreases access and quality even within universal systems that allow multiple insurers and choice of insurers. Moral hazard does not exist within health care markets; copays and gatekeeping do not reduce waste within the models. Allowing consumers free choice of providers increases quality and access, and the requirement of referrals reduces redundancy and increases quality. Furthermore, the effects of intra-system policy differences were measurable once the statistical model accounted for the income level of each country and the system type

chosen. According to **Figure 29**, requiring or financially incentivizing primary care registration increases the likelihood of overspending in health care which reduces quality and access to care. Allowing a choice of insurers (increasing competition between insurance options) increased costs and the likelihood to overspend which reduces quality of care and access to care. The use of global budgeting decreases expenditures but has no effect on over-expenditure meaning that global budgeting reduces access to care and quality of care. Requiring referrals or financially incentivizing them increased expenditures but not over-expenditures, meaning that requiring referrals increased quality and access to care. In conclusion, the final policy recommendations are provided:

1. Private health insurance was found to statistically increase costs and decrease access to care and quality of care. Competition between insurers, even within universal systems, reduces reimbursement negotiation power of insurers; and insurers reduce access through the use of networks. Because of these facts, the use of private health insurance, and competition within the insurance market, is not recommended. The United States should reorganize its insurance industry to utilize a single insurer. The simplest method would be to create individual state-wide insurance companies that can help account for regional differences. Despite the increases in insurance coverage caused by the ACA, the ACA will not be able to contain costs or guarantee full access to care.
2. Competition in the provision of care is beneficial to access to care and quality of care, but competition also increases expenditures and the likelihood of overspending. Socialized systems should work to slowly introduce and increase free market competition within the provision of care. Poorer countries may have to rely on public

hospitals while their economies develop (Cesur et al., 2017) but, should work to increase private practice for primary care with ample choice of providers to increase non-price competition to maximize access to care, quality of care, and health outcomes.

3. Choice of providers, as represented by not requiring or financially incentivizing registration with a primary care provider, increased access to care and quality of care. Therefore, all systems should work toward increasing consumer choice of providers, thus increasing non-price competition amongst providers.

APPENDIX A: TABLE 3.1 FROM (OECD, 2010)

Table 3.1. **Overview of the indicators on health policies and institutions**

Reliance on market mechanisms and regulations to steer the demand and supply of health care	Main criteria taken into account
1. Insurers	
1.1 Basic coverage - choice of insurer	Type of coverage (single national or local schemes, multiple insurers). In case of multiple insurers, number of insurers, market shares and ability of people to choose their insurer.
1.2 Basic coverage - insurer levers for competition	Insurers' ability to modulate the benefit basket, the level of coverage or premiums and to contract with providers. Existence of a risk-equalisation scheme. Availability of information for consumers on premiums/coverage and on insurers' performance.
1.3 "Over the basic" coverage: market forces	Share of population covered by non-primary insurance (duplicate, complementary or supplementary private health insurance) - share of health care expenditures financed out of private health insurance and degree of market concentration.
2. Providers	
2.1 Degree of private provision	Breakdown of physicians and hospital services according to their nature (public or private).
2.2 Volume incentives embedded in provider payment schemes	Physician and hospital payment modes scored according to incentives to generate volume of services.
2.3 Regulation of prices billed by providers	Regulation of drug prices and of prices billed by physicians and hospitals.
2.4 User information on quality and prices	User information on quality and prices of various health care services.
2.5 Regulation of the workforce and equipment	Quotas for total number of medical students and by speciality; regulation of practice location; policies to address perceived shortages; regulation of hospital high-tech equipment and activities (number of hospitals and beds, specific services, high cost medical equipment) and control of recruitment and remuneration of hospital staff.
2.6 Patient choice among providers	Degree of freedom in choosing among primary care physicians, specialists and hospitals.
3. Users	
3.1 Patient choice among providers	Degree of freedom in choosing among primary care physicians, specialists and hospitals.
3.2 Gate-keeping	Obligation or incentive to register to a GP and/or to get referrals to access secondary care.
3.3 Price signals on users	Extent to which patients face out-of-pocket expenses (cost-sharing and "over-the-counter").
Coverage principles to promote equity	
4. Level of insurance coverage	
4.1 Breadth - population covered	Proportion of the population covered by basic health insurance.
4.2 Scope of basic coverage	Range of goods and services covered by basic health insurance.
4.3 Depth of coverage	Level of the costs covered for key goods and services included in the basic benefit package, actual level of coverage by health insurance (including PHIs) and out-of-pocket payments for essential care.
Budget and management approaches to control public spending	
5. Setting and sharing the spending envelope	
5.1 Priority setting	Definition of the health benefit basket; criteria taken into account in defining it; effective use of health technology assessments (HTA); definition and monitoring of public health objectives.
5.2 Stringency of the budget constraint	Rules and/or targets to fix the health budget and its allocation across sub-sectors and/or regions.
5.3 Regulation of the workforce and equipment	Quotas for total number of medical students and by speciality; regulation of practice location; policies to address perceived shortages; regulation of hospital high-tech equipment and activities (number of hospitals and beds, specific services, high cost medical equipment) and control of recruitment and remuneration of hospital staff.
5.4 Regulation of prices paid by third-party payers	Regulations of prices paid by third-party payers for primary care physicians, specialists, hospital services and drugs.
6. Decentralisation and delegation	
6.1 Degree of decentralisation to sub-national governments	Number of key decisions taken at a sub-national government level.
6.2 Degree of delegation to insurers	Number of key decisions taken at the insurer level.
6.3 Consistency in responsibility assignment across levels of government	Number of decisions falling under the responsibility of more than one government level and consistency in responsibility assignment.

Source: OECD.

Figure 32: OECD 2010, Figure 3.1

APPENDIX B: OECD VARIABLE DESCRIPTIONS

Table 22: OECD Variables and Descriptions

Source	Category	Variable Name	Variable Description and Measure	% Miss
	Country ID	Country	Name of Country	0.00
		Year	Year	0.00
OECD Health System Surveys 2009, 2012, 2016	Health System Type	PrimeProvis	Public or Private Provision of Primary Care, 1=Private 0=Public	0.00
		Insurance	Public or Private Insurance of Care, 0=public/ compulsory, 1=Voluntary choice of providers	0.00
		HospProvision	Hospitals Primarily Public/ Private, 0=Public, 1=Private	0.00
		OECDSysType	System Type based on Insurance, Primary care and Hospitals	0.00
	Insurance Information	InsureSource	Source of Health Insurance, National=National health system (even if run by local Gov't), Multiple=multiple insurance funds, Single-Payer=Single Health Insurer	0.07
		MultiSelect	If Multiple Insurers, how is insurer selected	0.07
		CovLevel	Are insurers required to offer the same coverage?	0.07
		PriceRegulate	Prices of premiums are regulated by the government	0.07
		PrimeCostSharing	Cost Sharing for Patients for Primary Care, question 12, 0=No cost sharing, 1=co-pay or cost sharing	0.02
		AcuteCostShare	Cost Sharing for Acute Care or Specialists, 0=No cost sharing, 1=cost sharing	0.02
		PoorCopay	Poor Exempt from Copays, 0=Poor exempt, 1=Poor not exempt	0.05
		2ndInsurance	Secondary Private Insurance, 0=No, 1=yes	0.02
		InsCompete	Insurance Competition Coded, Dummy 0=no choice, 1=choice	0.05
	Provision	Capitation	24b. How are these providers paid? Capitation, 1=yes	0.05
		FeeForService	24b. How are these providers paid? Fee-for-service, 1=yes	0.05
		PayPerform	24b. How are these providers paid? Pay-for-performance 1=yes	0.05
		Budget	24b. How are these providers paid? Global budget, 1=yes	0.05
		PrivateHospitals	Private For-Profit Hospitals Allowed, 1=yes	0.02
		PrimeID	Primary Identity, 0=Public, 1=Private	0.02
		AcuteID	Inpatient Identity, 0=Public, 1=Private	0.02
	Gatekeeping	PrimaryRegister	36. Are patients required or encourage to register with a primary care physician or practice? 0=No obligation or incentive, .5=Financial Incentive, 1=Required	0.08
		Referral	37. Do primary care physicians control access to specialist care? 0=No obligation or incentive, .5=Financial Incentive, 1=Required	0.08

Source	Category	Variable Name	Variable Description and Measure	% Miss
		PrimeChoice	38.a. Are patients generally free to choose a primary care practice for primary care services? 0=No Choice, .5=Financial Incentive, 1=Free Choice	0.05
OECD Demographic References	Population	Population	Total Population In 1000s	0.00
		PopFemale	Female population In 1000s	0.00
		PercentPopF	% of Population Female	0.00
		PopMale	Male population In 1000s	0.00
		PercentPopM	% of Population Male	0.00
		Fertility	Children per women aged 15 to 49	0.22
		Pop65up	Population 65+ In 1000s	0.00
		Pop65F	1000s of Females 65+	0.00
		Pop65M	1000s of Males 65+	0.00
		PecentPop65up	% of population 65+	0.00
		Pop80up	Population 80+ in 1000s	0.00
		Pop80F	Female population 80+ in 1000s	0.00
		Pop80M	Male population 80+ in 1000s	0.00
		PercentPop80	% Population 80+	0.00
	Employment	Employed	1000s of persons employed	0.24
		PecentEmployed	% of population employed	0.24
OECD Economic Comps	Wealth	GDPusPPPMillions	GDP in US$ PPP	0.00
		GDPperCap	GDP Per Capita in US$ PPP	0.00
OECD Country Statistical Profiles		GDPGrowth	Real GDP Growth	0.00
		IncomePerCapita	National Income Per Capita in US$	0.00
	Income Inequality	GINIoecd	GINI at disposable income post taxes and transfers, 0-1 scale	0.34
		PovertyPop	Poverty Rates Total Population	0.28
		PovertyChild	Poverty Rates Children 17 and Under	0.28
		Poverty18to65	Poverty Rates 18-65	0.28
		Poverty65up	Poverty Rates 65+	0.28
		HoursWorked	Average Hours Worked	0.03
	R&D	RDExpenditures	Expenditures on Research and Development in US$ 2005	0.07
	Environmental	CO2emissions	CO2 Emissions in thousand tons from fuel combustion	0.20
		GreenGasEmissions	Greenhouse gas emissions in thousand tons	0.24
		HealthExpGDPshare	Health Expenditures as % of GDP	0.00

Source	Category	Variable Name	Variable Description and Measure	% Miss
OECD Health Expenditure and Financing	Health Care Expenditures	HealthExpPPPcurrent	Health Expenditures Current Prices PPP	0.00
		HealthExpPPPConstant	Health Expenditures Constant Prices PPP Base Year	0.00
		ExpPerCapCurrent	Per capita, current prices, current PPPs	0.00
		ExpPerCapBase	Per capita, constant prices, OECD base year	0.00
		ExpPerCapPPPBase	Per capita, constant prices, constant PPPs, OECD base year	0.00
	Expenditures Government/Compulsory Financing Schemes	PublicGDPExp	Public Share of expenditures of gross domestic product on Health Care	0.00
		PublicShareEXP	Public Share of current expenditure on health	0.00
		PubExpCurrentPPP	Public Current prices, current PPPs	0.00
		PubExpBase	Public Constant prices, OECD base year	0.00
		PubExpConstant	Public Constant prices, constant PPPs, OECD base year	0.00
		PerCapPubExpCurrentPPP	Public Per capita, current prices, current PPPs	0.00
		PerCapPubExpBase	Public Per capita, constant prices, OECD base year	0.00
		PerCapPubExpConstant	Public Per capita, constant prices, constant PPPs, OECD base year	0.00
	Expenditures Voluntary/Household out-of-pocket	PrivateGDPExp	Private Share of expenditures of gross domestic product on Health Care	0.00
		PrivateShareEXP	Private Share of current expenditure on health	0.00
		PrivExpCurrentPPP	Private Current prices, current PPPs	0.00
		PrivExpBase	Private Constant prices, OECD base year	0.00
		PrivExpConstant	Private Constant prices, constant PPPs, OECD base year	0.00
		PerCapPrivExpCurrentPPP	Private Per capita, current prices, current PPPs	0.00
		PerCapPrivExpBase	Private Per capita, constant prices, OECD base year	0.00
		PerCapPrivExpConstant	Private Per capita, constant prices, constant PPPs, OECD base year	0.00
OECD Health Status	Life Expectancy	LifeExpectancy	Total Population at Birth in years	0.00
		LEFemale65	Life Expectancy of Females 65+ in years	0.00
		LEMale65	Life Expectancy of Males 65+ in years	0.00
	Infant Mortality Per 1000 Live Births	InfantNoMin	Infant mortality, No minimum threshold of gestation period or birthweight	0.04
		NeonatalNoMin	Neonatal mortality, No minimum threshold of gestation period or birthweight	0.08
		PerinatalMortality	Perinatal mortality per 1000 total Births	0.10
		MaternalMortality	Maternal mortality per 100,000 live births	0.12
	Perceived Health Status	GoodHealth	Good/very good health, total aged 15+	0.28
		FairHealth	Fair (not good, not bad) health, total aged 15+	0.30

Source	Category	Variable Name	Variable Description and Measure	% Miss
		BadHealth	Bad/very bad health, total aged 15+	0.28
	Perceived Health Status by Socio-Economic Status/Education	GoodHealthPoor	Good/very good health, total aged 15+, Income quintile 1 (lowest)	0.28
		GoodHealthWealth	Good/very good health, total aged 15+, Income quintile 5 (highest)	0.28
		GoodHealthEdLow	Good/very good health, total aged 15+, Low education (ISCED 0 to 2)	0.28
		GoodHealthEdMid	Good/very good health, total aged 15+, Medium education (ISCED 3 and 4)	0.28
		GoodHealthEdHigh	Good/very good health, total aged 15+, High education (ISCED 5 to 8)	0.28
OECD Social Protection	Public Versus Private Insurance Coverage % of Population	PercentInsured	Total Percent of public and primary private health insurance	0.18
		PublicInsurance	Government Total Health Care	0.18
		PublicAcuteCare	Government In-Patient and Acute Care	0.21
		PublicOutCare	Government Out-Patient Medical Care	0.21
		PublicRx	Government Pharmaceutical Goods	0.24
		PrivateInsuranceTotal	Private Health Insurance Coverage	0.40
		PrivateInsPrimary	Private Primary Health Insurance Coverage	0.36
		PrivateInsuranceDup	Duplicate Private Health Insurance Coverage	0.45
		PrivateInsComp	Complementary Private Health Insurance Coverage	0.43
		PrivateInsSupp	Supplementary Private Health Insurance Coverage	0.51
OECD Health Care Utilization (includes data on wait times for procedure but very few countries responded)	Consultations	DocConsults	Doctor Consultations (in all Settings) per Capita	0.41
	Immunizations Children	ImmuneDTP	Immunization: Diphtheria, Tetanus, Pertussis % of Children	0.20
		ImmuneMeasles	Immunization: Measles % of children	0.20
		ImmuneHepB	Immunization: Hepatitis B % of children	0.38
	Hospital Utilization	InpatientUse	Inpatient Care Discharges Per 100,000 Population	0.31
		InpatientStay	Inpatient Care Average Length of Stay in Days	0.29
		CurativeUse	Curative Care Discharges Per 100,000 Population	0.35
		CurativeStay	Curative Care Average Length of Stay in Days	0.31
	Access to Medical Technology	CTEaccess	Computed Tomography exams, per 100,000 Population	0.47
		CTEuse	Computed Tomography exams, per Scanner	0.51
		MRIaccess	Magnetic Resonance Imaging exams per 100,000 Population	0.47
		MRIuse	Magnetic Resonance Imaging exams per scanner	0.53
		PETaccess	Positron Emission Tomography (PET) exams per 100,000 Population	0.64
		PETuse	Positron Emission Tomography (PET) exams per Scanner	0.69

Source	Category	Variable Name	Variable Description and Measure	% Miss
OECD Non-Medical Determinants of Health	Tobacco	SmokeAmount	Grams Per Capita	0.56
		TobaccoUse	% of Population 15+ who are Daily Smokers	0.46
	Alcohol	Alcohol	Liters per Capita age 15+	0.28
	Obesity	ObeseSelf	Overweight or obese population self-reported %	0.66
		ObeseMeasured	Overweight or obese population measured %	0.80
		ObeseCombined	Overweight or obese population measured or Self-Reported %	0.53
OECD Health Care Quality Indicators	Skipped Medical Care (Costs)	SkipConsult	Consultation skipped due to costs	0.80
		SkipTest	Medical tests, treatment or follow-up skipped due to costs	0.83
		SkipRx	Prescribed medicines skipped due to costs	0.78
	Waitlist	Wait4Weeks	Waiting time of more than four weeks for getting an appointment with a specialist	0.81
	Patient Service and Understanding	EnoughTimeAll	Patients reporting having spent enough time with any doctor during the consultation	0.91
		EnoughTimePrime	Patients reporting having spent enough time with their regular doctor during the consultation	0.82
		EasyAll	Patients reporting having received easy-to-understand explanations by any doctor	0.92
		EasyPrime	Patients reporting having received easy-to-understand explanations by their regular doctor	0.82
		AskAll	Patients reporting having had the opportunity to ask questions or raise concerns to any doctor	0.94
		AskPrime	Patients reporting having had the opportunity to ask questions or raise concerns to their regular doctor	0.94
		DecisionAll	Patients reporting having been involved in decisions about care or treatment by any doctor	0.92
		DecisionPrime	Patients reporting having been involved in decisions about care or treatment by their regular doctor	0.82
OECD Health Care Resources	Health Care Providers	PhysicianDensity	Number of Practicing Physicians, Per 1000 Population	0.11
		GeneralPractice	Generalist Practitioners, Density Per 1000 Population	0.02
		SpecialPractice	Specialist Practitioners, Density Per 1000 Population	0.02
		NurseDensity	Practicing Nurses, Density per 1000 Population	0.22
	Hospitals	Hospitals	Total Hospitals per Million Population	0.07
		HospPublic	Publicly Owned Hospitals Per Million Population	0.40

Source	Category	Variable Name	Variable Description and Measure	% Miss
		HospNonProfit	Not-For-Profit, Private Hospitals per Million Population	0.42
		HospProfit	For-Profit, Private Hospitals per Million Population	0.42
		HospBeds	Hospital Beds per 1000 population	0.18

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