Abstract

Title of Dissertation:	EVALUATING COSTS, QUALITY AND PERFORMANCE WITHIN A MARKET ECONOMY FRAMEWORK FOR THE NATIONS OF THE ORGANIZATION FOR ECONOMIC COOPERATION AND DEVELOPMENT (OECD)
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Background: National healthcare delivery systems and social determinants of a population coexist within the confines of capitalism. But not all capitalist economies behave the same way. Two poles exist that demarcate the degree to which that national economy engages in coordination or liberal competition. The 38 member nations of the Organization for Economic Cooperation and Development (OECD) represent democratic governments with market-based economies. COVID-19 demonstrated that nations with Coordinated Market Economies (CME) fared better in both economic (national GDP and labor productivity measures) and health outcomes (case positivity rates and deaths) than Liberal Market Economies (LMEs). The distinguishing trait of the CME is the degree to which protection is afforded to the individual via social policy and normative values. Social and welfare markets are critical and more prevalent within CMEs. Creation of a CME order is predicated on growth of human capital stock whereas LMEs coordinate via hierarchies, competitive markets and market incentives. The current practice of evaluating differences in healthcare costs across nations utilizes the GINI coefficient and market income (i.e., total national income before debts and taxes) as independent variables.

This new approach will endeavor to create a Coordination Index across values of economic equality, education, political institutions, market concentration and employment stability. This new approach evaluates whether the OECD nations based on their level of coordination (i.e. CME vs. LME traits) produce significant differences via the Triple Aim framework: cost, care quality, and system performance by using the Coordination Index to assess cost on a total per capita expenditures basis; quality through life expectancy of the total population, and system performance via avoidable mortality.

Data and Methods: A conceptual framework was first designed to explain the synergies across Andersen's Behavioral Model, Lorenzoni and Belloni's Reciprocal Domains, Hall and Soskice's Coordinated Markets, and with support from Esping-Andersen and Gunnar Myrdal's analyses on welfare states and Keynesian programs. A comprehensive literature review was conducted to make the case for inclusion of these frameworks and the differing traits they offer if collated into a novel data index. Finally, I tested the model and hypotheses empirically. Data comes from the 38 OECD nations for the period of 2008 to 2018. Measures used to create the index included: GINI coefficient of the market income; Index of Economic Freedom; Freedom in the World Score; Labor Market Institutions Index; Strictness of Employment Protection; Social Progress Index; World Integrated Trade Solutions Market Concentration; and the OECD Database. I created the coordination index using the average measures of the aforementioned multidimension aspects of coordination using the datasets presented above. After which, I applied linear regression analyses to examine the association between Coordination Index and cost, quality, and system performance.

Results: I established a conceptual model delineating the components of market and national coordination that would in theory serve as material influences on healthcare cost, quality and

system performance. The empirical findings were consistent with this theory. Coordination plays a significant part in healthcare cost, quality and system performance. The empirical findings were consistent with the theory. The new Coordination index further surpassed the benchmark of an Alpha score range of 0.65 to 0.7 indicating reliability of the measure. The Creation of a new Coordination Index on a z-scale (mean: 0, median: 0.133, minimum: -4.602, maximum: 2.531) explained a higher degree of variance and association in univariate regression with Total Health Expenditure: (coeff. 0.275, 0.263 adjusted R-squared, Standard Error 0.023, Root MSE 0.460, $p < 0.001$) compared to using GINI alone (coeff: -3.917, 0.131 adjusted R-squared, Standard Error 0.498, Root MSE 0.500, $p<0.001$). I further find that Coordination had a positive association and was significantly associated with higher total cost in a baseline model and when adjusted for insignificant findings and collinearity was still significant (coeff. 0.036, $p<0.05$). I also find that Results showed first that the mean difference between higher quartile rankings and lower quartiles of Coordination in regard to Total Health Expenditure is significant ($p<0.01$), and secondly that a statistically significant ($p<0.01$) difference exists amongst Total Health Expenditure by quartiles of Coordination. The findings indicate that changes in Market Coordination towards the mean distribution of the OECD are associated with a higher total expenditure of 0.036 on a natural log basis, or approximately $1.036 (in thousands) per year higher Total Expenditure. I also find that Coordination did have a positive association but not a statistically significant association with a natural log of Life Expectancy in a baseline model nor when adjusted for insignificant findings and collinearity (coeff. 0.002, $p<0.05$) in regression. I conclude however though first that the mean difference between quartile rankings of Coordination is significant for quartiles 1 and 4 ($p<0.01$) and quartiles 2 and 3 ($p<0.01$) in regard to Life Expectancy. Secondly, that a statistically significant ($p<0.01$) difference exists amongst

variances by quartiles of Coordination for Life Expectancy. The findings indicate that changes in Market Coordination towards the mean distribution of the OECD is associated with an increase in mean Life Expectancy of 0.002 on a natural log scale, or nearly 1 year when converted. I use the metric of Avoidable Mortality as a measure for system performance and find that Coordination was negatively associated and statistically insignificant on an Avoidable Mortality per 10 000 scale in a baseline model nor when adjusted for insignificant findings and collinearity (coeff. 0.275, $p<0.05$) in regression. However, I do conclude first that the mean difference between higher quartile rankings and lower quartile rankings of Coordination with is significant (p-value: 0.000, $p<0.01$) for quartiles 2 and 3 as well as quartiles 1 and 4 (p-value: 0.000, $p<0.01$). Secondly, that a statistically significant ($p<0.01$) difference exists among variances by quartiles of Coordination for Avoidable Mortality. This finding indicates that changes in Market Coordination towards the mean distribution of the OECD are associated with a decrease in Avoidable Mortality of approximately 3 deaths per 100 000.

Conclusion: Within the OECD nations, changes in market Coordination towards the mean distribution of the OECD are significantly associated with, and have increases in healthcare cost, quality, and system performance. Quartile levels of Coordination are also shown to produce statistically significant differences in cost, quality and system performance as well, with higher levels of Coordination having lower cost, higher quality and better performance. Though slightly imperfect in its pursuits, Coordination as a concept advances the notion that the pursuit of a welfare state which places the values of economic equality, education, political institutions, market concentration and employment stability as priorities has a relationship to healthcare as an institution. Changes to these institutions and values should be made in harmonization with all

other policy measures to achieve substantive gains. Failure to improve healthcare in conjunction with these other values risks enfeebled outcomes to the former.

EVALUATING COSTS, QUALITY AND PERFORMANCE WITHIN A MARKET ECONOMY FRAMEWORK FOR THE NATIONS OF THE ORGANIZATION FOR ECONOMIC COOPERATION AND DEVELOPMENT (OECD)

By

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Dedication

To my wife for her patience; grandparents for their example; my parents and their support; my girls for their inspiration and energy; and all my many coaches, professors, and mentors throughout my life and career for providing the right balance of support and challenge to foster achievement.

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Table of Abbreviations

ACA	Affordable Care Act, Patient Protection and Affordable Care Act of 2010
Adj	Adjusted
AIAS	Institute for Advanced Labour Studies
CGE	Computable General Equilibrium
CI	Confidence Interval
CME	Coordinated Market Economies
Coor	Coordination Index
COVID-19	Coronoavirus Disease 2019
DALY	Disability Adjusted Life Years
DEI	Diversity, Equity, and Inclusion
EDI	Global Economic Diversification Index
EPI	Environmental Performance Index
ESI	Environmental Sustainability Index
FA	Factor Analysis
GDP	Gross Domestic Product
GINI	GINI Index named for Corrado Gini
GLM	Generalized Linear Model
GPI	Genuine Progress Indicator
HCQI	Health Care Quality Initiative
HHI	Herfindahl-Hirschman Index
IEWB	Index of Economic Wellbeing
ISEW	Index Sustainable Economic Welfare
LME	Liberal Market Economies
M&A	Mergers and Acquisitions
MAR	Missing at Random
MCAR	Missing Completely at Random
MNAR	Missing Not at Random
N	Number of Observations
NAFTA	North American Free Trade Agreement
Obs	Observations
OECD	Organization for Economic Cooperation and Development
P	Probability
PCA	Principal Factor Analysis
PISA	Programme for International Student Assessment
PPP	Purchasing Power Parity
Pr	Probability
Prob	Probability
RCT	Randomized Controlled Trial
RMSE	Root Mean Square Error
SE	Standard Error
SES	Socio-Economic Status
SPI	Social Progress Index
Std	Standard
SVI	Social Vulnerability Index
t	T-Statistic
UHC	Universal Health Coverage
UN	United Nations

USD	United States Dollars
V	V-Statistic
VIF	Variance Inflation Factor
W	Test statistic to indicate goodness-of-fit
WHO	World Health Organization
WISE	Wellbeing, Inclusion, and Sustainability
z	z-score
Z	Z-Statistic

1. Introduction

For years, the U.S. system has been marred by dramatically higher spending than peer nations. In 2016 spending reached nearly twice as much as 10 other high-income countries.[1] Over the span of 2007 to 2017, health insurance premiums increased about 55%.[2] Prescription drug prices in the United States average over 2.5 times higher than those in 32 other peer nations.[3] Yet with these and other exceptional variations, from 2000 to 2010 the United States has the largest proportion of population without healthcare in comparison to other OECD nations.[4] These incomparable traits have stoked and perpetuated a notion of exceptionalism, implicitly saying that a "nation, region, or political system is exceptional and does not [need to] conform to the norm."[5] This ethnocentric construct "insulates us from the experience of other nations"[6] and forces the insulated to become conservative and weary of change.

There are a multitude of potentially mitigating circumstances feeding the flames of exceptionalism: demand-side factors vis-à-vis patient preferences, health status, income, access[7] or supply-side factors such as financial incentives, beliefs, abilities, practice norms[7] or a lack of transparent and clear information on quality and other asymmetries,[8] for example on pricing. Certainly, the predisposing endemic health issues rampant in the United States, notably obesity and life expectancy being alarming outliers compared to peer nations[1] could be compounding costs. Coupled with the weight of Social Determinants of Health, or the conditions in the environments where people are born, live, learn, work, play, worship, and age. These social determinants "affect a wide range of health, functioning, and quality-of-life outcomes and risks"[9] and are not easily ameliorated. Consequently, "addressing social determinants of health is critical for any systematic effort aiming to improve population health and health equity"[10] because

discrepancies in social determinants of health are caused by, and representative of "the unequal distribution of power, income, goods, and services."[11]

The operations of a national healthcare delivery system as well as the endemic social determinants of a population both coexist within the confines of capitalism.[12–14] But not all capitalist economies behave the same way. Two poles exist that demarcate the degree to which that national economy engages in coordination or liberal competition.[12] Of the 38 member nations of the Organization for Economic Cooperation and Development (OECD) they represent a quorum of democratic governments with market-based economies dedicated to collaborating towards policy standards that promote sustainable economic growth in the world.[15] Importantly, these 38 OECD nations also represent different prioritizations of pursuits of wealth manifest on the scale of coordination and competition. This is evidenced by the realities of COVID-19, where those nations in Coordinated Market Economies (CME) fared better in both economic (national GDP and labor productivity measures) and health outcomes (case positivity rates and deaths) than Liberal Market Economies (LMEs).[16,17]

The distinguishing trait of the CME is the degree to which protection is afforded to the individual via social policy and normative values.[12] As such, the concept and delivery of social protections as a means to suture the bifurcated labor, social and welfare markets is critical and more prevalent within CMEs[12] since they require internal systems and orders to enable their viability and authority vis-a-vis: education, technology and innovation, military strength, trade, economic output, and the like.[18] Creation of this order does not form in a vacuum of the invisible hand of the market, but is created rather through the harmonized growth of capital stock: the things in which people, businesses, and governments invest in over time. Whereas on the contrary, in LMEs firms coordinate via hierarchies, competitive markets and market incentives.[12]

Notably however, the same factors to stand up and facilitate coordination (education, technology and innovation, military strength, trade, economic output, and the like[18]) also permeate the basic social determinants of health themselves.[11] As a corollary to the notion of CME, the existence of a nationalized and comprehensive solution for all would appear to be something of a prerequisite for. Existing studies and comparative data on this topic are limited though and often focus on specific interventions and treatments rather than a comprehensive national solution. Likewise, the import of the enabling factors of politics, institutional and normative values, and social welfare principles remain unanswered. A new and innovative approach is needed that evaluates healthcare delivery within the framework of CME and LME[12] that takes into account the exacerbating economic consequences felt from market reforms and politics laid out under a neoliberal agenda, "a prioritization of corporate rights over democratic rights."[19]

More recent efforts shed light on the reality that race, manifest in structural and cultural racism are further compounding factors to one's social determinants of health[20] and that race is further a factor to a vulnerable population predisposed economic, educational, and social difficulties that make it harder for one to improve health status and remediate potentially addressable social determinants.[21] But race itself is a quagmire when trying to research cross national values as it is a social construct, "and ethno-racial groups are neither inherently nor innately different."[22] However, we would be remiss to ignore the importance of the racial construct, "race matters because it has been made to matter […] it is powerfully politically salient."[22]

Capitalism stands as "one of the great inventions of the human race—an unparalleled source of prosperity, opportunity and innovation."[23] Further, capitalism stands as one of the main orienting principles among the OECD nations and nearly all other countries. However, the unrelenting pursuit of profits "is endangering untold numbers of people […] This is especially true in the

United States […] where many workers do not have paid sick leave and so will be compelled to work even if they're sick."[24] Thus exacerbating disease burden to further economic subsistence.

This is evident from recent events where the social burden of COVID-19 was been disproportionately borne by those in need: "While COVID-19 has been termed a great equalizer; necessitating physical distancing measures across the globe, it is increasingly demonstrable that social inequalities in health care profoundly, and unevenly, impacting COVID-19 morbidity and mortality.[25] In response to COVID-19 just like with the recession in 2008, fiscal policy within the United States simultaneously purchased vast sums of assets from the banking system to steady the recession while simultaneously increasing lending by lowering and holding interest rates low.[26] As a consequence, whether intentional or not: the period immediately following COVID-19 created one of the greatest wealth transfers in history,[27,28] an era worse than the than during the Great Depression.[29]

The Friedman Doctrine identifies one responsibility of business: to increase profits.[30] However, as evidenced above: CMEs and LMEs value and prioritize their profit seeking behaviors differently and experienced disparate outcomes because of COVID-19. Similarly, the social order and trust of the institutions across the CMEs and LMEs vary. Consequently, a gap exists in the Friedman Doctrine as the blueprint for capitalism—there must be a secondary orientation point in conjunction with profits, one that looks to resolve a societal challenge as well as generating revenues.[31]

As a prerequisite to future success and resolving inequality and other social problems: markets must promote transparency and accountability otherwise the markets become too powerful.[23] "Firms have not just a moral duty to contribute to the health of the institutions that keep our society strong […] but also an economic interest in doing so."[23] We must widen our gaze

towards generating shared value and stability instead of simple profits to promote human capital and productivity. Human productivity is the most important driving force in determining national and global economic wealth, power, living standards and stability.[18] Access to coverage and protections on remittance of care are foundational to allowing everyone to maximize their productivity; for themselves, and for society. Access to coverage and protections are prioritized within CMEs.

Findings from this study will demonstrate whether the necessity of institutional traits of a CMEs are a prerequisite for the United States in reducing national and individual expense while simultaneously improving patient and population outcomes.

1.1 Objective

Herein, it is the objective of this work to assess whether the various methods for healthcare delivery among the OECD nations, and based on their level of coordination (i.e. CME vs. LME traits), produce significant differences via the Triple Aim framework:[32] cost, patient quality, and system performance.

The central hypothesis then is that since LMEs are primarily driven by market competition, as firms must sustain their profitability,[135] there will be significant positive variation and yearly growth in expenditure, and significant negative variation in quality and performance measures over time under LME operations due to competition over prices and reductions in quality compared to CME markets.

I examined whether the diverse economic approaches manifest in the OECD nations and their levels of coordination result in significant differences in cost, quality, and performance in a span of ten-years 2008 – 2018 to coincide with ACA implementation within the United States. I am

not concerned with specific causation but rather with directional relationships for two reasons. First, due to the complementarity[33,34] of the variables I cannot separate dependent and independent variables for the entirety of market dynamics and "a description of organic life and an evaluation of its possibilities of development cannot aim at completeness, but only at sufficient width of the conceptual framework."[35] Which ultimately makes this a political question in nature and thus not subject to the rules of calculus and scientific theory. Which directly feeds the second reason of why I are not concerned with causation as the main finding: "once you acknowledge cause as the core of a problem, you have built something into it that not only baffles people, but worse, immobilizes them"[36] with a metaphysical obstacle for which people cannot think past and continuously set their eye towards—thereby missing other exigent and related issues.

1. 2 Structure of the dissertation

The structure of the dissertation commences with an overview of the literature to identify key important concepts and areas of study and then develop and explicate the gaps in knowledge. From here, I can coalesce the established frameworks and the knowledge gaps into a new conceptual framework on the importance of coordination as a concept for achieving cost, quality and performance within a delivery system.

I begin with a discussion and analysis about the concept of capitalism and why the parable of capitalism is not mutually exclusive with coordination and welfare states, and that true implementation of a capitalist structure is predicated on matrix based on incentive structures.[12] At the center of which sits the core beliefs of the national political economy in which inter-firm disputes get resolved: either through industrial relations, vocational training and education, corporate governance, inter-firm relationships, and relationships of the employees.[12] I move on

within the discussion towards the concept of competition within capitalism as it serves as the bedrock principle of the system and that a fecundity of coordinated competition is preferable over consolidated markets. After conceptual introductions in the preceding section, I move towards more established evaluative frameworks of the Triple Aim framework:[32] cost, patient quality, and system performance and introduce other relevant studies that look at a small subsection of the overarching key independent variables to be explored. At the conclusion of the overview, I will segue towards the knowledge gap where the relevance of the seemingly distant concepts will bear fruit, similarly with the introduction of the conceptual framework guiding the research as well.

Chapter Two following this introductory chapter will be methodological assessment dedicated to recalibrating the notion of coordination (the advancement from CME from LME), as outlined within the knowledge gaps, and objectively quantifying how coordination can be assessed to achieve a more encompassing Coordination Index that satisfies the gap. As a result, I am then able to operationalize and make use of the new coordination index created in the subsequent chapters. Chapter Three will examine the cost variations among the OECD nations under the hypothesis that there is a significant variation in spending based on levels of coordination. Current research does conclude that while both the United States spends more than peer nations on healthcare[37] and that actual expenditure should be lower than what is observed,[38] little attempt is made to discern what relationship may exist between the ethos and operating environment of business and institutions. Chapter Four continues in similar fashion to examine the quality variations among the OECD nations, postulating there is a significant difference in mortality over time by levels of coordination indicative that quality and performance may be semi-exogenous to cost.[39–41] Chapter Five addresses system performance variation under the similar

hypothesis that there is a negative difference in performance over time, and that nations with higher degrees of coordination experience better levels of performance utilizing existing research that system quality is a function of the strength of a system[42] and capability of a system.[42–44] I finish with a final discussion of all findings.

1.3 Revisiting the concept

1.3.1 Background on Capitalism

Capitalism stands as "one of the great inventions of the human race—an unparalleled source of prosperity, opportunity and innovation."[23] But not all capitalist economies behave the same way—there are poles and politics which exist that delineate the degree to which that national economy engages in coordination or liberal competition.[12] Those factors of politics dictate the degree to which complex laws, barriers to entry, decreased market competition and decreased compliance bare influence.[19] Within the confines of that capitalistic framework healthcare operations and the social determinants of health are borne.

The Friedman Doctrine identifies one responsibility of business: to increase profits.[30] Further, the Friedman Doctrine remains a core tenet of neoliberalism politics from the days of the New Deal through the Reagan Administration to present time.[19]

However, as noted above: CMEs and LMEs value and prioritize their profit seeking behaviors differently and experience disparate outcomes because of COVID-19. Similarly, the social order and trust of the institutions across the CMEs and LMEs vary. Consequently, a gap exists in the Friedman Doctrine as the blueprint for capitalism—there must be a secondary orientation point in conjunction with profits, one that looks to resolve a societal challenge as well as generating revenues.[31]

As a prerequisite to future success, resolving inequality and other social problems: markets must promote transparency and accountability otherwise the markets become too powerful.[23] "Firms have not just a moral duty to contribute to the health of the institutions that keep our society strong […] but also an economic interest in doing so."[23] Modern society furthermore demands and "require that corporations acknowledge and discharge social as well as private responsibilities as members of the communities in which they operate."[45]

Given the limited goal-scope of capitalism and constraints of neoliberalist policies, the funding through global financial institutions must focus away from market-driven solutions and instead look at investments into universal public health and to "promote real economy activities and health and social protection."[46]

When economic output and the rewards reaped are disproportionately distributed, Capitalism automatically generates arbitrary and unsustainable inequity[47] and flies in the face of the tenants of the Declaration of the Rights of Man and Citizen: "social distinctions can be based only on common utility."[48] Capitalism is driven by profit, and it has been clear for some time that "our institutions are not yet adequate to let men and women do what they would to play a responsible part in the betterment and ennobling and beauty of our society. That is one reason why we abdicate to such a dismal extent to the one thing whose institutional basis is hypertrophic in our society: the dollar."[34] And yet, society's indifference to the suffering manifest by those without resources serves as a reminder of the cruelty of inequality.[49] The different implementations of capitalist frameworks provide for distinctive health system characteristics: distribution of resources throughout the country, modes of financing primary services, distribution of practitioner types and specialties, ratios of earnings[42] and notably, profits. Thus, we as society see a dose-response interaction between "tax cuts, free trade deals, and financial deregulation—

so called-Reaganomics (or, 'voodoo economics') […] where intended to spur economic expansion, create jobs, increase productivity, and restore confidence in the economy"[19] and an inability to provide consistently equitable healthcare. We as individuals must remind ourselves that capitalism and an economy are "not an end in itself. It [capitalism and an economy] exist to serve men. When it ceases to do that, it creases to be acceptable".[50]

There are various theories and modes of capitalism. Malthus believed that economic advancement meant an "accelerated velocity towards illimitable, and hitherto unconceived improvement, or [condemnation] to a perpetual oscillation between happiness and misery,"[51] and bitterly after the pursuits forever reaching for that future goal of an improved state.[51] Malthus was of the mind however that it was not the inherent pursuit of growth or another variable thwarting society's efforts to betterment, but rather plainly overpopulation stood in its way[51] harking to the notion of scarcity, for which Ricardo thought land was the ultimate scarce resource and would produce the greatest disruption to the social balance: the landlords themselves owning the greatest share of land in spite of a growing population owning a diminishing share.[52] In modern economics, one can see almost an adoption of the Maslow hierarchy of needs[53] on a societal scale wherein under Kuznets' theory: income inequality will decrease once a certain level of economic production is produced.[54] According to the Kuznets' Curve hypothesis, as economies develop their inequality increases as a result of the market forces; however, once the economy reaches the precipice of maximal utility—inequality will decrease[54] and the ability to satisfy the hierarchy of needs will reach all. A theory shared by Solow,[55] and operationalized in the trickle-down economics of the Reagan administration.

The primary test of economies is continually modernizing industries to the current paradigms and securing higher rates of national growth.[56] How this is achieved is done through differing

lenses of that of behaviors and values. On the one hand, an economy may instill a set of normative behaviors and attitudes among actors, and on the other may implement formal sanctions within the hierarchy of suppliers and resources; or alternatively, a matrix based on incentive structures for which behaviors can be predicted from those incentives.[12] At the center of these modes sits the core beliefs of the national political economy which dictates the manner in which inter firm disputes get resolved: either through industrial relations, vocational training and education, corporate governance, inter-firm relationships, and relationships of the employees.[12] The manner in which firms resolve their differences is the compass by which national political economies can be measured against. In LMEs firms coordinate via hierarchies, competitive markets and market incentives; in CMEs firms coordinate on non-market relationships and pursuits of core competencies.[12] Under this classification, market equilibrium in a CME is derived from strategic interaction and alignment among actors. As opposed to within an LME, the core responsibility of business is to increase profits, according to the Friedman Doctrine[30] and other neoliberal constructs.[19] An index of overall market cooperation does not exist, however, if one looks towards the interplay of market competition and employment protections, one can tease out the degree of coordination between actors and institutions as an approximate tool to distinguish CME from LME and mark an increase in coordination as the movement towards CME along that axis.

Competition as a concept matters because it helps to secure against inequality by allowing an alternative to simply shifting wealth to the supplier and monopolist in an equation,[57] as John Stuart Mill wrote: “where competitors are so few, they always end by agreeing not to compete.”[58] Adam Smith too was a proponent of competition but wary of market concentration: “People of the same trade seldom meet together, even for merriment and diversion, but the

conversation ends in a conspiracy against the public, or in some contrivance to raise price."[59] These patriarchs of economics elude to the concept behind Game Theory whereby firms are able to reach cooperative agreements and outcomes on the basis of what look like generally independent decisions versus outright abject collusion.[60] The Smith and Mill's fear of conspiracy was borne out by the Prisoner's Dilemma demonstrated by Axelrod in the 1980s: ongoing cooperation among very few players, as opposed to many is the optimum strategy for the firms.[61]

Under these beliefs of Game Theory then that the market rewards smaller firms' cooperation, I view rises in the number of mergers and acquisitions (M&A) in markets. And, while not all M&As are always a problem, research does suggest that there is no clear gain in efficiency of resources and assets.[62–64] Firms make money because of market power, mergers cause higher prices as demonstrated that the average markups in 1980 were 18% above a firm's marginal cost, and in 2017 that number was found to be 67% above a firm's marginal cost.[65] Since the 1990s, over 75% of US industries have experienced market concentration.[64]

What can be seen in the implementations of capitalism is the shifting of wealth, capital and equity from labor to business owners thus impacting the general social welfare, which has become the crux of the debate around globalization[13] and growth of corporatism, or Ersatz Capitalism: the privatization of gains and the socializing of loss.[26,66] Neo corporatism is generally the capacity of a state to negotiate lasting bargains between employers and trade unions for improved wages, working conditions and policy[67] in an effort to redistribute wealth and equity. What then occurs is a causal linkage between politics and economy where uncertainty about the future (risk exposure) takes an active role in shaping the redistribution of resources via policy.[13] This passes the sensibility test; coupled with the individual beliefs we as society have for inequality, fairness, religion, altruism, and attitudes towards established institutions, all these

factors along with interactions with the workforce color attitudes on fairness and redistribution. Calls for redistribution of wealth should not be minimized solely based on people being poor, Rehm et al stipulate that values and beliefs are an integral component along with interactions with the labor market.[13]

At odds, or in competition with the growth of markets, is the idea of personal responsibility and moral hazard: should the individual shoulder the burden and risk or is it the role of markets, or, plainly an asymmetry of information.[68] Welfare programs exist to provide a means of resolving the equity gap when markets are out of sync with individual's profits. Research suggests that politics influences population health in so far as more egalitarian traditions, with advanced levels of democracy are consistently related to better populations, and welfare programs with long periods of social support have strong effects on moderating the impacts of inequality.[69] Notably life expectancy is significantly associated with the usage of welfare systems that are focused on the institutionalized efforts and commitments to maintaining full employment rather than just serving on an earnings-based welfare need.[70]

A systematic search of studies testing the linkage of political systems and health inequalities and concluded that social inequalities do not emerge naturally or haphazardly from the market. Rather social inequalities are instead a political construct created as a biproduct of the growth of capitalism, whether through the fall of the Soviet Union in Eastern Europe or market and policy reforms in western nations.[71]

Social justice as a concept predates Plato, but was forever commemorated within his Crito: "one must never act unjustly […] one should not repay an injustice with an injustice […] harming a man in any way is no different from doing an injustice"[72] and has been this way since again memorialized in the Rights of Man and Citizen.[48] Yet, the degrees of inequity vary by nation

despite Capitalism being the common operating principle among nations. According to Kuznets, at a given point of maximum utility, inequality will decrease[54] and yet, COVID increased inequality[73] and yet we still see monetary policy that harms the masses in vast wealth transfers[28,74] as demonstrated that In Denmark—one of the world's most equal nations—it takes only two generations for low-income families to enter the middle class; in the US before COVID, it took 5 years.[75] The paradigm of trickle-down economics in the United States is a blight on equity and numb to the needs of the masses, labor markets and institutions must match the values and beliefs of the masses.[13] The great Dr. Martin Luther King Jr. said that "We as a nation must undergo a radical revolution of values. We must rapidly begin the shift from a thing-oriented society to a person-oriented society. When machines and computers, profit motives and property rights, are considered more important than people, the giant triplets of racism, extreme materialism, and militarism are incapable of being conquered."[76]

The Declaration of Independence identifies the unalienable Rights of Life, Liberty and the pursuit of Happiness.[77] Securing the "Blessings of Liberty to ourselves and our Posterity" is further memorialized in the Constitution's preamble.[78] All of which echo the sentiments of John Locke: "Being all equal and independent, no one out to harm another in his life, health, liberty, or possessions."[79]An individuals' pursuits of happiness and liberty are hamstrung by debt[80] and impaired by differences in health equity.[81–83] As such, providing an equitable, quality and cost-effective solution for healthcare is a Constitutional necessity, and while not specifically captured within the text of the Constitution more than meets the originalist interpretations for future Supreme Court adjudication.

With the continued growth in inequality, a move towards UHC would provide a needed placation for the masses: demonstrating their voices and needs are heard by politicians. Likewise, an

acknowledgement among all citizens that a social contract exists wherein the government recognizes and canonizes recognition of the innate natural rights of the individual.[84] Acceptance of mass reforms such as this would mirror the introduction of British liberalism pre-World War I in an era rife with political struggle and discontent. But in an effort to predict the growing trend of radicalism: British elites accepted reform to allow for, and preserve stability.[85] This move ensured Britain's stability through the era of World Wars, the "age of catastrophe"[86], or as prophetic-satirist Kurt Vonnegut sharply dubbed: "mankind's attempt at suicide."[87] This newfound liberalism would, as former Prime Minster David Lloyd George said "promotes measures for ameliorating the conditions of life for the multitudes […] to removing the immediate causes of discontent."[88] These threats hardly fell off in the interwar period before World War II, and following another moment of introspection for humanity: Western European nations constructed a new socioeconomic order that would protect its citizens[89] and provide a basic level of well-being for the masses[85] and provide a "freedom from want."[85]

The post-war era of expansion of welfare states was multifaceted. On its surface an attempt to provide peace and stability for past events; "but also a deliberate attempt to undercut the support of extremist ideologies on the left and right that had played off anomie, dislocation, and atomization in the past in order to undermine support for liberal democracy."[85] This was an attempt to stem social division and conflict, ensure economic growth and equality, and avert political extremism[85]. Failure to provide this relief falls prey to the past political instability seen in Europe and throughout the world. Underlying the current national problems seem is the decline of institutions and structures[85], the very precipitating problems that feed revolution. As such, liberal democracy requires: the rule of law; protections for minorities and individual liberties; a strong state; legitimacy of government; political equality for which welfare benefits

provide the backbone of.[85] Without relief, society runs the risk of repeating past failures: currency disorders "destroying the basis for international trade and international investment and even international faith. In their wake, we saw unemployment and wretchedness—idle tools, wasted wealth. We saw their victims fall prey, in places, to demagogs and dictators. We saw bewilderment and bitterness become the breeders of fascism and finally of war"[90] as Henry Morgenthau Jr. said at Bretton Woods. As Carl Sagan prophesized: "you have to know the past to understand the present."[91] Lastly, the continued preservation of a competitive democracy requires a responsive pluralistic social order with both formal and informal codified social values.[92]

Canada declared in 1984 the primary objective of Canadian health policy to protect, promote and restore the physical and mental well-being of residents;[93] France provides a guarantee to coverage of costs for any person;[94] Germany similarly promises an entitlement to healthcare;[95] Italy,[96] Japan[97] and the United Kingdom as well have made similar proclamations.[98] The United States has no proclamation or principal mandate for access, equity, or the right to healthcare. The United States presently is unable to satisfy the World Health Organization's definition of health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity"[99] nor meet the WHO's definition of Universal Health Coverage "that all individuals and communities receive the health services they need without suffering financial hardship."[100] The concept of UHC is not novel in the United States and dates to the 1930s and even the Presidential Agenda of the 1940s.[101]

1.3.2 Cost Variations

In a study comparing the distribution of public and private health spending in OECD nations, Anderson et al present the spending measures in a variety of manners such as per capita spend,

per capita GDP, total health spending all of which presented in converted year 2000 United States Purchasing Power Parity (PPP).[37] To demonstrate the cross-national variation in health sector share of GDP in comparison of per capita GDP, Anderson et al leverage a bivariate regression to show the distribution.[37] The study ultimately concluded that the United States spends more on health care than any other compared country; and, on most measures of health services utilization the United States is below the OECD median suggesting that the difference between spend is mostly caused by higher unit prices.[37] These methods are nearly identical to ones used later in a Commonwealth Fund study comparing health care spending, supply, utilization, prices and quality among 13 industrialized nations for 2009:[38] average spending on health per capita, and total health expenditure on health as a percent of GDP shown in US PPP. The Commonwealth Fund uses linear regression to predict per capita spending and percent of GDP spending compared to observed and concludes that U.S. spending should be approximately 11 percent of GDP, compared to the observed 17.4%.[38] An additional method of demonstrating cost and quality is shown by Viner et al for 2008 demonstrate the associations of national wealth with adolescent health outcomes across nations on a basis of the log of GDP with the log of the outcome, adjusted by the log of the population[102] as well as via a pooled, cross-sectional analysis utilizing the same data source as this study but for 2009.[103]

Prevailing thought from the 1990s suggests that medical technology and utilization of it accounts for the majority of the discrepancy in health expenditure for the US compared to peer nations,[104,105] in an updated version of these studies, Smith et al demonstrate that approximately 27-48% of health spending growth.[106] More refined approaches to the notion of rising differences in costs suggests that potentially the heterogeneity of efficacy of technology may play a role, and that a typology of the cost-effectiveness for treatments and promoting greater access for the most

cost-effective of them helps markets gain control over rising costs.[107] Unsurprisingly then as the access to these less cost-effective treatments increased so too did the dividends to those utilizing them and owning the means[108]—thereby feeding the moral hazard of markets and prompting adverse selection among carriers.[109] Pursuant to the typology of cost-effectiveness, Viner et al identified that countries with political and economic systems that produced greater income inequality had poorer health across all outcomes, and the association of the log of Gini index with the log of outcomes as well,[102] highlighting the linkage between income inequality, GDP and outcomes for all countries. As evidenced by the findings by Stuckler et al that their constructed model concludes that each additional $100 increase in social welfare spending is associated with a 1.19% drop in all-cause mortality.[110]

1.3.3 Quality Variations

According to Arah et al, a health performance framework takes a broad and social view of the determinants model, and advocates usage of the Health Care Quality Initiative (HCQI) framework which focuses on cardiac care, mental health, diabetes mellitus, patient safety, and primary care and prevention and health promotion.[111] Utilizing this structure of patient safety and prevention, a time-series country-level loess regression model for the period of 1990 to 2010 estimates preterm birth rates by a random effects model to account for heterogeneity.[112] A similar study assessed differences in disease prevalence and treatment rates for the most common conditions between the United States and ten European countries and calculated prevalence rates and differences between prevalence to conclude primarily that disease prevalence and rates of medication usage were much higher in the United States.[113] The research team was able to opine and conclude that based on differences in obesity rates between the US and Europe, it would seem that part of the difference in prevalence is attributable to poorer underlying condition.[113]

Thus, giving more credence to broader focus of measures per the HCQI categories of reporting, used elsewhere in other studies.[114]

In a dynamic study of disease prevalence within the populations of US and Europe for 2004 stratified by wealth, Avedano et al use a number of previously discussed processes, such as: adjusting wealth to annual PPP; examining outcomes of cardiac care, diabetes; and using a loess regression model.[115] The authors here again find that American (adults in this instance) are less healthy than Europeans at all wealth levels; with the poorest Americans at the greatest health disadvantage.[115]

Additional methods of assessing quality variation across borders include a ranking of infant mortality by mortality rates per 1 000 for the given year of 2005,[41] mortality rates per 1 000[39] as well as leveraging descriptive statistic tabulations for 2004 of linked data[103,116] are both validated and accepted norms for presenting quality data, as well as using multivariable logistic regression.[40] Within these respective measures, the United States yet again fairs worse than comparative nations in infant mortality;[41] the bottom quartile for life expectancy;[39] is demonstrated to show that higher expenditure is only associated with two of five health measures improving;[23] and, that the US has higher readmission rates than any other nation following a treatment for Acute Myocardial Infarction.[40]

1.3.4 Knowledge Gaps

Reducing and controlling costs of healthcare remains a high priority for every nation, however, taking the rising toll on costs (both on the individual and national level) within the context of wealth inequality and institutional trust is a novel venture. Ample models exist on comparing: costs[37,38]; quality is lacking,[39–41,103]; and performance[42–44] in healthcare between the United States

and other compared countries as a common means to discuss misalignment among nations on these goals. But I believe the pressing need is in quantifying the degree to which national markets "promote real economy activities and health and social protection"[46] over advancing increase profits and gains—the degree of societal coordination over market competition[12] by way of market coordination and those impacts on cost, quality and performance of nations as these are foreseeably relevant outcomes when promotion: income equality, laws and regulation to promote equity, political pluralism, workers' rights and protections, social welfare and social values, and education.

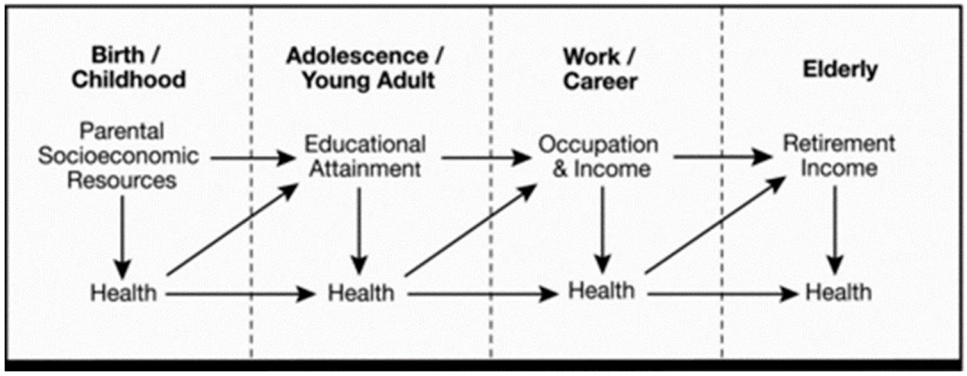
Unfortunately, within the Capitalist Coordinated Market framework the current mechanism for distinguishing CME and LME is primarily oriented around price competition. Similarly, in evaluating healthcare cost across nations, the GINI coefficient is a common measure used to assess variances in the costs of health delivery systems. But apart from utilizing GINI coefficient and market income (i.e.., total national income before debts and taxes)[102] as independent variables there is a lack of evidence and experimentation assessing whether cost increases vary in a meaningful way by adoption of Capitalist models. Notably, within these limitations of GINI and market income: the welfare benefit and social propensities are not strictly included. As a consequence, the relationship between political institutions and freedom and the impact of these factors on cost, quality and performance of the healthcare industry are not firmly established.

1.3.5 Conceptual Model

The conceptual framework feeding this research is derived from a myriad of axiomatic frameworks. As a foundational component: "knowledge of an effect depends on, and involves, the knowledge of its cause."[117] The cause and effect under this analysis are economic output and macroeconomic forces, and healthcare delivery. To this end, it was established under the

conditions of Newtonian physics, "that nature will exhibit the same effects under the same conditions"[35] and consequently, and a priori investigation of the varieties of capitalism, there must exist some differing societal propensities or attitudes towards profits. In this I find strict parallels to physics again: the existence of complementarities between healthcare delivery and economics wherein the study of two phenomenon from a cultural perspective may be nearly inseparable and preclude distinction and measurement of the two variables.[34,35,118] Case in point: over the life cycle of an individual, the domains of Socio-Economic Status (SES) continuously have a reciprocal relationship among themselves.[119]

Figure 1: Reciprocal Nature of Domains[4]



More acutely a distinguishing between the phenomenon of healthcare and economics by the distinct categories of: the allocation of real resources (human labor and other physical inputs); and the financial resources (claims expenses and GDP) for those resources can be done.[37] Within the interplay of the allocation of resources and the cost of resources is borne, the moral hazard breeds "fertile ground"[107] for growth in health expenditure. This fertile ground coexists with rising prices, demonstrated in a study of over three decades of claims data for the United States that stipulates demand for health services is inelastic and insensitive to changes in unit prices.[120] In light of the rising costs, moral hazard enters frame as the existence of a third-party payer (i.e. an insurance company) subsidizing the costs of care between the provider and the patient, thus

leading to potentially an over consumption or insufficient precautions against adverse health outcomes.[121]

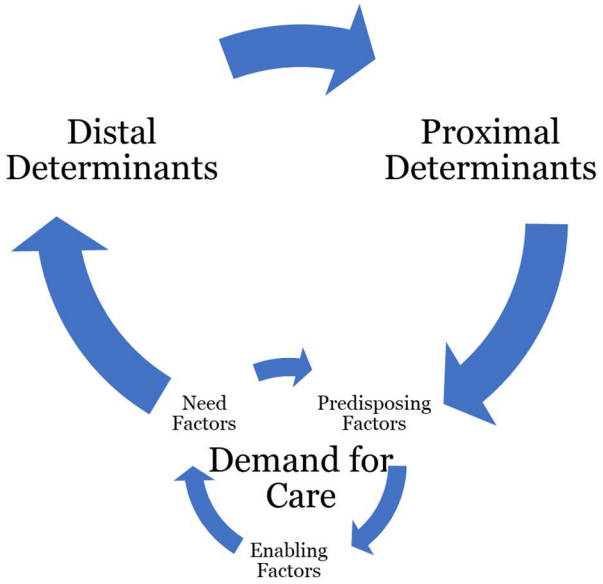
The existence of both proximate and distal health determinants[122] serve as inputs into the more complete Computable General Equilibrium (CGE) approach. Under this theory capital economies are impacted by external factors such as: technology, policy, and pandemics and the fundamental outputs of a CGE model are bucketed into: capital, skilled and unskilled labor, natural resources, and land.[16] Within the context of the CGE and the CMEs and LMEs, Shang et al concluded that the Liberal Market Economies (LME) (United Kingdom, Australia, Canada, and New Zealand) when compared to Coordinated Market Economies (CME) (Japan, Germany, and Sweden) were more responsive to the impact of the disease, concluding that an increased government authority can moderate the disease outbreaks' impacts. From a distal determinants perspective again however, the strongest determinants of health are structural factors such as national wealth, income inequality and access to education[102] which impact the outputs and outcomes of a system.[123]

A further axiom established from the proximal determinants of health affirms that a UHC initiative tethered to a single-payer framework would provide for reduced hospital fees and clinical savings of approximately $100 billion (about $310 per person in the US) annually.[124] A similar study places the figure at over $450 billion (about $1,400 per person in the US) annually in a Medicare for all framework in savings relative to the current paradigm.[125]

The final piece to the model borrows from The Andersen Behavioral Model of Health incorporates multivariate contextual determinants of health into three major components: the predisposing factors of demography; enabling factors of financing and organization to enable service utilization; and the individual need, be it perceived, or evaluation based.[126]

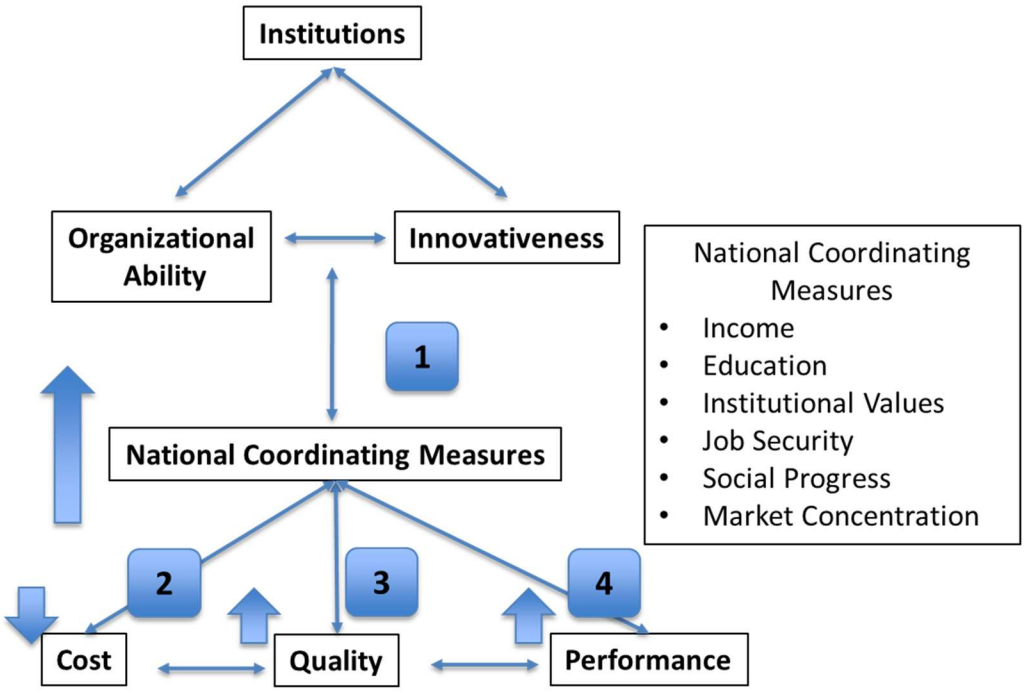
Visually the ordained need for care fits together as follows:[122,126–128]

Figure 2: Conceptual Framework of Need



When finally the overlay of reciprocal relationships ofdomains[119] and with the demand and determinants of care[122,126–128] is made, I find the potential for enabling traits within economic equality,[54,129] education,[12,92,130] political institutions,[12,70,85,92,128,130–132] market concentration,[57,64,85,132] and employment stability[12,13,70,90,133,134] and related indices of the[135] Overall Index of Economic Freedom[136]; Overall Freedom in the World Score[137]; Labor Market Institutions Index;[135] Strictness of Employment Protection;[138] Social Progress Index;[139] and World Integrated Trade Solutions Market Concentration[140] may be influencing variables to the demand and determinant models. Here I come to the conceptual framework of this work which seeks to provide a quantitative evaluation method for political dogmas, international norms, humanitarian values, and intra-corporation and government coordination as the core imperative traits of a functioning economy and government and those impacts on cost, quality and performance of healthcare.

Figure 3: Conceptual Framework in Question



The social and economic utility is herein maximized when health needs are satisfied. Under the Grossman model, the existence of good health is an integral component to generating income and production[141] and understood by the simple notion that a healthy economy requires a healthy workforce. Good health is thus essential to the wellbeing of society.[83] Conceptually, it is further understood that the direct costs associated with the provisioning of care to a sicker and unhealthier population exceed those of a healthier population[142] and that the burden of unhealthy status is predominantly spread over the disadvantaged, thus making those groups even more costly to the sum of over $300 billion (about $920 per person in the US) over a 10-year period.[143]

The confluence of these premises thus beg the question as to why then does a universal solution not exist within the United States, "for each thing there must be assigned a cause, or reason, both for its existence and for its nonexistence."[117] The reason for those varied societal propensities are

beliefs about the causes of inequality, considerations of fairness, religious beliefs, hope for reciprocity, and altruism have been suggested as driving forces behind the formation of attitudes toward redistribution of wealth.[144–146]

Something more dynamic is needed that speaks to the economic motivations of an enterprise and the way in which a country does business. This dynamism is something like resource-based theory where competitive advantage and subsequent market dominance drive a firm's behavior.[147] Adoption of a resource-based theory and framework compels decision-makers to scope solutions in terms of strictly the vital components and conditions for success,[148] thereby removing superfluous drivers such as profit, market dominance and competitive advantage. Implementation of resource-based theory and the view further promulgates fostering dynamic capabilities or "organizational and strategic routines by which firms achieve new resource configurations as markets emerge, collide, split, evolve, and die"[149] are intrinsically linked itself towards a dynamic reconfiguration and deployment of resources to improving practice and efficiency.[150,151]

The adjoining of Andersen[126], Grossman[141] resource-based theory of allocations[148] may seem frivolous based on overly inclusive of theory; however, these frameworks align and fit as well with the Donabedian Quality Framework: structure, process, and outcomes.[152] The structures in this instance being the SES domains, and how the system allocates and expenses resources. Process synonymous with the coordination between government and enterprise; and lastly, outcomes on the individual and system performance metrics.

Chapter 2: Expanding the Definition of Market Coordination and Developing a Coordination Index for Measurement

2.1 Introduction

Not all capitalist economies behave the same way in adjudicating and administering healthcare benefits and operations. Two poles exist that define the extent to which that national economy engages in coordination or liberal competition,[12] which shape the demand and supply curves of the market response to the healthcare needs of a nation. The 38 member nations of the Organization for Economic Cooperation and Development (OECD) represent a quorum of democratic governments with market-based economies dedicated to collaborating on policy standards that promote sustainable economic growth in the world.[15] Importantly, these 38 OECD nations also represent different prioritizations of pursuits of wealth. This is evidenced by the realities of COVID-19, where those nations in Coordinated Market Economies (CME) fared better in both economic (national GDP and labor productivity measures) and health outcomes from COVID-19 (case positivity rates and deaths) than Liberal Market Economies (LMEs).[16,17] Ultimately, the operations of a national healthcare delivery system, as well as the endemic social determinants of a population both coexist within the framework of capitalism.[12–14]

One of the key distinguishing traits of the CME nations like Germany, Japan, Sweden, and the Netherlands to name some[12], apart from market interactions is the degree to which protection is provided to the individual via social policy and normative values[12] as compared to LME nations (like for example the United States, Australia and Great Britain).[12] Thus social welfare systems and ideology are more prevalent in CMEs than LMEs.[12] Creation and delivery of social protections as a means to suture the bifurcated labor, social and welfare markets requires internal systems and orders to enable their viability and authority. These protections are provided vis-a-

vis: education, technology and innovation, military strength, trade, economic output, and the like.[18] Creation of this order does not form in a vacuum of the invisible hand, but rather the harmonized growth of capital stock: the things in which people, businesses, and governments invest in over time. On the contrary, in LMEs, firms coordinate via hierarchies, competitive markets and market incentives.[12]

Ample models exist on comparing: costs[37,38]; quality,[39–41,103] and performance[42–44] in healthcare between the United States and other countries as a common means to discuss misalignment among nations on these goals. But I believe the pressing need is in quantifying the degree to which national markets "promote real economy activities and health and social protection"[46] over advancing increase profits and gains—the degree of societal coordination over market competition[12] by way of market coordination and those impacts on cost, quality and performance of nations as these are foreseeably relevant outcomes when promotion: income equality, laws and regulation to promote equity, political pluralism, workers' rights and protections, social welfare and social values, and education. [12] Similar views on this anomalous interaction between society, government, regulation and rights exist and are manifest in implicit social contracts or network hierarchies.[153] It is important to further note that the levels of coordination themselves are not binary but more akin to a spectrum and not a mutually exclusive balance of forces of competition, networking and government/governance.[154] For my purposes I leverage the Coordinated Market framework which looks at the coordination of government and industry as a foci for those intrinsic protections and social values.[12,153,154]

Unfortunately, within the Capitalist Coordinated Market framework the current mechanism for distinguishing CME and LME is primarily oriented around price competition and income inequality[12] as opposed to more value and behaviorally oriented traits. For visibility into the

dynamics of CME and LME, the United States, along with the United Kingdom, Australia and Canada are commonly classified as LMEs, whereas Austria, Denmark, Sweden, Germany and Japan (to name a few) are commonly regarded as CMEs.[12] This Coordinated Market framework is broadly applicable across fields, not solely healthcare, which will be a focal point. But still the narrowness of the Coordinated Market framework faces the same problems in this healthcare arena as others. This problem is demonstrated by existing studies evaluating healthcare cost across nations only using the GINI coefficient is a common measure used to assess variances in the costs of health delivery.[42,102] But apart from utilizing GINI coefficient and market income (i.e., total national income before debts and taxes)[102] as independent variables there is a lack of evidence and experimentation assessing whether cost increases vary in a meaningful way by adoption of Capitalist models. Notably, within these limitations of GINI and market income: the welfare benefit and social propensities are not strictly included. As a consequence, the between political institutions and freedom —a crucial element to the manner in which social protections are provided[12–14], and for which the impact of these factors on cost and performance of the healthcare industry are not firmly established.

The objective of this paper is to create a new composite coordination index.[12] that can be used to distinguish levels of multifaceted coordination among OECD nations to refine what it means to be a CME as opposed to an LME within a healthcare market. Those nations with higher levels of coordination from the Coordination Index, most lend themselves towards classification as true CMEs, while those with low levels of Coordination align towards the profit-seeking ideology of the LMEs. . The central hypothesis is that since LME nations are primarily driven by market competition in all markets there will be significant positive variation and yearly growth in

expenditure, and significant negative variation in quality and performance measures over time due to those pursuits within the healthcare market.[12,64,71,102,123,155,156]

To do this, I will provide a quantitative evaluation method for political dogmas, international norms, humanitarian values, and intra-corporation and government coordination as the core imperative traits of a functioning economy and government. Thusly, a new view of Coordination, distinct from GINI and price competition alone is integral across exigent economic traits like: economic equality,[54,129] education,[12,92,130] political institutions,[12,70,85,92,128,130–132] market concentration,[57,64,85,132] and employment stability[12,13,70,90,133,134] and related indices of the[135] Overall Index of Economic Freedom[136]; Overall Freedom in the World Score[137]; Labor Market Institutions Index;[135] Strictness of Employment Protection;[138] Social Progress Index;[139] and World Integrated Trade Solutions Market Concentration[140]. While healthcare and an economy can function irrespective to the values of economic equality,[54,129] education,[12,92,130] political institutions,[12,70,85,92,128,130–132] market concentration,[57,64,85,132] and employment stability[12,13,70,90,133,134] and political plurality and social progress[139], these same values are fundamental towards creating a stable economy, equity, and material within the field of healthcare.

2.2 Conceptual Framework

Prior analyses[135,157] defined coordination from the perspective of training, education, governance and inter-firm relations and employment relations[158] in terms of industry and economy—agnostic to the existence of UHC or the degree of market competition. A new composite variable is needed, composed of multiple datasets and measures, all of which are on a spectrum of mostly unobservable traits along the continuum of economic, political, normative beliefs and values, and institutional scores.[159] To answer the need of a multidimensional measure I need the core

components that comprise the notion of market coordination and the intrinsic values it represents. The core components of coordination must include:

- Income inequality must be a component within Coordination for a multitude of reasons stemming from the likelihood that higher-income countries can spend more on healthcare,[38,160] the principle notion that rising income levels generate growth in health care costs,[106] and income inequality is one of the strongest determinants of health.[102]
    - Income inequality measures by way of the GINI coefficient[42,102,135] serve as a standard mechanism for describing income and inequality of income.
- Mechanisms to navigate social and business contracts, inter and intra-firm relationships and the laws of doing so are integral to a thriving market: "its absence [the rule of law] is a harbinger of societal collapse. Yet the difference between a society where laws are generally followed and enforced and one where bribery, corruption, and violence are prevalent has much less to do with the laws on the books […] and is much more likely to come down to whether people trust that the laws are being fully enforced fairly."[19] Laws and contracts serve a myriad of ends: laws govern the economy to promote free, liberal and neoliberal markets, which concentrate state power,[19]wealth, and influence. Laws also are constructed dictate coverage options for specific groups and diseases.[161]
    - These values and their import for usage are captured through an assessment of the laws, regulation and infrastructure supporting government and financial institutions in a variety of conceptual frameworks[30,65,192]
    - by way of the Index of Economic Freedom This index is viewed as both a standard-bearer on the topic of economic freedom and multinational assessments, and a recognized and validated dataset.[163]

- The importance of political freedoms cannot be overstated, the first minimal condition of a democracy requires that citizens have their rights to free and fair elections, and preservation of rights:[85,131] "Its [Government] major function […] to preserve law and order."[164] As a corollary to this importance and relevance between politics and health, we have seen the degradation between these two theaters and the direct impact on health via the reversal of the Dobbs Decision at the Supreme Court level.
    - The import of political pluralism and individual freedoms is done by way of the Freedom in the World.[12,70,85,92,128,130–132,137] Freedom in the World represents a heavily leveraged dataset in international comparative politics, but does present some problems with its equal weighting of measures and ambiguous answering which may lead to problems with independence.[165] But despite this shortcoming affords a benefit in its assessment of civil liberties which the other main political datasets do not.[165] These civil liberties are critical to the view of coordination.
- Protections and securities provided by employment and labor groups is a critical component to understanding not just varieties of capitalism and coordination,[12] but also ways in which the burden of upskilling for paradigm shifts within industry and economies can be jointly resolved by government, industry and civilians.[12] To a finer point however, social protections and securities provide remedial efforts to mitigate job-lock and staying in positions because of the health insurance they provide,[134] and the risks of being unemployed or under-employed: minorities, unemployed, young, old and sick "are ill cared for by our institutions and our practices [within the United States]".[34] As a consequence, some of the most effective interventions towards improving health and

stability of individuals are structural changes which improve access to education and employment,[102] as was the attempt under the United Kingdom's Sure Start program.[166]

- I ascribe the pursuits of coordination by workers to social welfare and education programs through the measure of the overarching power and influence of labor groups and unions[12,13,16,17,37,167] within national boundaries with industry and government by way of the Labor Market Institutions Index.[167]
- Mass employee dismissals are an additional measure on the employment front. The Strictness of Employment Protection Index tracks legislation, regulations, and collective bargaining agreements[138] that distinguishes the protections of that labor force[12,13,16,17,37,167] from mass reductions in force and is used regularly in the social sciences and employment analyses.[168,169]

- As mentioned in the preceding bullet, the basic structural changes often provide the largest scale improvements in health.[102] In modern economics, I see almost an adoption of the Maslow hierarchy of needs[53] on a societal scale wherein under Kuznets' theory: income inequality will decrease once a certain level of economic production is produced.[54] According to the Kuznets' Curve hypothesis, as economies develop inequality increases as a result of the market forces; however, once the economy reaches the precipice of maximal utility—inequality will decrease[54] and the ability to satisfy the hierarchy of needs will reach all, as well as providing the capability to meet new unforeseen needs.
    - A measure attesting to the basic, fundamental and foundational components of need: nutrition, basic medical care, water and sanitation, shelter, personal safety, access to basic knowledge, access to information and communication,

environmental quality, and opportunity[11–14,20,21,26,46,66,69,92,110,126] by way of the Social Progress Index[139] is included within the coordination index. While Social Progress Index does use equal weighting, it is still an accepted and useful tool when the ends of the index are not the goal itself, but informative.[170]

- Game Theory's Prisoner Dilemma, demonstrated by Axelrod in the 1980s suggests that ongoing cooperation among very few players, as opposed to many is the optimum strategy for firms.[61] Under these beliefs the market rewards smaller firms' cooperation, and yet rises in the number of mergers and acquisitions (M&A) in markets rise. And, while not all M&As are always a problem, research does suggest that there is no clear gain in efficiency of resources and assets.[62–64] Firms make money because of market power, and mergers cause higher prices as demonstrated that the average markups in 1980 were 18% above a firm's marginal cost, and in 2017 that number was found to be 67% above a firm's marginal cost.[65] Since the 1990s, over 75% of US industries have experienced market concentration.[64]
    - Because of these facts, coordination must examine a specific measure of the market concentration within an economy[57,59,64,85,132] for which I use the Herfindahl-Hirschman Index (HHI) of market concentration.[140]
- Lastly, access to education is important, however ensuring quality of that education is critical as it aligns across the spectrum of economic coordination[12,92,130,157,167] and structural determinants of health.[102]
    - As such, I include a comprehensive quality assessment of school performance.[171] While PISA is one of few large scale international comparative datasets for educational policy and regularly used for such purposes,[172] it does present some

notable limitations in not taking certain considerations into account, namely: pedagogical practices, and cultural, social, economic and political contexts.[173] However, the index leverages many of these dimensions and thus the combination provides a cogent assessment of how an educational system supports and educates students to meet future demands. Likewise, profound policy or criticisms about such educational systems are not made within this body of work, and so the directional validity of the preparedness of a student body remains valid and relevant and PISA provides usefulness in the comparative assessment.

- Additional considerations such as defense spending were assessed for relevance. However, literature did not explicitly associate this data point with relevance to the conceptual framework put forward; and likewise, the degree of defense spending by nation varies markedly—with some nations in the sample spending well under 1% of GDP on the capability[174] which could dramatically skew the sample. Similarly, the inclusion of infrastructure spend as another measure was considered but not included as it was felt to be implicit in other measures, notably within the Social Progress Index and the needs for infrastructure in the labor market dimensions.

The standard of practice for creating new composite variables from continuous data with the same measurements can be made using simple arithmetic means; however, the chosen indices are from different measurements and scales and require a different approach. The preferred methodology is to first ensure and/or transform each index into a normal distribution either visually through a scatter plot or analytically with skewness or a Pearson's correlation, and then convert the measure to standardized z scores after which the measures can be summed up into the new composite variable.[175,176] Cronbach's alpha with an original parameter for acceptability

is a target alpha value of at least between 0.65 and 0.70 as per standard practice.[177–180] Values below this threshold will require the measures be investigated for their Pearson correlations and may necessitate adjustment of the model.

The objective of this paper is to develop $Coor$ as the new composite variable of GINI coefficient, Economic Freedom, World Score Freedom, Strictness of Employment Protection, and World Integrated Trade Solutions Market Concentration, Labor Market Institutions Index, and education. At which in ensuing chapters, Coor can be used to assess the relationship between market coordination and healthcare costs, quality and performance.

I have identified that other validated indices do exist which attenuate some of the qualities I aim to highlight, however they are incomplete for a variety of reasons. Below is a depiction of some of the issues for the identified sets, and recognize that there may be additional datasets out there as well. This is meant to be illustrative and not a complete review of all available sources.

Table 1: Analysis of Alternative Datasets

Index	Sample Size	Years	Components	Weakness
Social Vulnerability Index (SVI)[181]	205 US counties[182]	2011 to date	• Socioeconomic Status • Demographics • Minority Status • Housing type	• Non-standardized measurements and domains[183]
World Inequality Database[184]	216 Countries	1800 - date	• Economic measures • Exchange Rates	• Variations in measure definitions across borders[185] • Reliance on tax records[185]
Global Economic Diversification Index (EDI)[186]	112 Countries	2000 - date	• Revenue • Economic output • Trade	• Simplification of sectors and collapsing of economic sectors
Human Development Index[187]	193 Countries	1990 - date	• Life expectancy • Expected years of school • Mean years of school	• Simplification and collapsing of key dimensions[188] • Limited use of other components

			• Per capita Gross National Income (GNI)	like politics and environment[188]
Nordhaus and Tobin[189]	117 Countries	1929 – 1965	• Economic measures and Leisure Time[190]	• Simplification of market dynamics[191] • Excludes additional factors, i.e. environmental considerations • Lacks information on non-market acts like work, child rearing, and other welfare acts[189]
Osberg and Sharpe's Index of Economic Wellbeing (IEWB)[192]	United States, Canada, United Kingdom, Australia, Norway, Sweden	1981 - 2008	• Income distribution, capital flows, income inequality and economic security[193]	• Limited sample size • Reliance on economic indicators
Environmental Sustainability Index (ESI)[194]	146 Countries	1999 – 2005	• Environmental policy and human vulnerability to environmental change	• Limited scope of indicators • Limited inclusion of economic factors
Environmental Performance Index (EPI)[195]	180 Countries	2002 – date	• Framework of indicators across climate change, environmental health, and ecosystem	• Limited scope of indicators • Limited inclusion of economic factors
Index Sustainable Economic Welfare (ISEW)[196]	United States, United Kingdom, Germany, Netherlands, Austria, Canada, Sweden, Chile, Finland, Poland, Belgium, China	1945 - 2010	• Framework of defense and non-defense spending to capture personal consumption	• Non-standard zed measurement across sample nations over different reporting periods
Genuine Progress Indicator (GPI)[197]	20 Countries	1950 – date	• Framework of economic, social benefits and dimensions, environmental factors and leisure time	• Simplification of market dynamics and non-standardized definitions[198]
Wellbeing, Inclusion, and Sustainability WISE[199]	218 Countries	1995 - 2015	• Physical and mental wellbeing, education, income and wealth distribution, and sustainability across generations and the environment	• Subjectivity of some measures of wellbeing and cultural context[200]

2.3 Methods

Based on my conceptual framework, to create the Coor, I collected data from the following perspectives for all nations of the OECD. Data was subsequently downloaded, collated in Microsoft Excel Office 365 and then loaded into Stata 17.0

2.4.1 Measure

The measures used to create the Coordination index included…Overall Index of Economic Freedom[136] (an average of all measures); Overall Freedom in the World Score[137] (sum of Political Rights and Civil Liberties measures); Labor Market Institutions Index;[135] Strictness of Employment Protection;[138] Social Progress Index;[139] and World Integrated Trade Solutions Market Concentration.[140]

2.4.2.1 Missing Values

The dataset has missing values and the potential reasons for why need to be identified, and whether it is a result of randomness or associated with some other nonignorable factor(s),[201] these factors are as categorized as Missing at Random (MAR), Missing Completely at Random (MCAR), or Missing Not at Random (MNAR).[202] The supposition at this time surrounding the missing data is the confluence of new entrants into the OECD, periodicity of collection varying across measures, and changes in measure constructs. Focusing at this time on the variables that are relevant to the Coordination Index, the following datasets have missing values that are relevant:

Table 2: Table of Missing Values and Descriptive Statistics Across Indices

	Observations	Mean	Std. deviation	Min	Max
Economic Freedom Index	407	71.311	6.268	53.200	84.200
Freedom House Index	407	92.111	9.180	32.000	100.000
GINI Definition pre-2012	156	0.311	0.053	0.236	0.510
GINI Definition post-2012	346	0.314	0.055	0.220	0.494
Social Progress Index	296	82.315	5.502	64.770	89.960
PISA Math	147	490.701	30.311	400.000	554.000
PISA Reading	146	491.096	24.510	420.000	539.000
PISA Science	147	494.667	28.575	415.000	554.000
Strictness of Employment Protections	386	2.312	0.588	0.488	3.560
HHI	407	0.102	0.104	0.032	0.559
Labor Relations Index	134	5.761	3.949	0.000	11.000

The process for dealing with those missing values is to establish the typology of missing values through the Little's Test,[203–205] utilizing logistic regression within the dataset[203] to determine whether the missing data type is MNAR or MAR, and using unconditional mean imputation[206]methods as the variables represent continuous variables but with non-infinite ranges.[203,207,208] Full findings of the typology work can be found in Appendix I.

Table 3: Missing Data Type by Variable for Mean Imputation

	Missing Data Type
GINI pre-2012 Definition	MAR
GINI post-2012 Definition	MAR
Social Progress Index	MAR
PISA Reading	MCAR
Strictness of Employment Protections	MAR
Labor Relations Index	MNAR
Percent of Population Tobacco Users	MNAR
Debt-to-GDP Ratio	MNAR
Percent of Population Insured	MNAR

Classification for the variables are as follows. For the GINI index, and while some sources use GINI as an ordinal variable[209] due its ability to classify, I will use GINI as ratio data because the range of the data from 0 to 1 has precise intervals. Because of the interrelationships of the GINI data to the complete data of HHI, and Freedom House and Economic Freedom, a flexible model to control for random and fixed effects is preferable, a Generalized Linear Model (GLM)

imputation method is viable. Social Progress Index, while again can be used as ordinal data for groupings based on the definition of the data and range of scores from 0 to 100[210], will be used as interval data and use the linear regression model. PISA test scores follow a similar analysis where there is no true 0 and the scores themselves do not have substantive meaning in isolation, but rather in comparison[211], additionally since it is observed data, employ Predictive Mean Matching Imputation models for PISA, and a linear model for the Strictness of Employment Index.

2.4.2.2 Justification for Index of Economic Freedom

Justification for using the Index of Economic Freedom stems from the need to overlay values that convey the import, authority, plurality and scope of the laws, regulations and infrastructures required to run a functioning government and financial institutions.[12,70,85,92,128,130–132,162] Specifically seeking to evaluate on the economic policies of a country and the impact therein that inhibiting economic growth and development supports. For which similar datasets do exist; but are limited in scope as they focus on free and fair elections and political pluralism.[212] Conversely, the Index of Economic Freedom presents an overall Score of, Property Rights, Government Integrity, Judicial Effectiveness, Tax Burden, Government Spending, Fiscal Health, Business Freedom, Labor Freedom, Monetary Freedom, Trade Freedom, Investment Freedom, Financial Freedom on a 0 to 100 scale—the higher the return on that scale the higher the implied level of Freedom is achieved. The Index of Economic Freedom does contain similar measures as other sets,[212] but goes further in describing the behavioral and normative values beyond free and fair elections. This data comes from the Heritage organization and is primarily focused on associated tax burdens related to each indicator within the measure.

Looking at the Index of Economic Freedom[136] positive tails for Government Spending and Judicial Effectiveness exist which makes sense as I would not hypothesize negative values for either of these given the sample as well as the metric. On a final note, the Fiscal Health and Judicial Effectiveness measures only started being collected in 2017. Accordingly, the Overall Score values, for which all years are captured and standardized by their construct is used as the measure of Economic Freedom Index. I assess for normality and, shown below in the Normality Test, and ascertain that we reject the null that the data is normally distributed per a Chi-squared p-value of 0.0189, below a 0.05 significance.

Table 4: Normality Test for Index of Economic Freedom

Skewness and kurtosis tests for normality

Variable	Obs	Pr(skewness)	Pr(kurtosis)	Adj chi2(2)	P-value
Business Freedom	407	0.063	0.000	25.770	0.000
Financial Freedom	407	0.004	0.000	18.500	0.000
Fiscal Health	74	0.000	0.071	14.410	0.001
Government Integrity	407	0.033	0.000	101.310	0.000
Government Spending	407	0.764	0.025	5.140	0.077
Investment Freedom	407	0.003	0.089	10.570	0.005
Judicial Effectiveness	74	0.190	0.366	2.630	0.269
Labor Freedom	407	0.005	0.000	21.460	0.000
Monetary Freedom	407	0.165	0.488	2.410	0.299
Overall Score	407	0.131	0.014	7.940	0.019
Property Rights	407	0.000	0.000	86.340	0.000
Tax Burden	407	0.005	0.007	13.320	0.001
Trade Freedom	407	0.000	0.000	190.060	0.000

Notes: N = 37 total nations, across 11 years of observations for 407 observations. The Fiscal Health and Judicial Effectiveness were new measures introduced in 2017 reporting year. Source: Index of Economic Freedom,[136] 2008-2018.

Using a Box-Cox transformation and identifying a Theta of 1.78, to the data are transformed and produce a few demonstrations of near-normality.

Table 5: Skewness and Kurtosis Index of Economic Freedom

Skewness and kurtosis tests for normality

Variable	Obs	Pr(skewness)	Pr(kurtosis)	Adj chi2(2)	Prob>chi2
Economic Freedom	407	0.061	0.034	7.660	0.021

Shapiro-Wilk Test for Normality

Variable	Obs	W	V	Z	Prob>z
Economic Freedom	407	0.987	3.639	3.076	0.001

Notes: Uses Transformed Economic Freedom Overall Score values. N = 37 total nations, across 11 years of observations for 407 observations. The Fiscal Health and Judicial Effectiveness were new measures introduced in 2017 reporting year. Source: Index of Economic Freedom,[136] 2008-2018.

The W score in the Shapiro-Wilk test gives needed comfort in determining normality for the data. At this time I generate a z-score distribution to make it ready to include into the composite variable.[175,176]

2.4.2.3 Justification for Freedom House Index

The literature review findings requires measures attesting to the value of individual freedoms[12,70,85,92,128,130–132,137] and values of political and civil liberties, beyond just experiencing free and fair elections.[212] For these values I incorporate the Freedom House Index which provides line by line results of Global Freedom, Electoral Process, Political Pluralism and Participation, Functioning of Government, Freedom of Expression and Belief, Associational and Organizational Rights, Rule of Law, Personal Autonomy, and Individual Rights. This data is from a nonprofit US based firm Freedom House consulting on political freedom, on a 0 to 100 scale—the higher the return on that scale the higher the implied level of Freedom is achieved. The scores are created through detailed analysis, review, and discussion by panel experts and think tanks.

Firstly to ascertain whether the dataset is normally distributed[175,176] it is affirmed that looking at the Freedom House Freedom in the World Data[137] we reject the null that the data is normally distributed per a Chi-squared p-value of 0.0000, below a 0.05 significance.

Table 6: Normality Test for Freedom in the World Index

Skewness and kurtosis tests for normality

Variable	Obs	Pr(skewness)	Pr(kurtosis)	Adj chi2(2)	Prob>chi2
Total Freedom House	407	0.000	0.000	192.010	0.000
Aggregate Political Pluralism	407	0.000	0.000	214.620	0.000

Aggregate Functioning Government	407	0.000	0.000	93.930	0.000
Aggregate Civil Liberties	407	0.000	0.000	180.320	0.000
Aggregate Freedom Expression	407	0.000	0.000	206.950	0.000
Aggregate Associational Organizational Rights	407	0.000	0.000	246.290	0.000
Aggregate Rule Law	407	0.000	0.000	126.070	0.000
Aggregate Personal Autonomy	407	0.000	0.000	92.210	0.000
Aggregate Political Rights	407	0.000	0.000	198.890	0.000
Aggregate Electoral Process	407	0.000	0.000	262.890	0.000

Notes: N = 37 total nations, across 11 years of observations for 407 observations. Source: Index of Freedom in the World Data[137] 2008-2018.

Using a Box-Cox transformation a Theta of 8.47 is identified, and the Total score of Freedom House is transformed. Similarly, a natural log transformation was run, and square root conversions to attempt to normalize the data. The most normal distribution appears to be the original data.

Table 7: Skewness and Kurtosis for Transformed Freedom in the World Index

Skewness and kurtosis tests for normality

Variable	Obs	Pr(skewness)	Pr(kurtosis)	Adj chi2(2)	Prob>chi2
Freedom House	407	0.000	0.000	192.01	0.000

Shapiro-Wilk Test for Normality

Variable	Obs	W	V	Z	Prob>z
Freedom House	407	0.701	83.722	10.544	0.000

Notes: Uses Original values for Overall Freedom House score. N = 37 total nations, across 11 years of observations for 407 observations. Source: Index of Freedom in the World Data[137] 2008-2018.

Upon acceptance of the distribution of values, shown below, all variables were converted to standardized *z* scores to then be summed up into the new composite variable.[175,176]

2.4.2.4 Justification for GINI Inequality Measure

Income inequality by means of the GINI Index is a standardized approach often utilized to depict income distribution across groups, and commonly used in health services research in the context of social determinants.[42,102,135] GINI Inequality is based on the comparison of cumulative proportions of the population against cumulative proportions of income they receive, and it ranges between 0 in the case of perfect equality and 1 in the case of perfect inequality.[213] Within

the data utilized, the methodological construct changed between 2011 and 2012, as such two separate definitions were obtained, both with missing values.

2.4.2.4.1 Missing Values for GINI Inequality Measure

While some sources use GINI as an ordinal variable[209] due its ability to classify, here it will used as ratio data because the range of the data from 0 to 1 has precise intervals. Detailed analysis of the imputation methods can be found in Appendix II.

The final results of the imputation effort are shown below compared to the original distribution.

Table 8: Descriptive Comparison Between Imputed and Original GINI Indices

Descriptive Summary of z-score for GINI Indices

	Obs	Mean	Std. deviation	Min	Max
New GINI Index with Imputed Values	407	-12.485	4.170	-26.800	-3.881
GINI Index Definition Post-2012	346	0.314	0.055	0.220	0.494

Results were converted to z-scores for later use.

2.4.2.5 Justification for Social Progress Index

The model must consider the fundamental and foundational basic human needs of populations.[11–14,20,21,26,46,66,69,92,110,126] Social Progress Index is distinct in that it focuses on the quality of a life by means of a host of factors as opposed to economic measures or just life expectancy. Similar datasets exist through, notably the United Nations Human Development Index[214] but are narrowly focused on life expectancy, years of schooling and standards of living. Similarly, the United Nations' World Happiness Report provides a similar view as Human Development coupled with perceptions of government corruption, but limited back to 2015 only.[215] The Social Progress Index however is a composite of 12 measures across three Dimensions: Basic Human Needs (nutrition and basic medical care, water and sanitation, shelter, personal safety),

foundations of wellbeing (access to basic knowledge, access to information and communication, health and wellness, environmental quality), and opportunity (personal rights, personal freedom and choice, inclusiveness, access to advanced education). All indicators are then standardized for a composite index. Data sources range from UN reports, non-government reporting, and global surveys such as Gallup. Values shown as SPI score out of a total of 100 points[139] – with the higher the return on that scale the higher the implied level of Progress achieved.

2.4.2.4.1 Missing Values for Social Progress Index Measure

As discussed in the missing values section, this is a known problem to be addressed and have run a unconditional mean imputation[206]for Social Progress. Detailed analysis of imputation methods can be found in Appendix II.

The final results of the imputation effort are shown below compared to the original values.

Table 9: Descriptive Comparison Between Imputed and Original Social Progress Indices

	Obs.	Mean	Std. Dev.	Min	Max
Imputed	407	82.315	4.690	64.770	89.960
Original	296	82.315	5.502	64.770	89.960

2.4.2.6 PISA Index

OECD Programme for International Student Assessment (PISA) Scores[171] is a raw score of student performance in each of mathematics, reading and science taken every 3-years for 15-year old student abilities to use their reading, math and science knowledge to answer questions. A minimum of 150 schools are selected in each country for a minimum sample of at least 6,300 students per country. A higher score means a higher achievement on the test and a more optimal outcome. Descriptive data on the PISA scores help to depict the non-normality of the data.

Table 10: Descriptive Summary of PISA Scores

Descriptive Statistics

	Obs	Mean	Std. Dev.	Min	Max
PISA Math	147	490.701	30.311	400.000	554.000
PISA Reading	146	491.096	24.510	420.000	539.000
PISA Science	147	494.667	28.575	415.000	554.000

Notes: Uses original values for PISA Math, Reading, and Science. N = 37 total nations, across 11 years of observations taken at 3-year intervals for 147 observations. Source: OECD[171] 2008-2018.

2.4.2.6.1 Missing Values for PISA

As discussed in the missing values section, PISA has missing values for which the original PISA unconditional mean imputation[206] will be used. Detailed analysis of the imputation methods can be found in Appendix II. But after much testing and validation, the final results of the imputation effort are shown below compared to the original distribution.

Table 11: Descriptive Summary Between Mean Imputed PISA Original PISA Scores

Summary Statistics

	Obs	Mean	Std. Dev.	Min	Max
Imputed PISA Reading	407	491.096	14.647	420	539
Original PISA Reading	146	491.096	24.510	420	539
Imputed PISA Science	407	494.667	17.136	415	554
Original PISA Science	147	494.667	28.575	415	554
Imputed PISA Math	407	490.701	18.177	400	554
Original PISA Math	147	490.701	30.311	400	554

2.4.2.7 HHI

World Integrated Trade Solutions Market Concentration: data comes from the world bank. The data captured will be Hirschman Herfindahl Index (HHI), the measure of the dispersion of trade value across partners. A perfectly diversified portfolio will be 0, a highly concentrated market is 1.[140]

When assessed for normality, perfect normality is rejected as shown below for both the HHI scores.

Table 12: Skewness and Kurtosis for Original HHI

Skewness and kurtosis tests for normality

	Obs	Pr(skewness)	Pr(kurtosis)	Adj chi2(2)	Prob>chi2
HHI Concentration Index	407	0.000	0.000	227.960	0.000

Notes: N = 407 values across 37 total nations, across 11 years of observations for HHI Data. Source: World Integrated Trade Solutions Market Concentration World Bank.[140] 2008-2018.

Shapiro-Wilk Test for Normality

	Obs	W	V	Z	Prob>z
HHI Concentration Index	407	0.496	140.838	11.782	0.000

Notes: N = 407 values across 37 total nations, across 11 years of observations for HHI Data. Source: World Integrated Trade Solutions Market Concentration World Bank.[140] 2008-2018.

Using a Box-Cox transformation for HHI, a Theta of -0.69 is produced, for HHI is transformed with and retested for normality.

Table 13: Skewness and Kurtosis for Transformed HHI

Skewness and kurtosis tests for normality

	Obs	Pr(skewness)	Pr(kurtosis)	Adj chi2(2)	Prob>chi2
HHI Concentration Index	407	0.000	0.280	41.850	0.000

Notes: N = 407 values across 37 total nations, across 11 years of observations for HHI Data. Source: World Integrated Trade Solutions Market Concentration World Bank.[140] 2008-2018.

Shapiro-Wilk Test for Normality

	Obs	W	V	Z	Prob>z
HHI Concentration Index	407	0.896	29.017	8.020	0.000

Notes: N = 407 values across 37 total nations, across 11 years of observations for HHI Data. Source: World Integrated Trade Solutions Market Concentration World Bank.[140] 2008-2018.

Since the original range of HHI is perfectly diversified portfolio will be 0, a highly concentrated market is 1[140] a final transformation is needed to establish that when summed up with other indices, where a higher value is optimal, disaster is averted. For this, a simple linear transformation is done and all values of HHI are subtracted from 1 and converted to z-scores.

Upon acceptance of the distribution of values, all variables were converted to standardized *z* scores to then be summed up into the new composite variable.[175,176]

2.4.2.7 Strictness of Employment Protections

OECD indicators of employment protection legislation evaluate the regulations on the dismissal of workers on regular contracts and the hiring of workers on temporary contracts. They cover both individual and collective dismissals and are represented via the Strictness of Employment indicator. The indicators have been compiled using the Secretariat's own reading of statutory laws, collective bargaining agreements and case law as well as contributions from officials from OECD member countries and advice from country experts. The indicators have been compiled using the Secretariat's own reading of statutory laws, collective bargaining agreements and case law as well as contributions from officials from OECD member countries and advice from country experts on a 0-4 scale with 4 being representative of more protections afforded.[138] Version 3 of the data was recommended by the data administrator for use

2.4.2.7.1 Missing Values for Strictness of Employment Protections

Again using unconditional mean imputation[206] to fill in missing data, detailed analysis of imputation methods can be found in Appendix II.

The results of the imputation effort are shown below compared to the original distribution.

Table 14: Descriptive Summary of Mean Imputed and Original Strictness of Employment Indices

Descriptive Summary Imputed Strictness of Employment Indices

	Obs	Mean	Std. deviation	Min	Max
Imputed Index	407	2.312	0.573	0.488	3.560
Original Index	386	2.312	0.588	0.488	3.560

Upon acceptance of the distribution of values, all variables were converted to standardized z scores to then be summed up into the new composite variable.[175,176]

2.4.2.8 The Labor Relations Index

When establishing the Labor Relations Index on a 12-category level,[167] the previously published version contained interpolated values for all missing data. This was established after contacting the research team and getting a partial Stata code file. In further efforts to mimic the previous research team's process, it was established that the prior study data used an even different dataset from a different study.[216] However, in this version the interpolated values were dropped, and the Labor Relations Index was recreated on the 12-point scale varying from 0 (lowest) to 12 (highest). Likewise, the original dataset comes from the Institute for Advanced Labour Studies (AIAS),[217] which was then used into numerous studies by Huber et al. across a smaller subset of 22 OECD nations, however, not all data nor codebooks were shared or able to accessed. As such, the method for the Index comes from one paper,[167] and the data and codebook from elsewhere.[216] Recreating the index in its entirety to include the full range of OECD nations was not possible. However, recreating the index for that original study was feasible after much trial and error.

Broadly speaking, Huber et al. were able to construct a Coordinated Market Labor Relations Index, utilizing union density, union centralization authority and wage coordination variables as the key components of that index.[167] This same model was used utilizing a different dataset from which Huber et al. obtained their source data from.[217]

The end result was placed into a pairwise correlation below for reference against the published method.[167]

Table 15: Recreated Pairwise Correlation

	(1)	(2)	(3)	(4)
(1) Labor Relations Index	1.000			
(2) Union Concentration	0.662	1.000		
(3) Wage Coordination	0.408	0.482	1.000	
(4) Centralized Union Authority	0.690	0.862	0.570	1.000

The findings from the pairwise correlation are similar to the original interpolated findings (shown below) from the supplemental materials of the original study[167] and affirm consistency and validity of methods taken to recreate the index.

Figure 3: Pairwise Correlation from Original Study

Pairwise correlations

Variables	(1)	(2)	(3)	(4)
(1) ud	1.000			
(2) cent_int	0.586	1.000		
(3) adj_cov	0.441	0.510	1.000	
(4) wcoord	0.468	0.647	0.293	1.000

The newly recreated Labor Relations Index was then appended to the data file and coded for consistency with nations and ID numbers assigned and converted to the scaling of the original study.[167] Additionally, to preserve the ordinal nature of the Labor Relations Index,[167] I add the construct of 0.00001 to the values artificially increase the range of value for lower levels of Labor Relations Index.

2.4.2.8.1 Missing Values for Labor Relations Index

For the Labor Relations Index, since it does have 0 values, an additional step of adding a constant 0.00001 to preserve the distribution but remove the 0 values is done.[218]Detailed analysis of imputation methods can be found in Appendix II.

The final results of the imputation effort are shown below compared to the original distribution.

Table 16: Descriptive Summary of Mean Imputed Labor Relations Index and Original Labor Relations Index

	Obs.	Mean	Std. dev	Min	Max
Imputed	407	5.761	2.260	0.000	11.000

Original	134	5.761	3.949	0	11

Upon acceptance of the distribution of values, all variables were converted to standardized z scores to then be summed up into the new composite variable.[175,176]

2.5 The Composite Coor Index

The standard of practice for creating new composite variables from continuous data with the same measurements can be made using simple arithmetic means; however, the chosen indices are from different measurements and scales and require a different approach. The preferred methodology is to first ensure and/or transform each index into a normal distribution either visually through a scatter plot or analytically with skewness or a Pearson's correlation, and then convert each measure to standardized z scores after which the measures can be summed up into the new composite variable and divided by the total number of inputs[175,176]

Where, $Coor$ is the new composite variable of GINI coefficient, Economic Freedom, World Score Freedom, Strictness of Employment Protection, and World Integrated Trade Solutions Market Concentration, Labor Market Institutions Index, and education. And:

Key Measures

G_{in} = GINI coefficient (integer between 0 and 1)[135]
EF_{in} = Economic Freedom score (integer between 0 and 100)[136]
WS_{in} = Freedom in the World Score (integer between 0 and 100)[137]
LM_{in} = Labor Market Institutions Index (4 category scale of 4 (lowest) to 16 (highest)[135]
SEP_{in} = Strictness of Employment Protection[138]
SPI_{in} = Social Progress Index[139]
$WITS_{in}$ = World Integrated Trade Solutions Market Concentration[140]
$PISA_r$ = Total reading PISA score[171]
$PISA_m$ = Total math PISA score[171]
$PISA_s$ = Total science PISA score[171]

Cronbach's alpha with a value of at least between 0.65 and 0.70 as per standard practice is set as the parameter.[177–180] Values below this threshold will require the measures be investigated for their Pearson correlations and may necessitate adjustment of the model.

To this point, all data sets were transformed into their standardized *z* scores, and any abnormal distributions have been scrutinized, and it is the feeling that they represent a non-normal sample.

2.6 Results

From the descriptive statistics about the measures, they represent significantly disparate scales of reporting which would make it impossible to combine them into a single measure for evaluation.

Table 17: Summary Statistics of Original Variable Values

Descriptive Summary Statistics of Original Incorporated Indices

	Obs	Mean	Std. dev.	Min	Max
Economic Freedom	407	71.311	6.268	53.200	84.200
Freedom House	407	92.111	9.180	32.000	100.000
GINI	346	0.314	0.055	0.220	0.494
Social Progress	296	82.315	5.502	64.770	89.960
PISA Math	147	490.701	30.311	400.000	554.000
PISA Reading	146	491.096	24.510	420.000	539.000
PISA Science	147	494.667	28.575	415.000	554.000
Strictness of Employment Protections	386	2.312	0.588	0.488	3.560
HHI Concentration	407	0.102	0.104	0.032	0.559
Labor Relations	134	5.761	3.949	0.000	11.000

Notes: Uses original values for all variables and the Post-2012 GINI Index Definition. N = 37 total nations, across 11 years of observations for 407 observations. Variance from the 407 is due to missing values within data sets.

This difference in scale holds true for the newly imputed and transformed values.

Table 18: Descriptive Summary Statistics for Imputed and Transformed Variable Values

Variable	Obs	Mean	Std. dev.	Min	Max
Economic Freedom	407	15.658	1.077	12.468	17.837
Freedom House	407	92.111	9.180	32	100
GINI	407	-12.485	4.170	-26.800	-3.881
Social Progress	407	82.315	4.690	64.770	89.960
PISA Reading	407	491.096	14.647	420	539
PISA Science	407	494.667	17.136	415	554
PISA Math	407	490.701	18.177	400	554
Strictness of Employment Protections	407	2.312	0.573	0.488	3.560

HHI	407	-143.017	104.516	-479.684	-3.888
Labor Relations Index	407	5.761	2.260	0.000	11.000

Notes: Uses Transformed values for Economic Freedom, Original Freedom House, Transformed HHI, and Imputed and Transformed values GINI Index Post-2012 Definition, Social Progress, PISA Reading,/Science/Math, Strictness of Employment Protections, and Labor Relations Index. N = 37 total nations, across 11 years of observations for 407 observations. Variance from the 407 is due to missing values within data sets.

The above measures are converted to z-scores per the process proposed earlier and then the correlation between the indices themselves is checked. The Pearson Correlation is utilized and assume that a coefficient of greater than 0.7 (+/-) will represent a strong level of correlation and will investigate indices with that coefficient, or higher.[219]

Table 19: Correlation Matrix for Imputed and Transformed Variables

Correlation Matrix										
Index	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
(1) Economic Freedom	1.000									
(2) Freedom House	0.462	1.000								
(3) GINI	0.033	-0.345	1.000							
(4) Social Progress Index	0.439	0.755	-0.414	1.000						
(5) PISA Reading	0.232	0.315	-0.150	0.366	1.000					
(6) PISA Science	0.239	0.322	-0.175	0.344	0.935	1.000				
(7) PISA Math	0.208	0.318	-0.250	0.377	0.885	0.928	1.000			
(8) Strictness Employment Protections	-0.534	-0.184	-0.262	-0.151	-0.105	-0.071	0.018	1.000		
(9) HHI	0.291	0.196	-0.084	0.057	-0.003	-0.003	0.017	-0.210	1.000	
(10) Labor Relations Index	-0.185	0.083	-0.276	0.071	-0.044	-0.058	-0.004	0.0486	0.003	1.000

Notes: Uses Transformed values for Economic Freedom, Freedom House, HHI, and Imputed and Transformed values GINI Index Post-2012 Definition, Social Progress, PISA Reading/Math/Science, Strictness of Employment Protections, and Labor Relations Index.

Moving from the top of the Pearson Correlation downwards to assess areas in which values encroach upon the 0.7 (+/-) threshold, there are no significant concerns for correlation among Social Progress Index, Freedom House Index, PISA Reading, The Strictness of Employment Index—but rather more acutely within the PISA data as expected. For which Science is further omitted due to correlations. The Cronbach's alpha test was run for the new Coordination Index and with the standardized *z* scores across the summary measures. The original parameter for acceptability was a target alpha value of at least between 0.65 and 0.70 as per standard

practice.[177–180] The new Coordination Index as it stands now (including all indices), has a reliability of the average of the covariances of 0.696, meeting the target parameter with an interitem covariance of .203 which is right at the acceptability levels for composite indices.[220]

To determine whether or not the correct mix of variables are incorporated, or succumb to multicollinearity within the new index, the Variance Inflation Factor is run after running a simple regression of the component indices on a dependent variable of natural log of Total Health Expenditure.

Table 20: Variance Inflation Factor for Coordination Index

Variance Inflation Factor

Variable	VIF	1/VIF
PISA Math	5.27	0.190
PISA Reading	5.10	0.196
Social Progress Index	2.84	0.352
Freedom House Index	2.57	0.388
Strictness of Employment	2.03	0.493
Economic Freedom	1.95	0.513
GINI Index	1.53	0.654
Labor Relations Index	1.41	0.709
HHI Market Concentration	1.20	0.834
Mean	2.66	

The findings above satisfy that the model has no undue collinearity within it. The measures are then combined into the Coordination index for further analysis.

2.7 Determining Weights

To determine the appropriate weighting to give to the new Coordination Index, the variances of each index are obtained, shown in Table 21 for the non z-scored indices.

Table 21: Calculated Variances for Coordination Indices to Determine Weights

Variable	Variance
PISA Math	330.396

PISA Reading	214.544
Social Progress Index	21.994
Freedom House Index	84.281
Strictness of Employment	0.328
Economic Freedom	1.160
GINI Index	17.385
Labor Relations Index	5.109
HHI Market Concentration	10923.680

Principal Factor Analys (PCA)

To further test the model and assumptions, a Principal Factor Analysis (PCA) on the sum components of the Coordination Index as described in **Table 21** is conducted. The primary concern is with maximizing the predictive or associative power of the model. Since the model is largely theoretically based, of less concern are the relationships between the variables themselves. As such, PCA as opposed to the Factor Analysis (FA) is justified.

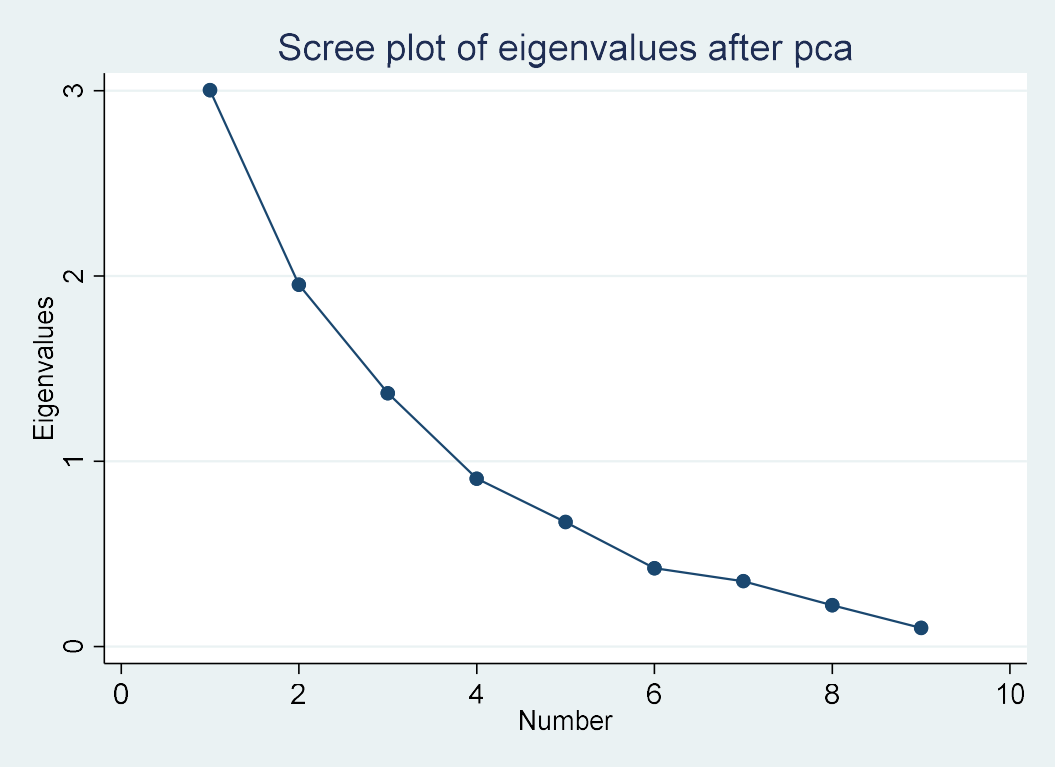
Table 22: Principal Component Analysis for Coordination Indices

	Eigenvalue	Difference	Proportion	Cumulative
Component 1	3.003	1.050	0.334	0.334
Component 2	1.953	0.586	0.217	0.551
Component 3	1.367	0.461	0.152	0.703
Component 4	0.906	0.234	0.101	0.803
Component 5	0.672	0.250	0.075	0.878
Component 6	0.422	0.069	0.047	0.925
Component 7	0.353	0.130	0.039	0.964
Component 8	0.223	0.123	0.025	0.989
Component 9	0.100	.	0.011	1.000

The general practice is to focus on Eigenvalues greater than or equal to 1.0, for which Components 1, 2, 3, and 4 which together explain approximately 80% of total variance within the index data. With the inclusion of Components 5, 6, 7, another 16% of total variance explained (a total of 96% for all 7 components) is explained. The total of all components represents 100% of the total variance within the data. A prediction is then done with the

predictive components based on the amount of variability they predict for future analysis. The inclusion of 7 components is checked visually by the plot below, the plateau at 7 with the diminish returns suggests this is the ideal number of factors.

Table 23: Plot of PCA Analysis



2.8 Sensitivity Analysis

Utilizing one-way sensitivity analysis on the newly constructed Coordination Index will allow assessment of whether its predictive power and performance is more robust than the standard use-case of GINI,[42,102,135] as well as whether the inclusion of certain datasets strengthens or weakens the model. To do so, three new models are constructed for a simple univariate regression utilizing a distinct model as defined below and the same dependent variable of Total per Capita Health Expenditure (value in thousands) on a natural log scale.[221]

Table 24: Model Specifications for Sensitivity Analysis

Model Number	Model Name	Description
Model 1	Education Only	Average of PISA Reading and Math as the only predictor
Model 2	Labor Relations Only	Labor Relations Index as the only predictor
Model 3	GINI	Model uses only the GINI index with imputed untransformed missing values and no other indices
Model 4	Base Case	Model incorporates Coordination Index without weights or PCA
Model 5	Base Case with Weights	Model incorporates weighting based on reciprocal of variances from **Table 21** multiplied by the subcomponents
Model 6	PCA	Utilizes PCA Only (Combined and averaged pc1, 3 and 4 as the only significant factors)
Model 7	PCA and Coor	Utilizes PCA and Coordination from Model 4 multiplied together
Model 8	PCA and Coor 2	Utilizes PCA and Coordination from Model 4 as a mean

The findings from the sensitivity analysis of the estimation results of the simple regressions are shown below with the addition of Adjusted R-squared and Root MSE to distinguish how well the model explains variation within the dependent variable:

Table 25: Regression of Model Outcomes and Natural Log of Total Health Expenditure

	Model 1 Education Only	**Model 2 Labor Only**	**Model 3 GINI Only**	**Model 4 Base Case**	**Model 5 Base Case with Weights**	**Model 6 PCA**	**Model 7 PCA and Coor**	**Model 8 PCA and Coor 2**
Health Expense	0.011***	0.205***	-3.917***	0.275***	0.398***	0.308***	-0.217***	0.477***
	(0.002)	(0.025)	(0.498)	(0.023)	(0.138)	(0.031)	(0.042)	(0.042)
Cons	2.604***	7.995***	9.224***	7.995***	6.687***	7.994***	8.046***	7.995***
	(0.776)	(0.025)	(0.158)	(0.023)	(0.454)	(0.024)	(0.028)	(0.023)
N	404	404	404	404	404	404	404	404
Adj. R-sq	0.105	0.145	0.131	0.263	0.018	0.192	0.061	0.244
Root MSE	0.507	0.496	0.500	0.460	0.531	0.482	0.520	0.466

Standard errors in parentheses
*** p<0.05, ** p<0.01, *** p<0.001**

Notes: Uses Log of Total Health Expenditure. N = 404 due to missing values for expenditure data.

All 8 analysis offer fairly similar results and have statistical significance at the p<0.001 level, and approximately similar Adjusted R-squared values. Based on these findings, however, ultimately it can be concluded that the combination of Standard Error (lower values being optimal), Adjusted R-squared (higher being optimal), and Root MSE values (lower being

optimal), along with a theoretical model, that the new Coordination Index (model 4) is the explains a higher amount of variance.

The sensitivity analysis in **Table *25*** is repeated but this time to omit the United States to assess the impact of the Coordination Index and check for sensitivities against the outlier properties of the United States and shown in **Table *26***. Again, all 8 analysis offer fairly similar results and have statistical significance at the p<0.001 level except for model 2 utilizing labor which is only significant at the 0.01 level. Model 4 offers the highest Adjusted R-squared value as well as one of the lowest Standard Errors and the lowest RMSE indicating again that the new Coordination Index (model 4) explains a higher amount of variance and is the most optimal model.

Table 26: Regression of Model Outcomes and Natural Log of Total Health Expenditure without the United States

	Model 1 Education Only	Model 2 Labor Only	Model 3 GINI Only	Model 4 Base Case	Model 5 Base Case with Weights	Model 6 PCA	Model 7 PCA and Coor	Model 8 PCA and Coor 2
Health Expense	0.011***	0.256**	-4.763***	0.306***	0.908***	0.333***	-0.210***	0.523***
	(0.001)	(0.012)	(0.463)	(0.021)	(0.138)	(0.029)	(0.040)	(0.038)
Cons	2.537***	7.813***	9.453***	7.957***	4.972***	7.960***	8.015***	7.959***
	(0.734)	(0.077)	(0.147)	(0.021)	(0.452)	(0.022)	(0.027)	(0.021)
N	393	393	393	393	393	393	393	393
Adj. R-sq	0.121	0.009	0.210	0.360	0.098	0.254	0.064	0.326
Root MSE	0.480	0.509	0.454	0.409	0.486	0.442	0.495	0.420

Standard errors in parentheses
*** p<0.05, ** p<0.01, *** p<0.001**

Notes: Uses Log of Total Health Expenditure. N = 404 due to missing values for expenditure data.

As a last order of thoroughness, the sensitivity analysis in **Table *25*** is repeated but this time with the addition of age groups to refine the model. Interestingly however, the PCA models in 6 and 8 seem preferable in this more complex multivariate sensitivity testing. However, since model 4 was the optimal function in the prior sensitivity analyses, and ultimately the PCA models in 6 and 8 utilize the similar findings and structure. I believe we have demonstrated that Model 4 still

validates better than competing methodologies and should be utilized in modeling for the ensuing chapters.

Table 27: Regression of Model Outcomes and Natural Log of Total Health Expenditure with Age

	Model 1 Education Only	Model 2 Labor Only	Model 3 GINI Only	Model 4 Base Case	Model 5 Base Case with Weights	Model 6 PCA	Model 7 PCA and Coor	Model 8 PCA and Coor 2
Health Expense	0.007***	-0.019	-2.343***	0.547***	0.015	0.306***	-0.143***	0.438***
	(0.002)	(0.010)	(0.511)	(0.053)	(0.128)	(0.027)	(0.039)	(0.037)
Age <15	0.083	-0.033	-0.006	0.046	-0.032	-0.145	-0.120	-0.082
	(0.430)	(0.439)	(0.430)	(0.392)	(0.441)	(0.384)	(0.434)	(0.380)
Age 15 – 24	-0.100***	-0.114***	-0.084***	-0.090***	-0.113***	-0.081***	-0.113***	-0.082***
	(0.024)	(0.025)	(0.025)	(0.022)	(0.025)	(0.022)	(0.024)	(0.380)
Age 15 – 64	0.037	-0.080	-0.053	-0.006	-0.078	-0.203	-0.171	-0.138
	(0.432)	(0.440)	(0.431)	(0.393)	(0.443)	(0.385)	(0.436)	(0.381)
Age 65 Plus	0.074	-0.038	-0.009	0.033	-0.037	-0.141	-0.132	-0.084
	(0.431)	(0.440)	(0.431)	(0.393)	(0.442)	(0.385)	(0.435)	(0.381)
Cons	0.965	16.033	13.607	8.187	15.676	27.319	25.057	20.969
	(43.227)	(44.024)	(43.097)	(39.299)	(44.279)	(38.487)	(43.549)	(38.096)
N	404	404	404	404	404	404	404	404
Adj. R-sq	0.269	0.237	0.269	0.392	0.231	0.417	0.256	0.429
Root MSE	0.458	0.468	0.458	0.418	0.470	0.409	0.462	0.405

Standard errors in parentheses
*** p<0.05, ** p<0.01, *** p<0.001**

Notes: Uses Log of Total Health Expenditure. N = 404 due to missing values for expenditure data.

Finally, to specifically identify whether the univariate and simplified multivariate sensitivity analysis falsely attributes significance to the new Coordination Index, we collapse the independent variable into quartiles based on levels of z-Coordination and run a final univariate model.

Table 28: Regression of Coordination Model and Quartiles of Coordination on Natural Log of Total Health Expenditure

	Model 4 Base Case	Quartiles of Coordination
Health Expense	0.275***	0.214***
	(0.023)	(0.021)
Cons	7.995***	7.459***
	(0.023)	(0.058)
N	404	404
Adj. R-sq	0.263	0.199

Root MSE	0.460	0.480

The last analysis in **Table *28*** depicts that at both the quartile level of Coordination and the base case of the Coordination Index as shown in **Table *20*** both are significant in univariate analysis.

2.9 Discussion

The Cronbach's alpha test was run for the new Coordination Index with the standardized *z* scores across the summary measures from Economic Freedom, Freedom in the World, and HHI and the imputed data from the Social Progress Index shown below. The original parameter for acceptability was a target alpha value of at least between 0.65 and 0.70 as per standard practice.[177–180] The new Coordination Index, encompassing the numerous other indices has a reliability of the average of the covariances of 0.696, satisfying the target parameter and is statistically reliable for usage.

Table 29: Alpha Test for New Coordination Index

Alpha test of Coor with, HHI Concentration, Social Progress, Overall Economic Freedom, and Total Freedom in the World

Item	Observations	Association	Item-test correlation	Item-rest correlation	Average interitem covariance	alpha
Economic Freedom	407	+	0.683	0.546	0.178	0.635
Freedom House	407	+	0.719	0.594	0.172	0.625
GINI Index	407	-	0.344	0.146	0.237	0.713
Social Progress	407	+	0.718	0.592	0.172	0.625
PISA Reading	407	+	0.636	0.487	0.186	0.647
PISA Math	407	+	0.626	0.474	0.188	0.650
Strictness of Employ	407	-	0.492	0.312	0.212	0.682
HHI	407	+	0.380	0.185	0.231	0.706
Labor Relations	407	-	0.265	0.061	0.251	0.728
Test scale					**.203**	**0.696**

Notes: Uses z-score and Normal values of Freedom House, Social Progress, PISA Reading and Math, Strictness of Employment Index, Labor Relations and Transformed values for Economic Freedom and HHI indices.

The Coordination Index is a composite of indices summated by z-scores of their distributions, simply inferring from these coefficients requires a bit of tact. Further, since our main research

question is concerned with degrees of coordination and the differences that provides, we can circumvent the need to ascertain "how much more coordinated" a market is as compared to our control group: the United States and can look instead of differences between Coordination as quartile rankings. Therefore, we can leave our analysis as z-Scores and infer that relative to the mean distribution that the United States, per **Table *30*: Mean z-Scores of Coordination by Year** , depending on the year is almost a full standard deviation less coordinated a market from the Sample group in terms of its levels of coordination. Visually we can affirm this in **Figure *4*** where we depict the average z-score by year for the OECD as a whole (inclusive of the United States) following the Z-score Y-Axis compared to the United States. In this display, we see that, while less Coordinated than the OECD average values, the values for the United States compared to the mean of the sample are nearly a full standard deviation below. In 2016 we start to see the convergence of the OECD Maximum with the mean, and a continued negative trend towards the mean while United States experiences a slight normalization of coordination. For context, the first Trump Administration took office in January 2017.

These findings in general do track consistently through the conceptual framework and literature review where increases in adverse traits of market consolidation, union reforms and the like are demonstrable, and they do in effect support the methodology of our work as independent by virtue of providing an expected outcome consistent with hypothesis.

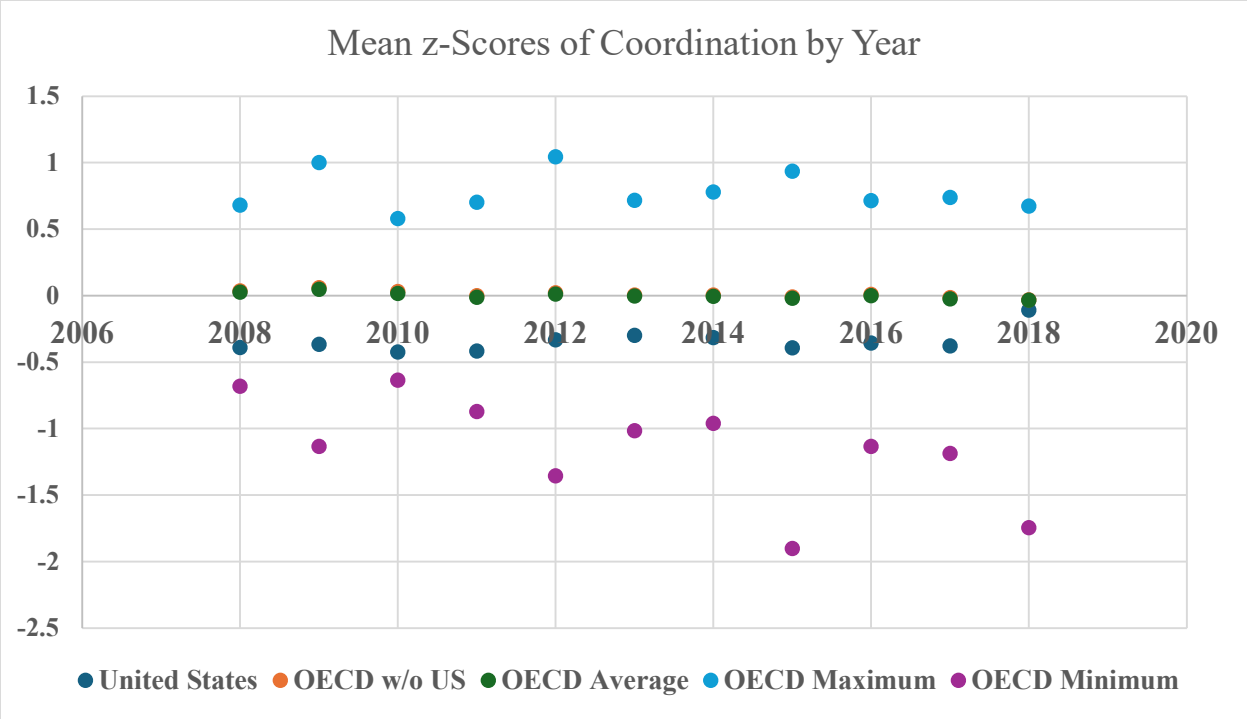
Table 30: Mean z-Scores of Coordination by Year

Mean z-Scores of Coordination by Year

Year	United States	Sample	Sample w/o US
2008	-0.391	0.025	0.036
2009	-0.366	0.047	0.059
2010	-0.425	0.018	0.030
2011	-0.417	-0.013	-0.002

2012	-0.332	0.012	0.022
2013	-0.299	-0.004	0.004
2014	-0.316	-0.005	0.004
2015	-0.392	-0.020	-0.010
2016	-0.356	-0.002	0.008
2017	-0.379	-0.024	-0.014
2018	-0.108	-0.035	-0.033
Mean	-0.344	0.010	0.000

Figure 4: Mean z-Scores of Coordination by Year



Since the definition of the quartiles will change per year depending on the changes in national scores feeding the Coordination Index, the question remains as to whether the shifting of annual definitions of quartiles itself presents a significant issue in the reshuffling of groups annually. For this in **Table *31*** we show the mean year over year for the quartiles, after which a paired t-test around those means is run and concludes that there is a non-significant p-value of 0.379 between the means, indicating that we cannot reject the null that there is a significant variation between means—or, practically, that the changes in groupings year over year does not pose a statistically significant difference.

Table 31: Mean Quartiles of z-Scores of Coordination by Year

Mean Quartiles of z-Scores of Coordination by Year

Year	Mean	Standard Deviation	Year
2008	2.432	0.987	37.000
2009	2.568	1.281	37.000
2010	2.378	0.953	37.000
2011	2.324	1.002	37.000
2012	2.622	1.277	37.000
2013	2.486	0.989	37.000
2014	2.378	1.089	37.000
2015	2.703	1.266	37.000
2016	2.486	1.121	37.000
2017	2.405	1.117	37.000
2018	2.676	1.226	37.000
Mean	**2.496**	**1.118**	**407.000**

2.10 Limitations

Unconditional mean imputation[206]poses a unique sword of Damocles/catch-22 with regard to missing data. On the one hand, it does offer up a means to resolve missing data without going through the Complete Case Analysis method and taking an already limited dataset and reducing it further. Additionally, with mean imputation it is assuaged with a fair degree of assurance that the descriptive statistical identity of the new imputed data does not significantly differ from the original data. On the other hand, mean imputations are very much a slippery slope with varying degrees of exactitude from which the analyst must derive a determination from as to whether the variance and uncertainty introduced into the model is permissible. To this trait of mean imputation, there is no finite, objective-binary-indicator ala a p-value or other finding that tells the analyst whether they have achieved their goal of precision, or if there are additional methods or models to be used—it is a subjective interpretation of uncertainty and variance and a comfortability (or an acquiescence to time and resources) that the final imputation is ideal. As such, using imputed data poses a limitation, for which I have tried my utmost to mitigate by ensuring multiple methods used, and t-tests between samples required to ensure that the best

imputation was used with the least amount of uncertainty and variance added into the model. But that presupposes that all known methods of imputation are used, for which I can resoundingly affirm that I have only scratched the surface of imputation. As such, while mean imputations present a path forward that does not have the consequences of Complete Case Analysis and reducing the sample, it requires a significant amount of time, energy, resources and patience to fine tune models and go through the brute force and trial and error process to land at a usable dataset. As a final note on imputation: imputed values are (by definition) less reliable than observed values. Lastly, I would be remiss were I not to mention the challenges in interpretations of coefficients and variables through heavy usage of z-scores, natural logs and other transformations. However, this is a minor limitation as the main research questions deal with associations and relationships and not the specific coefficients of the regression models themselves.

2.11 Conclusion

The analysis commenced with ultimate goal of establishing a new coordination index, inclusive of economic traits like: economic equality,[54,129] education,[12,92,130] political institutions,[12,70,85,92,128,130–132] market concentration,[57,64,85,132] and employment stability[12,13,70,90,133,134] and related indices[135] Overall Index of Economic Freedom[136]; Overall Freedom in the World Score[137]; Labor Market Institutions Index;[135] Strictness of Employment Protection;[138] Social Progress Index;[139] and World Integrated Trade Solutions Market Concentration[140]. Missing values were tabulated across the indices, and for those with missing values unconditional mean imputation[206]was utilized depending on the typology of missing data and the outcomes. Each of these subsequent imputed datasets were assessed for normality and dealt with accordingly. Each dataset was then converted to standardized z scores after which the

measures were correlated and assessed for multicollinearity as well, after which the ones that remained were summed up into the new composite variable and divided by the total inputs to create Coor.[175,176] Additional statistical methods were leveraged to ensure that the overall empirical methods in the construction of the index were satisfied. A weighted methodology utilizing the reciprocal of variances was done. Further a Principal Factor Analysis was conducted to identify a linear fit of each dataset. All models were then assessed with a simple univariate sensitivity analysis on the natural log of total health expenditure to determine maximum adjusted R-squared, lowest reasonable standard error, lowest Root MSE values and overall p-value significance. The new coordination index, Coor, was then tested for reliability utilizing Cronbach's alpha with an original parameter for acceptability was a target alpha value of at least between 0.65 and 0.70 as per standard practice,[177–180] and the results indicate an alpha of 0.696 which exceeds the standard for reliability.

Chapter 3: Evaluating the Relationship Between the Coordination Index and Health Expenditures in OECD Countries

3.1 Methods

Study Design

A standard linear regression model is predicated on satisfaction of basic assumptions such linearity, no autocorrelation, homoscedasticity, normality of residuals, and no multicollinearity. Linearity will be checked by plotting the residuals and looking for a random scattering around zero. As the data are not panel data, autocorrelation is less of a concern, however correlation will be checked still via a Spearman's rank; homoscedasticity via the Breusch-Pagan test; normality of residuals via the Shapiro-Wilk test; Variance Inflation Factor to demonstrate no perfect multicollinearity; and lastly a Ramsey RESET test to check for omitted variables.

$$E(Y_{TotalExpense}) = f(\beta_0 + \beta_{ih}X1_{i65} + \beta_{ih}X2_{iTob} + \beta_{ih}X3_{iOb} + \beta_{ih}X4_{iCoor} + \beta_{ih}X5_{iDebt} + \beta_{ih}X6_{iIns} + \beta_{ih}X7_{UHC} + \beta_{ih}X8_{Age} + \beta_{ih}X9_{PerceivedHealthStatus} + \beta_{ih}X10_{Educational\ Attainment} + \beta_{ih}X11_{GDPperCapita} + \beta_{ih}X12_{TotalHospitalsperMillion} + \beta_{ih}X13_{BirthsperK} + \beta_{ih}X14_{LargestPopSegment} + \beta_{ih}X15_{EmploymentRate} + \beta_{ih}X16_{VolIns} + \beta_{ih}X17_{SuppIns} + \beta_{ih}X18_{CompulsIns} + Time + U_{it})$$

Where, $Y_{TotalExpense}$ is an outcome variable of total health expenditure f is the functional form. And:

Outcome Variables

$EG_{TotalExpense}$ = Total Expense of Government funded Inpatient Services (value in thousands) [221]

Key Independent Variable

$X4_{iCoor}$ = Composite Coordination Index

Control Variables

$X1_{i65}$ = Percent of Population over age 65[221]

$X2_{iTob}$ = Tobacco Consumption (% population age 15+ who are daily smokers) [221]

$X3_{iOb}$ = Obesity (Obese population measured percentage of total population)[221]

$X5_{iDebt}$ = National Debt-to-GDP Ratio[222]

$X6_{iIns}$ = Percent of Total Population Covered by Public or Primary Voluntary Health Insurance Coverage[221]

$X7_{UHC}$ = Government/Compulsory Health Insurance Coverage[223]

$X8_{Age}$ = Age as percent of population structured in ranges[221]

$X9_{HealthStatus}$ = Perceived Health Status,[224]

$X10_{Education}$ = Educational attainment,[225]

$X11_{GDP}$ = GDP per Capita as US Dollars per person PPP converted,[226]

$X12_{TotalHospitals}$ = Total number of hospitals per 1 000 000,[227]
$X13_{BirthsperK}$ = Total births per 1 000,[228]
$X14_{LargestPopSeg}$ = Race as measured by the population density of the largest group,[229]
$X15_{EmpRate}$ = Employment rate for people 15 to 64 years[230]
$X16_{VolIns}$ = Voluntary Insurance Rate [231]
$X17_{SuppIns}$ = Supplemental Insurance Rate[231]
$X18_{CompulsIns}$ = Compulsory Insurance Rate[231]
Time = Year
U_{it} = Error term

To finally determine the efficacy of the models a P-value less than or equal to 0.05 for the individual measures within the model, as well as the overall model itself. Further, because the nature of the hypothesis and methods are oriented towards a social sciences inquiry, the R-squared threshold becomes less of a concern as well should the parts of the model themselves be significant.[232]

3.1.1 Data

Recent releases of secondary, publicly available data were collected from: Inpatient, Outpatient, Preventative and Pharmaceutical Spending,[221] Percent of Population over age 65,[221] Tobacco Consumption (% population age 15+ who are daily smokers), [221] Obesity (Obese population measured percentage of total population),[221] National Debt-to-GDP Ratio,[222] Percent of Total Population Covered by Public or Primary Voluntary Health Insurance Coverage,[221] and Government/Compulsory Health Insurance Coverage.[223] Data was subsequently downloaded, collated in Microsoft Excel Office 365 and then loaded into Stata 17.0.

3.1.2 Measures

As indicated in the preceding section, the control variables consisting of: Percent of Population over age 65;[221] Tobacco Consumption (% population age 15+ who are daily smokers);[221] Obesity (Obese population measured percentage of total population);[221] National Debt-to-GDP Ratio;[222] Percent of Total Population Covered by Public or Primary Voluntary Health Insurance

Coverage;[221] Government/Compulsory Health Insurance Coverage;[223] Age as percent of population structured in ranges,[221] Perceived Health Status,[224] Educational attainment,[225] GDP per Capita as US Dollars per person PPP converted,[226] number of hospitals per 1 000 000,[227] births per 1 000,[228] race as measured by the population density of the largest group,[229] employment rate for people 15 to 64 years,[230] insurance type (voluntary, supplemental, and compulsory)[231] and, year.

Covariates were chosen as common factors to include in analysis as: demographic factors (include age, race/ethnicity, socioeconomic status); health status and behaviors (i.e., tobacco usage and obesity); utilization factors by means of insurance status, access and number of hospitals; social and environmental factors.[233–236]

Descriptives are shown in the **Table 32** below of the imputed and original values which can be compared relative to the original values for the non-imputed sets.

Table 32: Descriptive Statistics for Original Distributions of Measures

Descriptive Summary Covariates

	Obs	Mean	Std. deviation	Min	Max
Log of Total Health Expenditure	404.000	7.994	0.536	6.693	9.254
Coordination	407.000	0.000	1.000	-4.602	2.531
Percent Population Obesity	407.000	20.500	7.020	3.383	39.967
Debt-to-GDP Ratio	393.000	79.539	45.548	8.472	234.381
Percent Total Population Insured	372.000	97.871	4.126	67.500	100.200
Government/Compulsory Health	407.000	0.597	0.491	0.000	1.000
Year	407.000	2013.000	3.166	2008.000	2018.000
Tertiary Education	395.000	32.860	10.054	12.000	57.900
Upper Post Secondary Education	384.000	43.171	14.095	13.900	76.400
Below Secondary Education	390.000	24.434	16.548	6.100	71.800
Perceived Health Status 15 to 24 years	354.000	90.418	6.022	45.500	98.600
Perceived Health Status 25 to 44 years	276.000	83.343	8.906	38.600	95.400
Perceived Health Status 45 to 64 years	354.000	62.648	15.809	26.300	90.000
Perceived Health Status 65+	354.000	41.043	21.676	2.900	88.500
GDP Per Capita	407.000	204.000	117.635	1.000	407.000
Percent Population <15	407.000	17.510	3.830	12.200	30.500
Percent Population 15 – 24	407.000	12.723	2.166	9.200	19.700
Percent Population 15 – 64	407.000	66.545	2.454	59.800	73.400
Percent Population 65+	407.000	15.945	4.152	5.900	28.000
Total Number of Hospitals	366.000	29.470	14.563	8.630	76.070
Employment Rate 15 - 64	404.000	66.961	7.438	44.200	86.500

Percent Use Tobacco	232.000	18.050	5.169	6.400	39.700
Density Largest Segment Population	407.000	0.880	0.130	0.533	1.000
Births per 1 000	407.000	11.701	3.068	6.340	23.690
Voluntary Insurance	361.000	97.617	5.329	67.500	100.000
Supplemental Insurance	273.000	32.357	30.616	0.000	97.900
Compulsory Insurance	208.000	25.353	30.600	0.000	91.600

Notes: Government/Compulsory Health is the binary variable depicting whether a government has UHC.

Table 33: Descriptive Statistics for Original and Imputed Distributions of Measures

Descriptive Summary Covariates

	Obs	Mean	Std. deviation	Min	Max
Log of Total Health Expenditure	404.000	7.994	0.536	6.693	9.254
Coordination	407.000	0.000	1.000	-4.602	2.531
Percent Population Obesity	407.000	20.500	7.020	3.383	39.967
Debt-to-GDP Ratio	407.000	79.539	44.756	8.472	234.381
Percent Total Population Insured	407.000	97.871	3.944	67.500	100.200
Government/Compulsory Health	407.000	0.597	0.491	0.000	1.000
Year	407.000	2013.000	3.166	2008.000	2018.000
Tertiary Education	407.000	32.860	9.905	12.000	57.900
Upper Post Secondary Education	407.000	43.171	13.690	13.900	76.400
Below Secondary Education	407.000	-0.118	0.081	-0.413	-0.019
Perceived Health Status 15 to 24 years	407.000	90.418	5.615	45.500	98.600
Perceived Health Status 25 to 44 years	407.000	83.343	7.329	38.600	95.400
Perceived Health Status 45 to 64 years	407.000	62.648	14.741	26.300	90.000
Perceived Health Status 65+	407.000	41.043	20.212	2.900	88.500
GDP Per Capita	407.000	204.000	117.635	1.000	407.000
Percent Population <15	407.000	17.510	3.830	12.200	30.500
Percent Population 15 – 24	407.000	12.723	2.166	9.200	19.700
Percent Population 15 – 64	407.000	66.545	2.454	59.800	73.400
Percent Population 65+	407.000	15.945	4.152	5.900	28.000
Total Number of Hospitals	407.000	29.470	13.808	8.630	76.070
Employment Rate 15 - 64	407.000	66.961	7.411	44.200	86.500
Percent Use Tobacco	407.000	18.050	3.899	6.400	39.700
Density Largest Segment Population	407.000	0.880	0.130	0.533	1.000
Voluntary Insurance	407.000	97.617	5.018	67.500	100.000
Supplemental Insurance	407.000	32.357	25.059	0.000	97.900
Compulsory Insurance	407.000	25.353	21.849	0.000	91.600

Notes: Government/Compulsory Health is the binary variable depicting whether a government has UHC.

Results:

What becomes apparent from an initial read of average per capita total health expenditure by country from the first year of study to last (2008 to 2018) in **Table 34** is that there is wide variation in initial and final year spending, as well as the magnitude of increase in spending.

Table 34: Average Total Health Expenditure per Capita by OECD Nation (shown in $USD PPP converted)

	2008	2018
Australia	3,350.14	5,190.89
Austria	4,009.31	5,518.54
Belgium	3,545.09	5,350.97
Canada	3,849.54	5,337.40
Chile	1,129.41	2,281.15
Costa Rica		1,529.72
Czechia	1,822.94	3,128.52
Denmark	3,777.71	5,306.70
Estonia	1,345.95	2,364.07
Finland	3,243.77	4,330.44
France	3,729.35	5,097.23
Germany	3,955.14	6,290.08
Greece	2,665.47	2,314.70
Hungary	1,492.59	2,106.90
Iceland	3,612.47	4,235.66
Ireland	3,643.27	4,876.91
Israel	1,839.05	2,748.98
Italy	2,932.46	3,495.87
Japan	2,799.20	4,554.28
Korea	1,512.07	3,067.11
Latvia	1,118.35	1,860.97
Lithuania	1,347.21	2,396.81
Luxembourg	5,431.11	5,292.06
Mexico	899.88	1,122.18
Netherlands	4,378.36	5,482.27
New Zealand	2,829.76	3,913.08
Norway	4,604.50	6,495.08
Poland	1,222.75	2,106.66
Portugal	2,448.03	3,134.13
Slovak Republic	1,687.06	2,008.97
Slovenia	2,297.54	3,045.11
Spain	2,671.94	3,427.32
Sweden	3,415.04	5,419.27
Switzerland	4,905.06	6,601.60
Türkiye	807.05	1,205.31
United Kingdom	3,180.35	4,188.27
United States	7,386.14	10,447.29

Notes: uses Total Health Expenditure per capita from OECD[221]

The trend of variation is similarly borne out by quartile level in **Table *35*** where the increase in Quartile corresponds to further deviation from the mean.

Table 35: Average Total Health Expenditure per Capita by Coordination Quartile (shown in $USD PPP converted)

	2008	2018
Quartile 1	3,100.65	2,121.06
Quartile 2	2,302.27	4,775.58
Quartile 3	3,113.45	4,360.54
Quartile 4	3,834.20	4,841.47

Notes: uses Total Health Expenditure per capita from OECD[221]

Lastly, the correlation between the two variables is demonstrated to be 0.399 which indicates a moderate degree of correlation which is safe to be assumed with a homogenous sample and does not cause consternation.

Table 36: Correlation Matrix of Correlation and Total Health Expenditure

Variables	(1)	(2)
(1) Coordination Index	1.000	
(2) Total Health Expenditure	0.399	1.000

3.1.2.1 Missing Values

There are missing values and the potential reasons for why, and whether it is a result of randomness or associated with some other nonignorable factor(s)[201] must be established. These factors are as categorized as Missing at Random (MAR), Missing Completely at Random (MCAR), or Missing Not at Random (MNAR).[202] It was identified in **Table 32** that there are missing values in: Percent of Population Tobacco Consumption, Percent of Population Obesity, National Debt-to-GDP Ratio, Percent of Total Population Covered by Public or Primary Voluntary Health Insurance Coverage, Perceived Health Status, Educational Attainment, Number of Hospitals and Employment Rate. A simple statistical test for whether data is missing completely at random exists in the Little's Test[203–205] which tests whether significant differences exist between means of different missing-value patterns.[204] When the Little's Test is run for

Tobacco Consumption, Percent of Population Obesity, National Debt-to-GDP Ratio, and Percent of Total Population Covered by insurance, it can be concluded that the data is not MCAR per the below:

Table 37: Little's MCAR Test

Number of Observations	= 407
Chi-square Distance	= 1635.587
Degrees of Freedom	= 500
Prob > chi-square	= 0.000

The p-value being significant indicates that the presence of missing data is not MCAR. Similarly, intuitively there will be correlation within the indices which is probably feeding the non-convergence. Ultimately, this confirms the notion that a more robust model is warranted versus simple imputation. The determination as to whether the missing data type is MNAR or MAR is to be done, for which logistic regression within the dataset[203] can be used. A significant association between the complete data and the missing dummy variable indicates an MAR type.

Beginning with a logistic regression of a dummy variable for Tobacco Consumption and the below is produced.

Table 38: Logistic Regression of Dummy Variable for Population Smoking

	Coefficient	Std. Error	z	P>|z|	95% CI	
Percent Pop 65 Plus	0.060	0.026	2.270	0.023	0.008	0.111
Government/Compulsory	-0.913	0.217	-4.200	0.000	-1.338	-0.487
Year	-0.036	0.034	-1.060	0.290	-0.101	0.030
Constant	70.766	67.470	1.050	0.294	-61.472	203.004

Notes: Uses original variable values. Government/Compulsory refers to the binary UHC variable. Findings based on n = 407, likelihood ratio chi-square test = 19.73, p-value 0.0002, pseudo R2 = 0.0355.

The model shows significant association between age and government/compulsory insurance coverage which we use as a marker for UHC. Repeating the logistic regression for the remaining

dummy variables for Obesity, UHC, and governmental debt and find significant associations with Age in all groups indicates that for these variables the missing values are due to unobserved factors and MNAR typology.

In this instance, since all of the indices in question represent continuous variables but with non-infinite ranges, unconditional mean imputation[206] is used. First normality of the complete variables is checked.

Table 39: Skewness and Kurtosis for Percent of Population 65+ and Year

Skewness and kurtosis tests for normality

	Obs	Pr(skewness)	Pr(kurtosis)	Adj chi2(2)	Prob>chi2
Percent of Population 65+	407	0.001	0.377	11.180	0.004
Year	407	1.000	0.000	205.410	0.000

Shapiro-Wilk Test for Normality

	Obs	W	V	Z	Prob>z
Percent of Population 65+	407	0.967	9.276	5.304	0.000
Year	407	0.981	5.305	3.974	0.000

Notes: Uses original values for Percent of Population 65+ and year.

In chapter 2 it was demonstrated that Percent of Population 65+ is normally distributed, likewise Year appears to be as well and next the mean imputations are done.

3.1.2.2 Percent of Population Tobacco Consumption

Viewing Tobacco Consumption as ratio data, it is anticipated there not being a linear relationship between variables and confirm as much with a correlation matrix.

Table 40: Correlation Matrix of Smoking

Variables	(1)	(2)	(3)	(4)
(1) Tobacco Consumption	1.000			
(2) Percent of Population 65+	0.242	1.000		
(3) UHC	-0.096	0.304	1.000	
(4) Year	-0.372	0.212	-0.003	1.000

Notes: Uses original values for Percent of Population Tobacco Consumption, Percent of Population 65+, Government/Compulsory as the binary UHC variable, and Year.

Due to the weak correlations, limitations on the breadth of data and nonlinearity within the available data utilize unconditional mean imputation[206] for Tobacco Consumption is used. Detailed analysis of imputation methods can be found in Appendix II.

The final results of the imputation effort are shown below compared to the original distribution.

Table 41: Descriptive Summary of Mean Imputed Percent of Population Using Tobacco and Original Values

	Obs.	Mean	Std. dev	Min	Max
Imputed	407	18.050	3.899	6.400	39.700
Original	232	18.050	5.169	6.400	39.700

3.1.2.3 Percent of Population Obese

The original intent was in utilizing Obesity as defined by the population measured percentage of total population as obese and obtained via the OECD statistics.[221]While OECD did have both a self-reported and a measured variable for obesity, the total number of observations over the span of analysis was only 133 and 84, respectively across both the self-reported and observed. Given the difficulties with overcoming a near 50% of missing values, and that the target for total observations were in the range of 407, a new search was conducted for a usable and more complete obesity measure and identified the World Health Organization's age-standardized prevalence of obesity among adults (18+ years) as a viable option.[237] The summary statistics for the World Health Organization Obesity Rate[237] are below and demonstrate a complete record to work with:

Table 42: Summary Statistics

	Obs	Mean	Std. deviation	Min	Max
Obesity Rate	407	20.500	7.019	3.383	39.967

Notes: N = 37 total nations, across 11 years of observations for 407 observations. Source: World Health Organization Age-standardized prevalence of obesity among adults (18+ year) [237] 2008-2018

Looking at the distribution of the new dataset from the World Health Organization, it can be concluded to be normally distributed.

Table 43: Normality Test of Original Values

Skewness and kurtosis tests for normality

	Obs	Pr(skewness)	Pr(kurtosis)	Adj chi2(2)	Prob>chi2
Pct. Pop. Obese	407	0.312	0.156	3.040	0.219

Shapiro-Wilk Test for Normality

	Obs	W	V	Z	Prob>z
Pct. Pop. Obese	407	0.985	4.064	3.339	0.000

Notes: N = 37 total nations, across 11 years of observations for 407 observations. Source: World Health Organization Age-standardized prevalence of obesity among adults (18+ year) [237] 2008-2018

Using a Box Cox transformation of the newly imputed data to see if the normality of the distribution can be improved, a Theta of 1.085 is produced. The data are transformed and rechecked for normality and conclude it worsened the normality of the distribution per the below.

Table 44: Normality Test of Transformed Percent of Population Obese

Skewness and kurtosis tests for normality

	Obs	Pr(skewness)	Pr(kurtosis)	Adj chi2(2)	Prob>chi2
Transformed Pct. Pop. Obese	407	0.000	0.000	107.190	0.000

Shapiro-Wilk Test for Normality

	Obs	W	V	Z	Prob>z
Transformed Pct. Pop. Obese	407	0.854	40.857	8.835	0.000

Notes: N = 37 total nations, across 11 years of observations for 407 observations. Source: World Health Organization Age-standardized prevalence of obesity among adults (18+ year) [237] 2008-2018

Moving forward with the untransformed WHO Obesity measure.

3.1.2.4 National Debt-to-GDP Ratio

As discussed in the missing values section, this is a known problem to be addressed and have run a unconditional mean imputation[206]for the Debt to GDP ratio. Detailed analysis of imputation methods can be found in Appendix II.

The final results of the imputation effort are shown below compared to the original values.

Table 45: Descriptive Summary of Imputed Debt-to-GDP Ratio and Original Values

	Obs	Mean	Std. deviation	Min	Max
Imputed	407	79.539	44.756	8.472	234.381
Original	393	79.539	45.548	8.472	234.381

3.1.2.5 Percent of Total Population Covered by Public or Primary Voluntary Health Insurance Coverage

As discussed in the missing values section, this is a known problem to be addressed and have run a unconditional mean imputation[206]for the percent of population covered by insurance. Detailed analysis of imputation methods can be found in Appendix II.

The final results of the imputation effort are shown below compared to the original distribution.

Table 46: Descriptive Summary of Imputed Percent of Population Insured and Original Values

	Obs	Mean	Std. deviation	Min	Max
Imputed	407	97.871	3.944	67.500	100.200
Original	372	97.871	4.126	67.500	100.200

3.1.2.6 Perceived Health Status

As discussed in the missing values section, this is a known problem to be addressed and have run a unconditional mean imputation[206]for Perceived Health Status. Detailed analysis of imputation methods can be found in Appendix II.

The final results of the imputation effort are shown below compared to the original distribution.

Table 47: Descriptive Summary of Mean Imputed Percent Health Status Good to Very Good and Original Values

	Obs.	Mean	Std. dev	Min	Max
Imputed 15 – 24	407	90.418	5.615	45.500	98.600
Original 15 – 24	354	90.418	6.022	45.500	98.600
Imputed 25 – 44	407	83.313	7.329	38.600	95.400
Original 25 – 44	276	83.343	8.906	38.600	95.400
Imputed 45 – 64	407	62.648	14.741	26.300	90.00
Original 45 – 64	354	62.648	15.809	26.300	90.00
Imputed 65 Plus	407	41.043	20.212	2.900	88.500
Original 65 Plus	354	41.043	21.676	2.900	88.500

3.1.2.7 Educational Attainment

Due to the weak correlations (the most profound being with Age under 15 at 0.486), limitations on the breadth of data and nonlinearity within the available data, unconditional mean imputation[206] for Educational Attainment is utilized. Detailed analysis of imputation methods can be found in Appendix II.

The final results of the imputation effort are shown below compared to the original distribution.

Table 48: Descriptive Summary of Mean Imputed Below Secondary Education and Original Values

	Obs.	Mean	Std. dev	Min	Max
Imputed	407	24.434	16.198	6.100	71.800
Original	390	24.434	16.548	6.100	71.800

3.1.2.8 Number of Hospitals

Due to the weak correlations (the most profound being with Obesity at 0.462), limitations on the breadth of data and nonlinearity within the available data, unconditional mean imputation[206] for the Number of Hospitals is utilized.

Detailed analysis of imputation methods can be found in Appendix II.

The final results of the imputation effort are shown below compared to the original distribution.

Table 49: Descriptive Summary of Mean Imputed Total Number of Hospitals and Original Values

	Obs.	Mean	Std. dev	Min	Max
Imputed	407	29.477	13.808	8.630	76.070
Original	366	29.477	14.563	8.630	76.070

3.1.2.9 Employment Rate

Due to the weak correlations (the most profound being with Disability Adjusted Life Years at -0.556), limitations on the breadth of data and nonlinearity within the available data, unconditional mean imputation[206] for the Number of Hospitals is utilized. Detailed analysis of imputation methods can be found in Appendix II.

The final results of the imputation effort are shown below compared to the original distribution.

Table 50: Descriptive Summary of Mean Imputed Employment Rate 15-64 years and Original Values

	Obs.	Mean	Std. dev	Min	Max
Imputed	407	66.961	7.411	44.200	86.500
Original	404	66.961	7.438	44.200	86.500

3.1.2.10 Final Covariate Descriptives

Table 51: Final Covariate Descriptives

Descriptive Summary Covariates

	Obs	Mean	Std. deviation	Min	Max
Percent Population Obesity	407	20.500	7.019	3.383	39.967
Debt-to-GDP Ratio	407	79.539	44.756	8.472	234.381
Percent Total Population Insured	407	97.871	3.944	67.500	100.200
Government/Compulsory Health	407	.597	.491	0	1
Year	407	2013.000	3.166	2008.000	2018.000
Tertiary Education	407	32.860	9.905	12.000	57.900
Upper Post Secondary Education	407	43.171	13.690	13.900	76.400
Below Secondary Education	407	-0.118	0.081	-0.413	-0.019
Perceived Health Status 15 to 24 years	407	90.4178	5.615	45.500	98.600
Perceived Health Status 25 to 44 years	407	83.343	7.329	38.600	95.400
Perceived Health Status 45 to 64 years	407	62.648	14.741	26.300	90.000
Perceived Health Status 65+	407	41.043	20.212	2.900	88.500
GDP Per Capita	407	204	117.635	1.000	407.000
Percent Population <15	407	17.510	3.830	12.200	30.500
Percent Population 15 – 24	407	12.723	2.166	9.200	19.700
Percent Population 15 – 64	407	66.545	2.454	59.800	73.400
Percent Population 65+	407	15.943	4.151	27.992	27.992
Total Number of Hospitals	407	29.470	13.808	8.630	76.070
Employment Rate 15 - 64	407	66.961	7.411	44.200	86.500
Percent Use Tobacco	407	18.050	3.899	6.400	39.700
Births per 1 000	407	11.701	3.068	6.340	23.690
Density Largest Segment of Population	407	0 .880	0.130	.533	1.000
Voluntary Insurance	407	97.617	5.018	67.500	100.000
Supplemental Insurance	407	32.357	25.059	0.000	97.900
Compulsory Insurance	407	25.353	21.849	0.000	91.600

Notes: Government/Compulsory Health is the binary variable depicting whether a government has UHC.

3.1.2.2 Outcome Variable

As part of data collection the recent releases of s Inpatient, Outpatient, Preventative and Pharmaceutical Spending[221] were collected. When attempting to reconstruct a total health expenditure figure as the sum of Inpatient, Outpatient, Preventative, and Pharmaceutical spending, the correlation between this new variable and the collected Total Health Expenditure[221] figure is 0.9214. In this instance, since there is variable through a validated methodology already collected, it was elected to use the pre-established Total Health Expenditure from the OECD[221] as the outcome variable of interest depicted on a natural log

scale. Further, the summary statistics and distribution for the log of Total Health Expenditure demonstrate that while it is short from the targeted 407 observations, at 404, imputing the missing observations is not necessary.

Table 52: Summary Statistics Log of Total Expense

Variable	Obs	Mean	Std. deviation	Min	Max
Log of Total Expenditure	404	7.994	0.536	6.693	9.254

3.2 Results

3.2.1 Regression

The first regression model shown below in **Table *53*** utilizes the original values of the data and none of the imputed values. Doing this allows for meaningful comparison between the values as they were given and those garnered from the imputation methods taken. The model in **Table *53*** delivers a very high Adjusted R-squared and a low RMSE suggesting that it explains a good deal of variation within Total Health Expenditure as well as soundly predicting the values from the model to the actual observed values. This can be compared to the imputed data used in **Table *54*Table *58***.

Table 53: Linear Regression Model of Log of Total Expenditure and z of Coordination Using Original Values

	Coefficient	Std. Error	t	P>|t|	95% CI	
Coordination	0.004	0.016	0.240	0.811	-0.029	0.037
Percent Population Obesity	0.008	0.005	1.680	0.101	-0.002	0.017
Debt-to-GDP Ratio	0.003	0.001	2.000	0.053	0.000	0.005
Percent Total Population Insured	0.221	0.283	0.780	0.441	-0.352	0.793
Government/Compulsory Health	-0.072	0.079	-0.910	0.367	-0.233	0.088
Year	-0.002	0.006	-0.370	0.713	-0.015	0.010
Tertiary Education	0.144	0.166	0.870	0.389	-0.191	0.479
Upper Post Secondary Education	0.146	0.165	0.880	0.383	-0.189	0.480
Below Secondary Education	0.132	0.166	0.800	0.431	-0.204	0.469

Perceived Health Status 15 to 24 years	0.006	0.008	0.750	0.459	-0.010	0.022
Perceived Health Status 25 to 44 years	-0.011	0.007	-1.500	0.141	-0.026	0.004
Perceived Health Status 45 to 64 years	0.013	0.006	2.370	0.023	0.002	0.025
Perceived Health Status 65+	-0.003	0.003	-0.880	0.387	-0.009	0.004
GDP Per Capita	0.003	0.001	5.880	0.000	0.002	0.004
Percent Population <15	0.169	0.146	1.160	0.254	-0.126	0.465
Percent Population 15 – 24	0.014	0.025	0.570	0.569	-0.036	0.065
Percent Population 15 – 64	0.153	0.145	1.050	0.298	-0.140	0.446
Percent Population 65+	0.171	0.145	1.180	0.247	-0.123	0.464
Total Number of Hospitals	0.004	0.001	3.690	0.001	0.002	0.007
Employment Rate 15 - 64	0.006	0.005	1.070	0.293	-0.005	0.016
Percent Use Tobacco	-0.005	0.005	-0.880	0.384	-0.016	0.006
Births per 1 000	-0.319	0.309	-1.030	0.308	-0.944	0.305
Density Largest Segment Population	-0.026	0.025	-1.060	0.297	-0.076	0.024
Voluntary Insurance	-0.225	0.285	-0.790	0.436	-0.802	0.353
Supplemental Insurance	0.003	0.001	3.090	0.004	0.001	0.005
Compulsory Insurance	-0.002	0.001	-2.690	0.010	-0.004	-0.001
Constant	-18.455	25.451	-0.730	0.473	-69.934	33.025

Notes: Findings based on n = 66. Uses natural log of Total Health Expenditure per Capita, z-score of Coordination, Original values Obesity, Debt to GDP, Population Insured, UHC as a dummy variable for percent of population insured, Year, Tertiary, Upper Post, Health Status, GDP per Capita, Age, Employment Rate, Tobacco Usage, Density of Population Segment, Births, and Transformed Below Secondary Education, Voluntary, Supplemental and Compulsory Insurance F-Statistic = 142.32, p-value 0.0000, R-squared = 0.990, Adjusted R-Squared = 0.983, Root MSE = 0.050.

Results from **Table *54*** share an encouraging adjusted r-squared and low RMSE, albeit the values for **Table *54*** are less favorable than in **Table *53*** utilizing the original values however. What can be gleaned from the initial results is a consistency in the main independent variable of concern: Coordination in baseline assessment has nearly an identical coefficient and standard error in both the imputed and unimputed models. Additionally, using the imputed data Coordination is statistically significant.

Table 54: Linear Regression Model of Log of Total Expenditure and z of Coordination Using Imputed and Original Values

	Coefficient	Std. Error	t	P>|t|	95% CI	
Coordination	0.036	0.015	2.310	0.021	0.005	0.066
Percent Population Obesity	0.002	0.003	0.820	0.410	-0.003	0.007
Debt-to-GDP Ratio	0.001	0.000	1.880	0.061	0.000	0.001
Percent Total Population Insured	-0.007	0.006	-1.290	0.196	-0.019	0.004
Government/Compulsory Health	-0.091	0.033	-2.800	0.005	-0.155	-0.027

Year	-0.003	0.005	-0.690	0.493	-0.012	0.006
Tertiary Education	0.006	0.002	2.840	0.005	0.002	0.010
Upper Post Secondary Education	0.001	0.002	0.830	0.407	-0.002	0.005
Below Secondary Education	0.411	0.284	1.450	0.148	-0.147	0.970
Perceived Health Status 15 to 24 years	0.004	0.004	1.030	0.302	-0.004	0.013
Perceived Health Status 25 to 44 years	-0.004	0.004	-1.060	0.288	-0.012	0.004
Perceived Health Status 45 to 64 years	-0.001	0.003	-0.160	0.870	-0.007	0.006
Perceived Health Status 65+	0.011	0.002	4.940	0.000	0.007	0.015
GDP Per Capita	0.002	0.000	7.460	0.000	0.001	0.002
Percent Population <15	0.073	0.193	0.380	0.706	-0.306	0.452
Percent Population 15 – 24	-0.076	0.015	-5.170	0.000	-0.105	-0.047
Percent Population 15 – 64	0.069	0.195	0.360	0.722	-0.314	0.453
Percent Population 65+	0.065	0.194	0.340	0.737	-0.317	0.448
Total Number of Hospitals	0.000	0.001	-0.220	0.828	-0.002	0.002
Employment Rate 15 - 64	0.007	0.003	2.320	0.021	0.001	0.012
Percent Use Tobacco	-0.005	0.003	-1.510	0.132	-0.012	0.002
Births per 1 000	-0.283	0.140	-2.020	0.044	-0.559	-0.008
Density Largest Segment Population	-0.019	0.015	-1.280	0.200	-0.049	0.010
Voluntary Insurance	0.010	0.004	2.230	0.026	0.001	0.018
Supplemental Insurance	0.001	0.001	1.360	0.175	0.000	0.002
Compulsory Insurance	-0.002	0.001	-2.070	0.039	-0.003	0.000
Constant	7.368	21.665	0.340	0.734	-35.232	49.968

Notes: Findings based on n = 404. Uses natural log of Total Health Expenditure per Capita, z-score of Coordination, Original values Obesity, Debt to GDP, Population Insured, UHC as a dummy variable for percent of population insured, Year, Tertiary, Upper Post, Health Status, GDP per Capita, Age, Employment Rate, Tobacco Usage, Density of Population Segment, Births, and Transformed Below Secondary Education, and imputed Voluntary, Supplemental and Compulsory Insurance, F-Statistic = 96.28, p-value 0.0000, R-squared = 0.869, Adjusted R-Squared = 0.860, Root MSE = 0.20051.

Testing some sub theories, chiefly: as expressed in the conceptual framework that there is a vast reciprocity of traits within Coordination and the underlying covariates used by virtue of the institutions and normative values of a nation a correlation matrix and running the full model in **Table *54*** but utilizing the quartiles of Coordination to compare significance between models can help tell this story.

Table 55: Correlation Matrix of Log of Total Expenditure, z of Coordination, and Covariates Using Imputed and Original Values

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)
(1) Log of Total Expenditure	1.00																										
(2) Coordination	0.59	1.00																									
(3) Percent Population Obesity	0.06	-0.25	1.00																								
(4) Debt-to-GDP Ratio	0.42	-0.05	0.11	1.00																							
(5) Percent Total Population Insured	0.45	0.31	-0.08	-0.01	1.00																						
(6) Government/Compulsory Health	-0.04	-0.23	0.31	-0.22	0.53	1.00																					
(7) Year	0.28	0.11	0.21	0.09	0.07	0.24	1.00																				
(8) Tertiary Education	0.50	0.18	0.09	0.49	0.39	0.43	0.38	1.00																			
(9) Upper Post Secondary Education	-0.61	-0.39	0.02	-0.43	-0.40	-0.13	-0.25	-0.87	1.00																		
(10) Below Secondary Education	0.35	0.46	-0.20	0.01	0.11	-0.49	-0.17	-0.02	-0.48	1.00																	
(11) Perc. Health Status 15 to 24 years	0.09	-0.18	0.67	0.32	-0.12	-0.11	-0.17	-0.14	0.17	-0.10	1.00																
(12) Perc. Health Status 25 to 44 years	0.34	-0.05	0.75	0.36	0.04	0.06	-0.03	0.14	-0.10	-0.04	0.93	1.00															
(13) Perc. Health Status 45 to 64 years	0.73	0.32	0.55	0.40	0.40	0.21	0.20	0.60	-0.65	0.26	0.48	0.73	1.00														
(14) Perceived Health Status 65+	0.77	0.42	0.47	0.36	0.40	0.21	0.30	0.64	-0.71	0.30	0.27	0.54	0.96	1.00													
(15) GDP Per Capita	0.88	0.72	-0.26	0.20	0.47	-0.18	0.07	0.30	-0.51	0.49	-0.05	0.13	0.49	0.52	1.00												
(16) Percent Population <15	-0.07	-0.08	0.26	0.06	0.19	0.16	0.08	0.36	-0.44	0.25	0.33	0.40	0.42	0.28	-0.09	1.00											
(17) Percent Population 15 – 24	-0.25	-0.12	0.22	-0.10	0.02	0.20	-0.09	0.37	-0.38	0.11	0.05	0.13	0.26	0.23	-0.32	0.71	1.00										
(18) Percent Population 15 – 64	-0.29	-0.02	-0.33	-0.26	-0.26	-0.02	-0.22	-0.27	0.40	-0.32	-0.50	-0.58	-0.52	-0.35	-0.24	-0.77	-0.22	1.00									
(19) Percent Population 65+	0.48	0.16	0.02	0.23	0.05	-0.22	0.16	-0.22	0.18	0.03	0.12	0.13	0.01	0.02	0.45	-0.57	-0.82	-0.09	1.00								
(20) Total Number of Hospitals	0.10	0.19	-0.45	-0.42	0.15	0.19	0.17	0.08	-0.15	0.16	-0.79	-0.66	-0.31	-0.16	0.20	-0.36	-0.13	0.34	0.12	1.00							
(21) Employment Rate 15 - 64	0.79	0.64	0.19	0.01	0.46	0.15	0.32	0.37	-0.43	0.22	0.11	0.35	0.72	0.78	0.72	0.02	-0.08	-0.18	0.20	0.02	1.00						
(22) Percent Use Tobacco	-0.46	-0.21	-0.49	-0.13	-0.34	-0.57	-0.48	-0.70	0.55	0.12	-0.06	-0.35	-0.67	-0.70	-0.22	-0.22	-0.26	0.22	0.07	-0.04	-0.53	1.00					
(23) Births per 1 000	-0.21	0.08	-0.77	-0.11	-0.02	-0.30	-0.33	-0.35	0.32	-0.03	-0.32	-0.51	-0.66	-0.68	0.15	-0.33	-0.44	0.23	0.22	0.24	-0.38	0.62	1.00				
(24) Density Largest Segment Pop.	-0.20	-0.21	0.29	0.04	0.16	0.20	-0.04	0.24	-0.27	0.11	0.43	0.44	0.33	0.16	-0.21	0.97	0.70	-0.72	-0.58	-0.43	-0.10	-0.14	-0.26	1.00			
(25) Voluntary Insurance	0.45	0.31	-0.09	-0.01	1.00	0.53	0.07	0.39	-0.40	0.12	-0.12	0.04	0.40	0.40	0.47	0.19	0.03	-0.26	0.04	0.16	0.46	-0.34	-0.02	0.16	1.00		
(26) Supplemental Insurance	0.49	0.41	-0.31	0.52	0.36	-0.18	0.07	0.61	-0.77	0.48	-0.07	0.05	0.46	0.47	0.50	0.43	0.25	-0.32	-0.25	-0.12	0.32	-0.19	-0.02	0.31	0.37	1.00	
(27) Compulsory Insurance	0.39	0.48	-0.28	0.38	0.31	-0.06	0.02	0.66	-0.70	0.23	-0.07	0.06	0.41	0.41	0.48	0.38	0.31	-0.19	-0.35	-0.14	0.37	-0.33	0.06	0.28	0.31	0.83	1.00

Uses natural log of Total Health Expenditure per Capita, z-score of Coordination, Original values Obesity, Debt to GDP, Population Insured, UHC as a dummy variable for percent of population insured, Year, Tertiary, Upper Post, Health Status, GDP per Capita, Age, Employment Rate, Tobacco Usage, Density of Population Segment, Births, and Transformed Below Secondary Education, Voluntary, Supplemental and Compulsory Insurance

Table 56: Linear Regression Model of Log of Total Expenditure and z of Quartile of Coordination Using Imputed and Original Values

	Coefficient	Std. Error	t	P>|t|	95% CI	
Quartile Coordination	0.023	0.013	1.790	0.074	-0.002	0.048
Percent Population Obesity	0.002	0.003	0.810	0.420	-0.003	0.007
Debt-to-GDP Ratio	0.001	0.000	1.980	0.049	0.000	0.002
Percent Total Population Insured	-0.008	0.006	-1.370	0.171	-0.020	0.004
Government/Compulsory Health	-0.084	0.033	-2.560	0.011	-0.149	-0.020
Year	-0.004	0.005	-0.930	0.352	-0.013	0.005
Tertiary Education	0.006	0.002	2.980	0.003	0.002	0.010
Upper Post Secondary Education	0.002	0.002	1.010	0.314	-0.002	0.005
Below Secondary Education	0.439	0.285	1.540	0.125	-0.122	1.000
Perceived Health Status 15 to 24 years	0.005	0.004	1.120	0.262	-0.004	0.013
Perceived Health Status 25 to 44 years	-0.004	0.004	-0.960	0.337	-0.012	0.004
Perceived Health Status 45 to 64 years	-0.001	0.003	-0.360	0.717	-0.007	0.005
Perceived Health Status 65+	0.01	0.00	4.92	0.00	0.01	0.02
GDP Per Capita	0.00	0.00	7.58	0.00	0.00	0.00
Percent Population <15	0.07	0.19	0.36	0.72	-0.31	0.45
Percent Population 15 – 24	-0.08	0.01	-5.14	0.00	-0.11	-0.05
Percent Population 15 – 64	0.06	0.20	0.33	0.74	-0.32	0.45
Percent Population 65+	0.06	0.19	0.31	0.76	-0.32	0.44
Total Number of Hospitals	0.00	0.00	-0.32	0.75	0.00	0.00
Employment Rate 15 - 64	0.01	0.00	2.72	0.01	0.00	0.01
Percent Use Tobacco	0.00	0.00	-1.28	0.20	-0.01	0.00
Births per 1 000	-0.29	0.14	-2.03	0.04	-0.56	-0.01
Density Largest Segment Population	-0.02	0.02	-1.44	0.15	-0.05	0.01
Voluntary Insurance	0.01	0.00	2.12	0.04	0.00	0.02
Supplemental Insurance	0.00	0.00	1.74	0.08	0.00	0.00
Compulsory Insurance	0.00	0.00	-2.05	0.04	0.00	0.00
Constant	9.994526	21.65237	0.46	0.645	-32.58	52.56907

Notes: Findings based on n = 404. Uses natural log of Total Health Expenditure per Capita, z-score Quartile of Coordination, Original values Obesity, Debt to GDP, Population Insured, UHC as a dummy variable for percent of population insured, Year, Tertiary, Upper Post, Health Status, GDP per Capita, Age, Employment Rate, Tobacco Usage, Density of Population Segment, Births, and Transformed Below Secondary Education, and imputed Voluntary, Supplemental and Compulsory Insurance, F-Statistic = 95.66, p-value 0.0000, R-squared = 0.868, Adjusted R-Squared = 0.859, Root MSE = 0.20108.

Comparing models in **Table *56*** and **Table 54** we find nearly identical results for R-squared, overall significance, adjusted R, and RMSE. Looking deeper at the results, the coefficients themselves are identical when the error term is removed, when included the average magnitude of difference is only about 0.097. With regards to the overall significance of the variables, the models differ by a minimum of 0.07 and a maximum of 0.153. I believe these results, coupled with the final sensitivity analysis in **Table *28*** indicate that the covariates themselves are considerable influencers to eroding the overall significance of the model.

Accordingly, based on the initial findings as well as the high degree of correlation the model is readjusted to omit highly insignificant variables: Obesity, Population Insured, Year, Age under 15, Age 15 – 64, Age 65 plus, Total Hospitals, Tobacco Usage and Births per thousand, negligible impacts are found to the results apart from a slightly higher adjusted r-squared value.

Table 57: Linear Regression Model of Log of Total Expenditure and z of Coordination

	Coefficient	Std. Error	t	P>|t|	95% conf. interval	
Coordination	0.045	0.014	3.250	0.001	0.018	0.072
Debt-to-GDP Ratio	0.001	0.000	3.090	0.002	0.000	0.001
Government/Compulsory Health	-0.111	0.027	-4.110	0.000	-0.164	-0.058
Tertiary Education	0.005	0.002	2.820	0.005	0.001	0.008
GDP Per Capita	0.011	0.001	11.830	0.000	0.009	0.013
Percent Population 15 – 24	0.002	0.000	8.660	0.000	0.001	0.002
Employment Rate 15 - 64	-0.079	0.008	-10.390	0.000	-0.094	-0.064
Density Largest Segment Population	0.005	0.002	2.400	0.017	0.001	0.009
Voluntary Insurance	-0.397	0.109	-3.650	0.000	-0.610	-0.183
Compulsory Insurance	0.005	0.003	1.860	0.063	0.000	0.011
Constant	-0.001	0.001	-2.360	0.019	-0.003	0.000

This updated model still presents some insignificant findings, for which it is rerun again omitting Voluntary Insurance and find negligible impacts to the overall model efficacy in R-squared and Root MSE.

Table 58: Linear Regression Model of Log of Total Expenditure and z of Coordination

	Coefficient	Std. Error	t	P>|t|	95% conf. interval	
Coordination	0.044	0.014	3.150	0.002	0.016	0.071
Debt-to-GDP Ratio	0.001	0.000	3.550	0.000	0.000	0.002
Government/Compulsory Health	-0.088	0.024	-3.660	0.000	-0.135	-0.041
Tertiary Education	0.004	0.002	2.720	0.007	0.001	0.008
GDP Per Capita	0.011	0.001	11.660	0.000	0.009	0.012
Percent Population 15 – 24	0.002	0.000	10.500	0.000	0.002	0.002
Employment Rate 15 - 64	-0.081	0.008	-10.630	0.000	-0.096	-0.066
Density Largest Segment Population	0.005	0.002	2.260	0.025	0.001	0.009
Compulsory Insurance	-0.451	0.105	-4.290	0.000	-0.657	-0.244
Constant	-0.001	0.001	-2.120	0.034	-0.002	0.000

Notes: Findings based on n = 404. Uses natural log of Total Health Expenditure per Capita, z-score of Coordination, Original Debt to GDP, UHC as a dummy variable for percent of population insured, Tertiary Education, GDP per Capita, Age, Employment Rate, Density of Population Segment, and Compulsory Insurance. F-Statistic = 245.16, p-value 0.0000, R-squared = 0.8692, Adjusted R-Squared = 0.858, Root MSE = 0.20176.

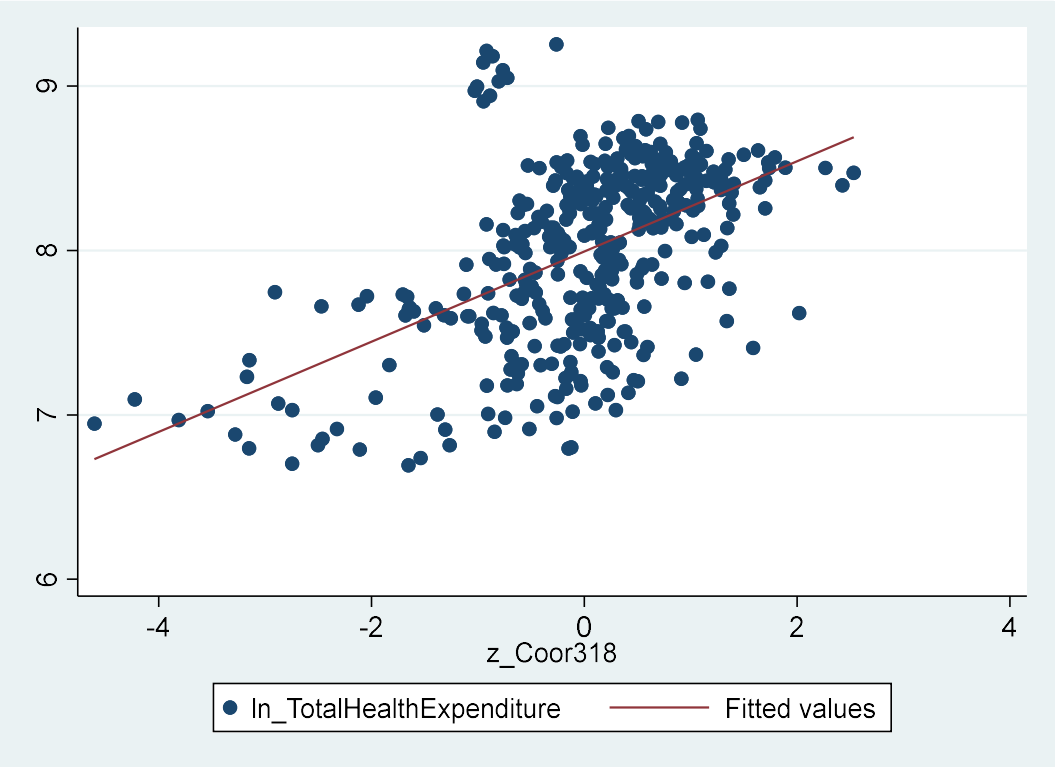
To better understand and interpret the findings, quartile ratings based on Coordination are created for use later.

3.2.2 Post Estimation

3.2.2.1 Linearity

When the log of Total Expense and the z of Coordination Index are plotted, there appears to be a linear relationship with a clustering at the mean of z-Coordination and Total Expense on a log scale.

Figure 5: Scatter Plot of z-Coordination and Total Expense



Accordingly, it is then justified in using the log of Total Health Expenditure and have satisfied that a linear relationship does exist between Total Health Expenditure and Coordination.

3.2.2.2 Correlation

To examine the strength and directions of the association between variables in the model, a Spearman Rank Correlation is used as the linearity suggests that as Coordination increases, so too does Costs.

Table 59: Spearman Rank Correlation Matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) Health Expenditure	1.000										
(2) Coordination	0.497	1.000									
(3) Debt to GDP	0.266	-0.145	1.000								
(4) UHC	0.223	0.226	0.053	1.000							
(5) Tertiary Ed	0.560	0.421	0.092	0.359	1.000						
(6) Health Status 65+	0.726	0.382	0.139	0.244	0.573	1.000					
(7) GDP per Capita	0.825	0.467	0.273	0.203	0.470	0.655	1.000				

(8) Age 15 – 24	-0.272	-0.126	-0.344	-0.202	0.008	0.213	-0.187	1.000			
(9) Employment Rate	0.642	0.521	-0.079	0.291	0.534	0.552	0.672	-0.076	1.000		
(10) Density Largest Segment	0.349	0.293	0.256	0.245	0.091	0.199	0.552	-0.202	0.296	1.000	
(11) Compulsory Insurance	0.255	0.381	-0.063	-0.009	0.463	0.334	0.245	0.242	0.321	0.008	1.000

Notes: Uses natural log of Total Health Expenditure per Capita, z-score of Coordination, Original Debt to GDP, UHC as a dummy variable for percent of population insured, Tertiary Education, Health Status, GDP per Capita, Age, Density of Population Segment, and Compulsory Insurance.

The Spearman's Rank demonstrates that the profound correlations among variables exists between the covariates and dependent variables at 0.825 for GDP per Capita, and 0.726 for Perceived Health Status 65+, and 0.642 for Employment Rate which importantly demonstrates that, while serial correlation cannot disproved due to the model type and non-panel data, the issue of correlation throughout the model is put to rest and conclude that there is moderate positive correlation between Total Health Expenditure and Coordination as expected within the conceptual framework. Similarly strong correlation between total health expenditure and perceived health status, GDP per capita and Employment Rate also exist.

3.2.2.3 Homoscedasticity

Homoscedasticity happens when the variance of the error is not constant across observations, thus resulting in inefficient estimates and invalid statistical tests. To test for this, the Breusch-Pagan test is employed on the model within **Table *58*** where the null hypothesis is that the variance of errors is constant and there is no heteroscedasticity.

Table 60: Breusch-Pagan/Cook-Weisberg Test

Breusch-Pagan/Cook-Weisberg Test	
Chi2(1)	= 1.11
Prob > chi2	= 0.293

Because of the nature of the Breusch-Pagan test, a statistically significant value means that one can conclude that there is no heteroscedasticity within the model. Given the p-value exceeds 0.05 significance, the null hypothesis is not rejected and conclude there is no heteroscedasticity.

3.2.2.4 Normality of Residuals

Once the residuals within are obtained as part of the post-estimation efforts and complete a Skewness and Kurtosis test is used to assess whether the residuals themselves are normally distributed. The null hypothesis of this test is that it is normally distributed.

Table 61: Skewness and Kurtosis Test for Normal Data

Shapiro-Wilk W Test for Normal Data					
	Obs	**Pr(skewness)**	**Pr(kurtosis)**	**Adj. chi2(2)**	**Prob>chi2**
Residuals	404	0.002	0.000	37.08	0.000

Based on the P-value, we reject the null hypothesis and conclude that the residuals themselves are not normally distributed and suggest deviation from normality. Accordingly, the model from **Table *58*** is rerun with the application of robust standard errors for analysis in the below with little impact to the model's efficacy.

Table 62: Linear Regression Model of Log of Total Expenditure with Robust Standard Error

	Coefficient	**Robust Std. Error**	**t**	**P>|t|**	**95% conf. interval**	
Coordination	0.044	0.012	3.500	0.001	0.019	0.068
Debt-to-GDP Ratio	0.001	0.000	3.900	0.000	0.001	0.002
Government/Compulsory Health	-0.088	0.023	-3.810	0.000	-0.133	-0.042
Tertiary Education	0.004	0.002	2.830	0.005	0.001	0.007
GDP Per Capita	0.011	0.001	8.300	0.000	0.008	0.013
Percent Population 15 – 24	0.002	0.000	7.220	0.000	0.001	0.002
Employment Rate 15 - 64	-0.081	0.009	-8.870	0.000	-0.099	-0.063
Density Largest Segment Population	0.005	0.002	2.790	0.005	0.001	0.008
Compulsory Insurance	-0.451	0.133	-3.400	0.001	-0.712	-0.190
Constant	-0.001	0.001	-2.360	0.019	-0.002	0.000

Notes: Uses natural log of Total Health Expenditure per Capita, z-score of Coordination, Original Debt to GDP, UHC as a dummy variable for percent of population insured, Teritary Education, Health Status, GDP per Capita, Age, Density of Population Segment, and Compulsory Insurance. Findings based on n = 404, R-squared = 0.862, Root MSE = 0.202.

3.2.2.5 Multicollinearity

To test whether the independent variables are highly correlated with one another which would impede the ability to understand the individual effects, the Variance Inflation Factor (VIF) is run on the model in **Table *62*** and finds there are no significant issues of correlation between the variables per the below:

Table 63: Variance Inflation Factor Table

Variance Inflation Factor

Variable	VIF	1/VIF
GDP per Capita	4.47	0.224
Per. Health Status 65+	3.32	0.301
Tertiary Education	2.51	0.399
Age 15 – 24	2.50	0.399
Employment Rate	2.41	0.416
Coordination	1.92	0.521
Density Largest Segment	1.85	0.541
Compulsory Insurance	1.69	0.592
Debt to GDP Ratio	1.62	0.616
UHC	1.37	0.730
Mean	2.37	

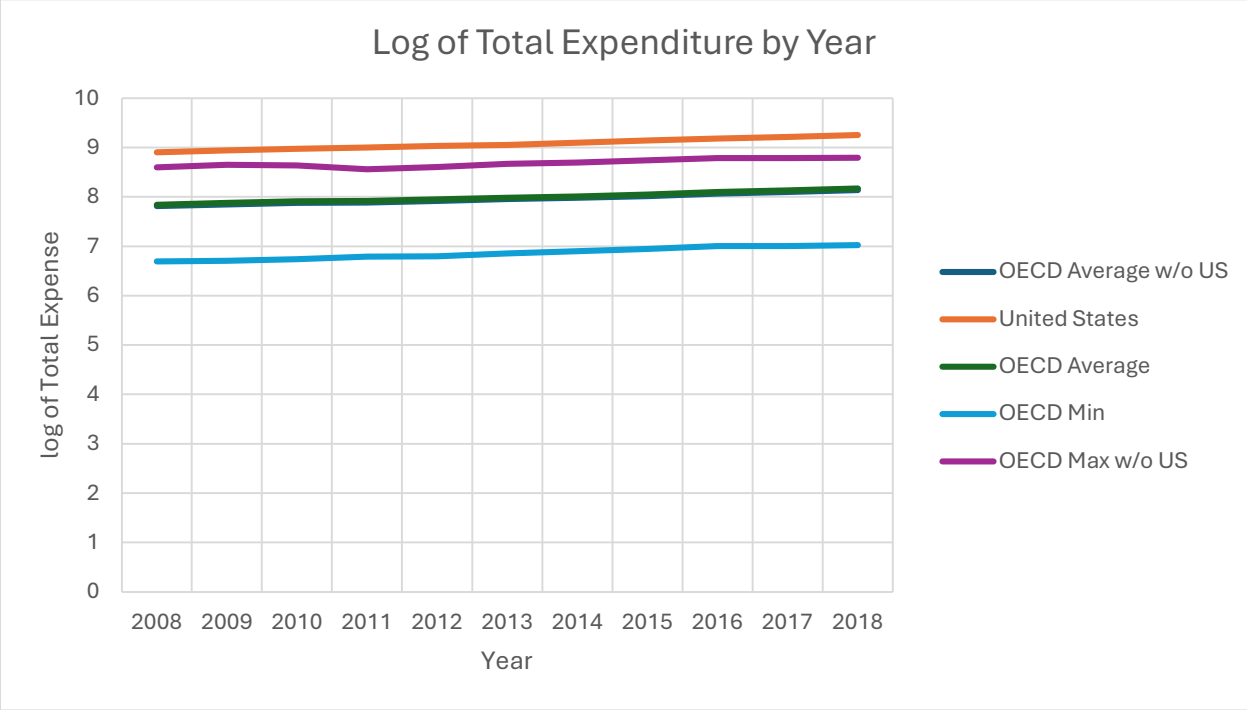
Notes: Uses natural log of Total Health Expenditure per Capita, z-score of Coordination, Original Debt to GDP, UHC as a dummy variable for percent of population insured, Tertiary Education, Health Status, GDP per Capita, Age, Density of Population Segment, and Compulsory Insurance.

3.3 Discussion

Recalling that the Coordination Index is a composite of indices summated by z-scores of their distributions, simply inferring from these coefficients requires a bit of tact. But given the basic question is oriented around associations and degrees of coordination, the research questions can be assessed by coordination levels by means of quartiles for which it is inferred that: the higher the quartile, the higher degree of coordination and the relationship to the log of total health

expenditure. Very different total health expenditure values by Coordination levels in **Figure 6** exist.

Figure 6: Log of Total Health Expenditure and Coordination Quartile Levels by Year



Turning back to the regression model in **Table 54**, the coefficient attached to Coordination represented an increase in total health expenditure of 0.036 for every unit increase in z-score of Coordination. Because total health expenditure is on a log basis, when converted back to its original per capita form from the natural log, it is possible to discuss the impacts of increasing coordination per the model and the resulting societal burden of the welfare benefits posture. Hence, an increase in z-score of coordination represents an increase in $1.036 (in thousands) per capita increase in expenditure. It is however worth noting that as a definition Total Health

Expenditure does not include accrued medical debt. This finding suggests that variations away from the mean z-score of Coordination therefore are higher expenditure nations.

3.4 Conclusion

The baseline models show that Coordination is associated with Total Health Expenditure when all covariates are utilized, and even after when the model in **Table *58*** is adjusted to remove insignificant predictors, collinearity and using Robust Standard Errors the finding is that Coordination as a concept is statistically significant. Suggesting, again, per the conceptual framework that there are relationships within these variables. To return to the base hypothesis that there is significant variation in Total Health Spending per Capita expenditure over time for CME vs LME nations due to the premium placed on profits by more LME oriented nations[12,64,155,156] it was demonstrated the statistical significance of Coordination in the linear regression model of Total Health Expenditure. What remains to be seen is whether there are significant variations in the expenditure by Coordination levels, for which the Levene's Test for equality of variances is used and which unequivocally informs that there is significant difference in variances between levels of Coordination in **Table 64**.

Table 64: Levene's Test for Equality of Variances

Levene's Test for Equality of Variances

	Summary of log of Total Health Expenditure		
Quartile	**Mean**	**Std. Deviation**	**Frequency**
1	7.672	0.624	102
2	7.908	0.504	100
3	8.067	0.437	101
4	8.333	0.295	101
Total			

	Test Statistic	Interpretation
W0	0.000	The p-value test statistic is statistically significant and there is significant variation for values centered at the mean.
W50	0.000	The p-value test statistic is statistically significant and there is significant variation for values centered at the median.
W10	0.000	The p-value test statistic is statistically significant and there is

significant variation for values centered using 10% trimmed mean.

The Levene's test however does not address however whether, per the original question if LME's (those more towards the lower quartile rankings) spend more than CMEs on a total expenditure basis in a significant fashion. To address this a Chi-Squared analysis between the quartiles in and the total expenditure in **Table 65** is done to ascertain that there is not a significant enough basis to reject the null hypothesis in this instance that these two variables are in fact independent. It is then concluded that the difference between quartiles of Coordination and total expenditure is in fact randomly based association. This is further corroborated by the very high Pearson Chi-Squared statistic of 1,209, an indication of greater deviation from what would be expected if the two variables were in fact independent. However, what the model fails to distinguish is what the operating costs, transaction costs, infrastructure costs, and administrative costs and burdens that each system carries. It was assumed that these costs would manifest by the level of Coordination using the summary level measures of the indices in Chapter 2 and would adequately capture these operating, transactions, infrastructure, and administrative costs as well as rent-seeking behaviors but may have inadvertently acted as confounders to that goal and masked those inadvertently.

Table 65: Chi-Squared Test on Coordination Quartiles and log of Total Health Expenditure

Chi-Squared Test on Coordination Quartiles and log of Total Health Expenditure

	Quartile 1	Quartile 2	Quartile 3	Quartile 4	Total
Total	102	100	101	101	404
Pearson chi2(1209)	= 1200	**Pr**	= 0.470		

While the Chi-Squared test demonstrates a random association exists between quartiles of coordination and total health expenditure, one more question of the data: is there a significant

difference between the means of the quartiles for their respective levels of expenditure? For this a two-sample t-Test is used and finds that for both high and low levels of coordination (quartiles 1 and 4) as well as mid-levels of coordination (quartiles 2 and 3) there is a significant variation in those expenditures per the below which affirms the initial null hypothesis.

Table 66: T-test of Log of Total Expenditure by Coordination Quartile Level

	Obs	Mean	Std. error	Std. dev	95% CI	
1	102	7.672	0.062	0.624	7.549	7.794
4	101	8.333	0.029	0.295	8.274	8.391
Combined	203	8.000	0.041	0.590	7.919	8.082
Diff		**-0.661**	**0.069**		**-0.796**	**-0.525**
T-statistic		**-9.624**				

	P-value	Interpretation
Pr(T<t)	**0.000**	Reject the null, mean difference is significantly greater than or less than zero
Pr(|T| > |t|)	**0.000**	Reject the null, p-value of difference between samples is statistically significantly different from 0
Pr(T > t)	**1.000**	Fail to reject the null, mean difference is not significantly greater than or less than zero

	Obs	Mean	Std. error	Std. dev	95% conf. interval	
2	100	7.908	0.050	0.504	7.808	8.008
3	101	8.067	0.044	0.437	7.981	8.154
Combined	201	7.988	0.034	0.477	7.922	8.054
Diff		**-0.159**	**0.066**		**-0.290**	**-0.028**
T-statistic		**-2.394**				

	P-value	Interpretation
Pr(T<t)	**0.008**	Reject the null, mean difference is significantly greater than or less than zero
Pr(|T| > |t|)	**0.018**	Reject the null, p-value of difference between samples is statistically significantly different from 0
Pr(T > t)	**0.991**	Fail to reject the null, mean difference is not significantly greater than or less than zero

3.5 Limitations

There are several limitations to address. As explained in Chapter 2, mean imputation was heavily leveraged to deal with missing data. While able to fill in those missing data gaps, it does inject

some variance and uncertainty into the models. As such, using imputed data poses a limitation. Another limitation is that it was assumed that the distribution of transaction costs, infrastructure, and a consistent set of norms with regards to contracting and negotiation, rent-seeking and the like would be captured by the Coordination Index. This assumption is probably the reason why the linear model depicts an increase in Coordination causing an increase in expenditure: these business costs and the inflations of them would continue per the limited model as they are not enumerated explicitly and captured—but alas, it was hypothesized that these costs would be controlled and produce a decrease in expense. Related to this flawed assumption is the reality that a lack of standardization in reporting measures and definitions across borders presents a complex and confounding issue. Lastly, I would be remiss were I not to mention the challenges in interpretations of the coefficients and variables through heavy usage of z-scores, natural logs and other transformations. However, this is a minor limitation as the main research questions deal with associations and relationships and not the specific coefficients of the regression models themselves.

3.6 Strengths

The vastness of datasets, ranging from economic, political, sociological, legal and health outcomes measures is a strength as no one index exerts undue influence on the outcomes. Likewise, the compendium of indices comes from a variety of organizations on the political spectrum: ranging from arguably more egalitarian/Left leaning sources such as the OECD data and Social Progress Index to the conservative/Right of the Economic Freedom scores from the Heritage Organization. Finally, while the regression results were unexpected, they do not diminish the findings of the Levene's Test on the variances which is the main research question: market and benefits Coordination is a meaningful measure with regards to health expenditure,

and the variances between nations based on levels of Coordination are themselves statistically significant.

Chapter 4: Evaluating the Relationship Between the Coordination Index and Health Outcomes in OECD Countries

4.1 Methods

A standard linear regression model is predicated on satisfaction of basic assumptions such as linearity, no autocorrelation, homoscedasticity, normality of residuals, and no multicollinearity. Linearity will be checked by plotting the residuals and looking for a random scattering around zero. Correlation checked via a Spearman's rank; homoscedasticity via the Breusch-Pagan test; normality of residuals via the Shapiro-Wilk test; and Variance Inflation Factor to demonstrate no perfect multicollinearity. The proposed initial model is as follows:

$$E(Y_{qual}) = f(\beta_0 + \beta_{ih}X1_{i65} + \beta_{ih}X2_{iTob} + \beta_{ih}X3_{iOb} + \beta_{ih}X4_{iCoor} + \beta_{ih}X5_{iDebt} + \beta_{ih}X6_{iIns} + \beta_{ih}X7_{UHC} + \beta_{ih}X8_{Age} + \beta_{ih}X9_{PerceivedHealthStatus} + \beta_{ih}X10_{Educational\ Attainment} + \beta_{ih}X11_{GDPperCapita} + \beta_{ih}X12_{TotalHospitalsperMillion} + \beta_{ih}X13_{BirthsperK} + \beta_{ih}X14_{LargestPopSegment} + \beta_{ih}X15_{EmploymentRate} + \beta_{ih}X16_{VolIns} + \beta_{ih}X17_{SuppIns} + \beta_{ih}X18_{CompulsIns} + Time + U_{it})$$

Where, Y_{qual} is an outcome variable of either all-cause mortality, life expectancy and potential years of life lost. The hypothesis is that there is a significant difference in mortality over time by levels of Coordination due to countries with greater degrees of political and income inequality having poorer outcomes.[71,102,123] The null of which would be there is no significant difference in mortality over time by levels of Coordination. And:

Outcome Variables
ACM_{bg} = All-cause mortality both genders[221]
LE_{bg} = Life expectancy both genders[221]
$PYLL_{bg}$ = Potential years of life lost both genders[221]
Key Independent Variable
$X4_{iCoor}$ = Composite Coordination Index
Control Variables
$X1_{i65}$ = Percent of Population over age 65[221]
$X2_{iTob}$ = Tobacco Consumption (% population age 15+ who are daily smokers) [221]
$X3_{iOb}$ = Obesity (Obese population measured percentage of total population)[221]
$X5_{iDebt}$ = National Debt-to-GDP Ratio[222]
$X6_{iIns}$ = Percent of Total Population Covered by Public or Primary Voluntary Health Insurance Coverage[221]

$X7_{UHC}$ = Government/Compulsory Health Insurance Coverage[223]
$X8_{Age}$ = Age as percent of population structured in ranges[221]
$X9_{HealthStatus}$ = Perceived Health Status,[224]
$X10_{Education}$ = Educational attainment,[225]
$X11_{GDP}$ = GDP per Capita as US Dollars per person PPP converted,[226]
$X12_{TotalHospitals}$ = Total number of hospitals per 1 000 000,[227]
$X13_{BirthsperK}$ = Total births per 1 000,[228]
$X14_{LargestPopSeg}$ = Race as measured by the population density of the largest group,[229]
$X15_{EmpRate}$ = Employment rate for people 15 to 64 years[230]
$X16_{VolIns}$ = Voluntary Insurance Rate[231]
$X17_{SuppIns}$ = Supplemental Insurance Rate[231]
$X18_{CompulsIns}$ = Compulsory Insurance Rate[231]
Time = Year
U_{it} = Error term

To finally determine the efficacy of the models a P-value less than or equal to 0.05 for the individual measures within the model, as well as the overall model itself. Further, because the nature of the hypothesis and methods are oriented towards a social sciences inquiry, the R-squared threshold becomes less of a concern as well should the parts of the model themselves be significant.[232]

4.1.1 Data

Recent releases of secondary, publicly available data were collected from: All-cause mortality both genders,[221] Life expectancy both genders,[221] Potential years of life lost both genders,[221] Percent of Population over age 65;[221] Tobacco Consumption (% population age 15+ who are daily smokers);[221] Obesity (Obese population measured percentage of total population);[221] National Debt-to-GDP Ratio;[222] Percent of Total Population Covered by Public or Primary Voluntary Health Insurance Coverage;[221] Government/Compulsory Health Insurance Coverage;[223] Age as percent of population structured in ranges,[221] Perceived Health Status,[224] Educational attainment,[225] GDP per Capita as US Dollars per person PPP converted,[226] number of hospitals per 1 000 000,[227] births per 1 000,[228] race as measured by the population density of the largest group,[229] employment rate for people 15 to 64 years[230] and, year. Data was

subsequently downloaded, collated in Microsoft Excel Office 365 and then loaded into Stata 17.0.

4.1.2 Measures

4.1.2.1 Covariates

Section 3.1.2.1 dealt with covariates for all the models and the mean imputation required to mediate missing values as identified in **Table 51**. Descriptives are shown in the **Table 32** of the original values which can be compared relative to the imputed distributions in **Table 33**.

4.1.2.2 Outcome Variable

The outcome dependent variable of Life expectancy total population[221] which, while not of critical importance is worth bringing forward due to the limitations outlined in prior chapters: the chosen dependent variable, has no missing values as demonstrated in **Table 67** which is an advantage.

Table 67: Descriptive Summary Statistics Dependent Variable

Descriptive Summary

	Obs	Mean	Std. deviation	Min	Max
Life Expectancy Total Population	407	80.035	2.681	71.700	84.300

Notes: uses original values of Life Expectancy Total Population.

Results:

What becomes apparent from an initial read of average Life Expectancy by country from the first year of study to last (2008 to 2018) in is that there is wide variation in initial and final year values, as well as the magnitude of change.

Table 68: Average Life Expectancy by OECD Nation (shown in years)

	2008	2018
Australia	81.400	82.700
Austria	80.600	81.800
Belgium	79.800	81.700
Canada	80.800	81.900
Chile	78.300	80.400
Costa Rica	79.300	80.300
Czechia	77.300	79.100
Denmark	78.800	81.000
Estonia	74.400	78.500
Finland	79.900	81.800
France	81.400	82.800
Germany	80.200	81.000
Greece	80.200	81.900
Hungary	74.200	76.200
Iceland	81.600	82.900
Ireland	80.200	82.200
Israel	81.100	82.900
Italy	81.700	83.400
Japan	82.700	84.300
Korea	79.600	82.700
Latvia	72.100	75.100
Lithuania	71.700	76.000
Luxembourg	80.700	82.300
Mexico	75.200	75.000
Netherlands	80.500	81.900
New Zealand	80.500	81.700
Norway	80.800	82.800
Poland	75.600	77.700
Portugal	79.500	81.500
Slovak Republic	74.900	77.400
Slovenia	79.100	81.500
Spain	81.500	83.500
Sweden	81.300	82.600
Switzerland	82.300	83.800
Türkiye	73.900	78.300
United Kingdom	79.600	81.100
United States	78.200	78.700

Notes: uses Life expectancy total population from OECD[221]

The trend of variation is similarly borne out by quartile level in where the increase in Quartile corresponds to further deviation from the mean.

Table 69: Average Life Expectancy by Coordination Quartile (shown in years)

	2008	2018
Quartile 1	77.633	79.180
Quartile 2	78.394	80.320
Quartile 3	79.600	81.011
Quartile 4	80.571	82.146

Notes: uses Life expectancy total population from OECD[221]

Lastly, the correlation between the two variables is demonstrated to be 0.408 which indicates a moderate degree of correlation which is safe to be assumed with a homogenous sample and does not cause consternation.

Table 70: Correlation Matrix of Coordination and Life Expectancy

Variables	(1)	(2)
(1) Coordination Index	1.000	
(2) Total Life Expectancy	0.408	1.000

4.2 Results

4.2.1 Regression

The first regression model shown below in **Table *71*** utilizes the original values of the data and none of the imputed values. Doing this allows for a meaningful comparison between the values as they were given and those garnered from the imputation methods taken. The model in **Table *71*** delivers a high Adjusted R-squared and a low RMSE suggesting that it explains a good deal of variation within Life Expectancy as well as soundly predicting the values from the model to the actual observed values. This can be compared to the imputed data used in **Table *72***.

Table 71: Linear Regression Model of Life Expectancy and z of Coordination Using Original Values

	Coefficient	Std. Error	t	P>|t|	95% CI	
Coordination	-0.007	0.118	-0.060	0.952	-0.245	0.231
Percent Population Obesity	-0.089	0.033	-2.710	0.010	-0.155	-0.022

Debt-to-GDP Ratio	0.017	0.009	1.860	0.070	-0.002	0.036
Percent Total Population Insured	1.838	2.028	0.910	0.370	-2.263	5.940
Government/Compulsory Health	1.924	0.568	3.390	0.002	0.776	3.073
Year	0.131	0.045	2.940	0.005	0.041	0.221
Tertiary Education	-0.724	1.186	-0.610	0.545	-3.123	1.674
Upper Post Secondary Education	-0.695	1.184	-0.590	0.561	-3.091	1.700
Below Secondary Education	-0.738	1.191	-0.620	0.539	-3.146	1.671
Perceived Health Status 15 to 24 years	-0.023	0.056	-0.420	0.676	-0.136	0.089
Perceived Health Status 25 to 44 years	0.016	0.052	0.310	0.755	-0.089	0.121
Perceived Health Status 45 to 64 years	-0.007	0.040	-0.180	0.858	-0.088	0.074
Perceived Health Status 65+	0.031	0.022	1.410	0.166	-0.014	0.076
GDP Per Capita	0.011	0.004	2.900	0.006	0.003	0.019
Percent Population <15	0.846	1.047	0.810	0.424	-1.271	2.964
Percent Population 15 – 24	0.107	0.178	0.600	0.550	-0.253	0.467
Percent Population 15 – 64	0.621	1.037	0.600	0.553	-1.477	2.719
Percent Population 65+	0.604	1.039	0.580	0.564	-1.496	2.705
Total Number of Hospitals	0.028	0.008	3.410	0.002	0.011	0.045
Employment Rate 15 - 64	0.002	0.038	0.060	0.954	-0.075	0.079
Percent Use Tobacco	0.017	0.038	0.440	0.662	-0.061	0.095
Births per 1 000	-0.508	2.211	-0.230	0.820	-4.980	3.964
Density Largest Segment Population	-0.040	0.176	-0.230	0.821	-0.396	0.316
Voluntary Insurance	-2.013	2.044	-0.990	0.331	-6.146	2.120
Supplemental Insurance	0.027	0.007	3.850	0.000	0.013	0.041
Compulsory Insurance	-0.013	0.006	-2.180	0.035	-0.026	-0.001
Constant	-166.645	182.258	-0.910	0.366	-535.297	202.007

Notes: Findings based on n = 66. Uses Life Expectancy, z-score of Coordination, Original values Obesity, Debt to GDP, Population Insured, UHC as a dummy variable for percent of population insured, Year, Tertiary, Upper Post, Health Status, GDP per Capita, Age, Employment Rate, Tobacco Usage, Density of Population Segment, Births, Transformed Below Secondary Education, Voluntary, Supplemental and Compulsory Insurance. F-Statistic = 75.57, p-value 0.0000, R-squared = 0.981, Adjusted R-Squared = 0.968, Root MSE = 0.357.

Table 72: Linear Regression Model of Life Expectancy Total and z-score of Coordination using Imputed and Original Values

	Coefficient	Std. Error	t	P>|t|	95% conf. interval	
Coordination	0.148	0.080	1.850	0.065	-0.009	0.305
Percent Population Obesity	-0.078	0.013	-5.850	0.000	-0.104	-0.052
Debt-to-GDP Ratio	0.008	0.002	4.330	0.000	0.005	0.012
Percent Total Population Insured	0.183	0.030	6.080	0.000	0.123	0.242
Government/Compulsory Health	0.254	0.169	1.500	0.135	-0.079	0.587
Year	0.096	0.024	3.930	0.000	0.048	0.144
Tertiary Education	0.022	0.011	2.040	0.042	0.001	0.043
Upper Post Secondary Education	-0.043	0.009	-5.080	0.000	-0.060	-0.027
Below Secondary Education	2.376	1.472	1.610	0.107	-0.519	5.270

Perceived Health Status 15 to 24 years	-0.038	0.022	-1.740	0.083	-0.081	0.005
Perceived Health Status 25 to 44 years	-0.021	0.020	-1.030	0.306	-0.061	0.019
Perceived Health Status 45 to 64 years	0.132	0.016	8.200	0.000	0.100	0.164
Perceived Health Status 65+	-0.041	0.011	-3.630	0.000	-0.064	-0.019
GDP Per Capita	0.001	0.001	1.030	0.302	-0.001	0.003
Percent Population <15	0.534	1.000	0.530	0.594	-1.433	2.501
Percent Population 15 – 24	-0.336	0.073	-4.590	0.000	-0.480	-0.192
Percent Population 15 – 64	0.595	1.012	0.590	0.557	-1.395	2.585
Percent Population 65+	0.445	1.009	0.440	0.660	-1.540	2.430
Total Number of Hospitals	0.001	0.005	0.190	0.851	-0.009	0.011
Employment Rate 15 - 64	0.054	0.015	3.680	0.000	0.025	0.082
Percent Use Tobacco	-0.019	0.018	-1.030	0.303	-0.054	0.017
Births per 1 000	0.366	0.730	0.500	0.617	-1.069	1.801
Density Largest Segment Population	-0.006	0.077	-0.080	0.933	-0.159	0.146
Voluntary Insurance	-0.103	0.022	-4.660	0.000	-0.147	-0.060
Supplemental Insurance	0.017	0.003	4.930	0.000	0.010	0.023
Compulsory Insurance	-0.014	0.004	-3.670	0.000	-0.022	-0.007
Constant	-175.246	112.612	-1.560	0.120	-396.666	46.175

Notes: Uses Life Expectancy, z-score of Coordination, Original values Obesity, Debt to GDP, Population Insured, UHC as a dummy variable for percent of population insured, Year, Tertiary, Upper Post, Health Status, GDP per Capita, Age, Employment Rate, Tobacco Usage, Density of Population Segment, Births, and Transformed Below Secondary Education,. Voluntary, Supplemental and Compulsory Insurance. Findings based on n = 407, F-Statistic = 88.12, p-value 0.000, R-squared = 0.858, Adjusted R-Squared = 0.848, Root MSE = 1.045.

Both results demonstrate that Coordination as a notional concept is not associated with Life Expectancy in a statistically significant way. Testing some sub theories, chiefly: as expressed in the conceptual framework that there is a vast reciprocity of traits within Coordination and the underlying covariates used by virtue of the institutions and normative values of a nation a correlation matrix and running the full model in **Table *72*** but utilizing the quartiles of Coordination to compare significance between models can help tell this story.

Table 73: Correlation Matrix of Life Expectancy, z of Coordination, and Covariates Using Imputed and Original Values

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)
(1) Life Expectancy	1.00																										
(2) Coordination	0.41	1.00																									
(3) Percent Population Obesity	-0.44	-0.44	1.00																								
(4) Debt-to-GDP Ratio	0.41	-0.07	-0.17	1.00																							
(5) Percent Total Population Insured	0.57	0.36	-0.51	0.16	1.00																						
(6) Government/Compulsory Health	0.47	0.24	-0.29	0.13	0.56	1.00																					
(7) Year	0.22	-0.05	0.11	0.12	0.07	-0.03	1.00																				
(8) Tertiary Education	0.50	0.45	-0.19	0.15	0.26	0.35	0.27	1.00																			
(9) Upper Post Secondary Education	-0.30	0.12	-0.14	-0.17	0.05	-0.09	-0.05	-0.06	1.00																		
(10) Below Secondary Education	0.35	-0.09	-0.07	0.25	0.13	0.08	-0.15	-0.18	-0.75	1.00																	
(11) Perc. Health Status 15 to 24 years	-0.05	-0.09	0.34	0.00	-0.09	-0.16	-0.08	-0.10	0.10	-0.15	1.00																
(12) Perc. Health Status 25 to 44 years	0.24	0.05	0.30	0.10	0.00	0.05	0.02	0.17	-0.04	-0.04	0.81	1.00															
(13) Perc. Health Status 45 to 64 years	0.62	0.18	0.10	0.23	0.16	0.25	0.08	0.44	-0.29	0.23	0.43	0.73	1.00														
(14) Perceived Health Status 65+	0.58	0.30	0.07	0.12	0.14	0.25	0.10	0.56	-0.29	0.20	0.20	0.53	0.91	1.00													
(15) GDP Per Capita	0.57	0.48	-0.30	0.20	0.40	0.21	0.12	0.47	0.08	-0.04	0.06	0.28	0.56	0.64	1.00												
(16) Percent Population <15	-0.12	-0.29	0.47	-0.22	-0.35	-0.15	-0.07	-0.05	-0.56	0.35	0.14	0.21	0.27	0.27	-0.20	1.00											
(17) Percent Population 15 – 24	-0.37	-0.30	0.45	-0.36	-0.46	-0.30	-0.26	-0.19	-0.39	0.23	0.03	0.01	0.06	0.12	-0.34	0.81	1.00										
(18) Percent Population 15 – 64	-0.32	-0.04	0.05	-0.41	-0.15	-0.18	-0.28	-0.28	0.22	-0.20	-0.01	-0.17	-0.26	-0.23	-0.30	-0.18	0.22	1.00									
(19) Percent Population 65+	0.30	0.29	-0.46	0.44	0.41	0.24	0.23	0.21	0.38	-0.21	-0.13	-0.09	-0.10	-0.11	0.36	-0.81	-0.88	-0.42	1.00								
(20) Total Number of Hospitals	0.14	0.25	-0.44	0.03	0.15	0.18	-0.05	0.28	0.11	-0.04	-0.42	-0.34	-0.13	-0.03	0.18	-0.25	-0.13	-0.03	0.25	1.00							
(21) Employment Rate 15 - 64	0.40	0.56	-0.27	-0.05	0.29	0.29	0.16	0.54	0.18	-0.21	-0.17	0.13	0.34	0.52	0.65	-0.14	-0.18	-0.20	0.25	0.28	1.00						
(22) Percent Use Tobacco	-0.09	0.00	-0.25	0.01	0.20	-0.07	-0.28	-0.23	0.22	0.01	0.01	-0.17	-0.30	-0.40	-0.11	-0.27	-0.27	0.09	0.19	0.13	-0.30	1.00					
(23) Births per 1 000	0.36	0.19	-0.44	0.31	0.35	0.11	0.00	0.00	0.08	0.08	-0.14	-0.04	0.12	0.10	0.49	-0.16	-0.17	-0.16	0.24	0.21	0.22	0.09	1.00				
(24) Density Largest Segment Pop.	-0.19	-0.28	0.46	-0.27	-0.35	-0.13	-0.17	-0.07	-0.44	0.26	0.19	0.23	0.23	0.20	-0.21	0.96	0.79	-0.17	-0.79	-0.24	-0.13	-0.21	-0.18	1.00			
(25) Voluntary Insurance	0.44	0.26	-0.40	0.31	0.73	0.48	0.04	0.32	0.05	-0.03	0.06	0.15	0.25	0.22	0.50	-0.33	-0.47	-0.20	0.42	0.13	0.30	0.06	0.16	-0.31	1.00		
(26) Supplemental Insurance	0.45	0.39	-0.28	0.06	0.27	0.08	0.00	0.46	-0.18	0.15	0.05	0.12	0.33	0.37	0.34	0.08	-0.06	-0.16	0.02	-0.01	0.15	0.01	0.08	0.07	0.22	1.00	
(27) Compulsory Insurance	0.24	0.34	-0.16	-0.06	0.12	0.02	0.03	0.50	-0.32	0.07	-0.07	0.04	0.22	0.31	0.23	0.23	0.20	-0.10	-0.15	0.08	0.28	-0.16	0.01	0.20	0.10	0.61	1.00

Uses Life Expectancy, z-score of Coordination, Original values Obesity, Debt to GDP, Population Insured, UHC as a dummy variable for percent of population insured, Year, Tertiary, Upper Post, Health Status, GDP per Capita, Age, Employment Rate, Tobacco Usage, Density of Population Segment, Births, and Transformed Below Secondary Education, Voluntary, Supplemental and Compulsory Insurance

Table 74: Linear Regression Model of Life Expectancy Total and Quartile of z-score of Coordination using Imputed and Original Values

	Coefficient	Std. Error	t	P>|t|	95% conf. interval	
Quartile Coordination	0.108	0.066	1.630	0.105	-0.023	0.239
Percent Population Obesity	-0.078	0.013	-5.800	0.000	-0.104	-0.051
Debt-to-GDP Ratio	0.009	0.002	4.410	0.000	0.005	0.013
Percent Total Population Insured	0.179	0.031	5.850	0.000	0.119	0.239
Government/Compulsory Health	0.287	0.171	1.680	0.094	-0.049	0.623
Year	0.092	0.024	3.810	0.000	0.044	0.139
Tertiary Education	0.023	0.011	2.150	0.032	0.002	0.044
Upper Post Secondary Education	-0.042	0.009	-4.780	0.000	-0.059	-0.025
Below Secondary Education	2.496	1.477	1.690	0.092	-0.409	5.401
Perceived Health Status 15 to 24 years	-0.037	0.022	-1.680	0.094	-0.079	0.006
Perceived Health Status 25 to 44 years	-0.020	0.020	-0.950	0.341	-0.060	0.021
Perceived Health Status 45 to 64 years	0.130	0.016	8.130	0.000	0.099	0.162
Perceived Health Status 65+	-0.042	0.011	-3.640	0.000	-0.064	-0.019
GDP Per Capita	0.001	0.001	1.120	0.264	-0.001	0.004
Percent Population <15	0.529	1.002	0.530	0.598	-1.440	2.498
Percent Population 15 – 24	-0.333	0.074	-4.490	0.000	-0.478	-0.187
Percent Population 15 – 64	0.584	1.013	0.580	0.564	-1.408	2.576
Percent Population 65+	0.434	1.010	0.430	0.668	-1.553	2.420
Total Number of Hospitals	0.000	0.005	0.050	0.960	-0.010	0.010
Employment Rate 15 - 64	0.058	0.014	4.070	0.000	0.030	0.086
Percent Use Tobacco	-0.015	0.018	-0.810	0.416	-0.051	0.021
Births per 1 000	0.358	0.731	0.490	0.625	-1.079	1.794
Density Largest Segment Population	-0.018	0.077	-0.230	0.817	-0.169	0.134
Voluntary Insurance	-0.105	0.022	-4.720	0.000	-0.148	-0.061
Supplemental Insurance	0.018	0.003	5.310	0.000	0.011	0.024
Compulsory Insurance	-0.015	0.004	-3.690	0.000	-0.022	-0.007
Constant	-166.199	112.347	-1.480	0.140	-387.099	54.702

Notes: Uses Life Expectancy, Quartile z-score of Coordination, Original values Obesity, Debt to GDP, Population Insured, UHC as a dummy variable for percent of population insured, Year, Tertiary, Upper Post, Health Status, GDP per Capita, Age, Employment Rate, Tobacco Usage, Density of Population Segment, Births, and Transformed Below Secondary Education,. Voluntary, Supplemental and Compulsory Insurance. Findings based on n = 407, F-Statistic = 87.91, p-value 0.000, R-squared = 0.857, Adjusted R-Squared = 0.848, Root MSE = 1.046.

Comparing models in **Table *72***and **Table *74*** we find nearly identical results for R-squared, overall significance, adjusted R, and RMSE. Looking deeper at the results, the coefficients themselves are on average nearly identical with a slight variance of 0.003 when the error term is removed,

when included the average magnitude of difference is only about 0.338. With regards to the overall significance of the variables, the models differ by a minimum of 0.113 and a maximum of 0.116. I believe these results, coupled with the final sensitivity analysis in **Table *28*** indicate that the covariates themselves are considerable influencers to eroding the overall significance of the model.

Accordingly, based on the initial findings as well as the high degree of correlation the model is readjusted to omit highly insignificant variables. Additionally, the initial models above show a very encouraging adjusted r-squared value indicative of a good fit to the model. However, the high RMSE suggests that perhaps using a natural log scale of Life Expectancy will improve the output. In so doing, the implications for overall fitness are minimal.

Table 75: Linear Regression Model of Natural Log Life Expectancy Total and z-score of Coordination

	Coefficient	Std. Error	t	P>|t|	95% conf. interval	
Coordination	0.002	0.001	1.810	0.072	0.000	0.004
Percent Population Obesity	-0.001	0.000	-5.530	0.000	-0.001	-0.001
Debt-to-GDP Ratio	0.000	0.000	4.160	0.000	0.000	0.000
Percent Total Population Insured	0.002	0.000	6.000	0.000	0.002	0.003
Government/Compulsory Health	0.003	0.002	1.280	0.203	-0.002	0.007
Year	0.001	0.000	3.680	0.000	0.001	0.002
Tertiary Education	0.000	0.000	2.000	0.046	0.000	0.001
Upper Post Secondary Education	-0.001	0.000	-5.050	0.000	-0.001	0.000
Below Secondary Education	0.030	0.019	1.580	0.115	-0.007	0.067
Perceived Health Status 15 to 24 years	-0.001	0.000	-1.950	0.052	-0.001	0.000
Perceived Health Status 25 to 44 years	0.000	0.000	-0.840	0.403	-0.001	0.000
Perceived Health Status 45 to 64 years	0.002	0.000	8.120	0.000	0.001	0.002
Perceived Health Status 65+	-0.001	0.000	-3.570	0.000	-0.001	0.000
GDP Per Capita	0.000	0.000	0.910	0.362	0.000	0.000
Percent Population <15	0.007	0.013	0.560	0.577	-0.018	0.032
Percent Population 15 – 24	-0.005	0.001	-4.820	0.000	-0.006	-0.003
Percent Population 15 – 64	0.008	0.013	0.610	0.545	-0.018	0.033
Percent Population 65+	0.006	0.013	0.450	0.651	-0.020	0.031
Total Number of Hospitals	0.000	0.000	0.130	0.896	0.000	0.000
Employment Rate 15 - 64	0.001	0.000	3.730	0.000	0.000	0.001
Percent Use Tobacco	0.000	0.000	-1.010	0.314	-0.001	0.000

Births per 1 000	0.007	0.009	0.740	0.459	-0.011	0.025
Density Largest Segment Population	0.000	0.001	-0.180	0.853	-0.002	0.002
Voluntary Insurance	-0.001	0.000	-4.540	0.000	-0.002	-0.001
Supplemental Insurance	0.000	0.000	4.990	0.000	0.000	0.000
Compulsory Insurance	0.000	0.000	-3.680	0.000	0.000	0.000
Constant	1.238	1.446	0.860	0.392	-1.604	4.081

Notes: Uses natural log of Life Expectancy, z-score of Coordination, Original values Obesity, Debt to GDP, Population Insured, UHC as a dummy variable for percent of population insured, Year, Tertiary, Upper Post, Health Status, GDP per Capita, Age, Employment Rate, Tobacco Usage, Density of Population Segment, Births, and Transformed Below Secondary Education, and Voluntary, Supplemental and Compulsory Insurance. Findings based on n = 407, F-Statistic = 86.27, p-value 0.000, R-squared = 0.855, Adjusted R-Squared = 0.845, Root MSE = 0.013.

Additionally, the new model with low RMSE indicative of predictive capacity further supporting the veracity of the latest model. It is found UHC, Below Secondary Education, Health Status 25 – 44, GDP per Capita, Age under 15, Age 15 – 64, Age 65 plus, Total Hospitals, Percent Use Tobacco, Density Largest Segment, Births per thousand are not significant at first pass, and the model rerun omitting these variables.

Table 76: Linear Regression Model of Log of Life Expectancy Total and z-score of Coordination

	Coefficient	**Std. Error**	**t**	**P>|t|**	**95% CI**	
Coordination	0.002	0.001	2.170	0.031	0.000	0.004
Percent Population Obesity	-0.001	0.000	-7.360	0.000	-0.001	-0.001
Debt-to-GDP Ratio	0.000	0.000	4.030	0.000	0.000	0.000
Percent Population Insured	0.003	0.000	9.080	0.000	0.002	0.003
Year	0.001	0.000	4.030	0.000	0.001	0.002
Tertiary Education	0.000	0.000	1.330	0.183	0.000	0.000
Upper Post Secondary Education	-0.001	0.000	-9.140	0.000	-0.001	-0.001
Per. Health Status 15 to 24	-0.001	0.000	-4.590	0.000	-0.001	-0.001
Per. Health Status 45 to 64	0.002	0.000	10.090	0.000	0.001	0.002
Perceived Health Status 65+	0.000	0.000	-3.420	0.001	-0.001	0.000
Age 15 – 24	-0.003	0.001	-5.160	0.000	-0.004	-0.002
Employment Rate	0.001	0.000	3.530	0.000	0.000	0.001
Voluntary Insurance	-0.001	0.000	-5.620	0.000	-0.002	-0.001
Supplemental Insurance	0.000	0.000	5.280	0.000	0.000	0.000
Compulsory Insurance	0.000	0.000	-4.170	0.000	0.000	0.000
Constant	2.182	0.522	4.180	0.000	1.157	3.207

Notes: Uses natural log of Life Expectancy, z-score of Coordination, Original values Obesity, Debt to GDP, Population Insured, Year, Tertiary, Upper Post, Health Status, GDP per Capita, Age, Voluntary, Supplemental and Compulsory Insurance.. Findings based on n = 407, F-Statistic = 141.57, p-value 0.000, R-squared = 0.845, Adjusted R-Squared = 0.839, Root MSE = 0.014.

The updated model presents similar findings to the original with equal levels of model fit and significance but returns an additional insignificant factor of Tertiary Education which is omitted and the model rerun.

Table 77: Linear Regression Model of Log of Life Expectancy Total and z-score of Coordination

	Coefficient	Std. Error	t	P>|t|	95% CI	
Coordination	0.002	0.001	2.330	0.020	0.000	0.004
Percent Population Obesity	-0.001	0.000	-7.270	0.000	-0.001	-0.001
Debt-to-GDP Ratio	0.000	0.000	4.180	0.000	0.000	0.000
Percent Population Insured	0.003	0.000	9.000	0.000	0.002	0.003
Year	0.001	0.000	4.400	0.000	0.001	0.002
Upper Post Secondary Education	-0.001	0.000	-9.040	0.000	-0.001	-0.001
Per. Health Status 15 to 24	-0.001	0.000	-4.860	0.000	-0.001	-0.001
Per. Health Status 45 to 64	0.002	0.000	10.040	0.000	0.001	0.002
Perceived Health Status 65+	0.000	0.000	-3.210	0.001	-0.001	0.000
Age 15 – 24	-0.003	0.001	-5.370	0.000	-0.004	-0.002
Employment Rate	0.001	0.000	3.610	0.000	0.000	0.001
Voluntary Insurance	-0.001	0.000	-5.500	0.000	-0.002	-0.001
Supplemental Insurance	0.000	0.000	5.440	0.000	0.000	0.000
Compulsory Insurance	0.000	0.000	-3.950	0.000	0.000	0.000
Constant	2.045	0.512	4.000	0.000	1.039	3.051

Notes: Uses natural log of Life Expectancy, z-score of Coordination, Original values Obesity, Debt to GDP, Population Insured, Year, Health Status, GDP per Capita, Age, Tobacco Usage, Transformed Below Secondary Education, Voluntary, Supplementary and Compulsory Insurance. Findings based on n = 407, F-Statistic = 151.25, p-value 0.000, R-squared = 0.844, Adjusted R-Squared = 0.838, Root MSE = 0.014.

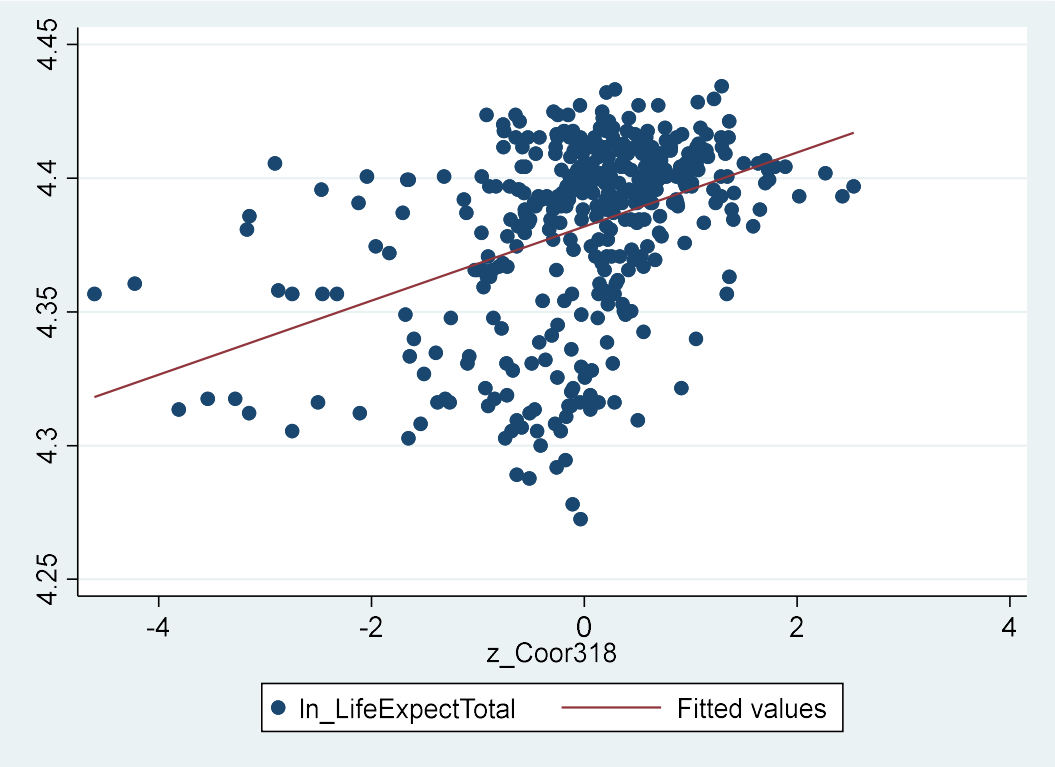
The latest updated model presents similar findings to the original with equal levels of model fit and significance.

4.2.2 Post Estimation

4.2.2.1 Linearity

To assess whether there is a linear relationship the natural log Life Expectancy for the total population and the interpolated z-score of Coordination Index are plotted and find there appears to be a linear relationship with clustering around the mean of z Coordination.

Figure 7: Scatter Plot of Coordination and Life Expectancy Total Population and z-Coordination



It is then satisfied that a linear relationship does exist between Life Expectancy and Coordination and justifies the usage and model.

4.2.2.2 Correlation

To examine the strength and directions of the association between variables in the model, a Spearman Rank Correlation is used as the linearity suggests that as Coordination increases, so too does Life Expectancy.

Table 78: Spearman Rank Correlation Matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(1) Life Expectancy	1.00														
(2) Coordination	0.41	1.00													
(3) Obesity	-0.50	-0.40	1.00												
(4) Debt to GDP Ratio	0.37	-0.15	-0.09	1.00											
(5) Pct. Insured	0.62	0.35	-0.41	0.17	1.00										
(6) Year	0.28	0.03	0.12	0.12	0.04	1.00									
(7) Post Secondary Ed	-0.33	-0.09	-0.19	-0.20	-0.13	-0.06	1.00								
(8) Per. Health Status 15 – 24	-0.01	-0.16	0.23	0.26	-0.12	-0.13	0.08	1.00							
(9) Per. Health Status 45 – 64	0.55	0.25	0.01	0.30	0.34	0.06	-0.34	0.35	1.00						
(10) Per. Health Status 65+	0.52	0.38	-0.04	0.14	0.34	0.11	-0.33	0.14	0.89	1.00					
(11) Age 15 – 24	-0.31	-0.12	0.44	-0.34	-0.24	-0.29	-0.29	-0.03	0.11	0.21	1.00				
(12) Employment Rate	0.39	0.52	-0.28	-0.08	0.46	0.18	0.14	-0.28	0.36	0.55	-0.08	1.00			
(13) Voluntary Ins.	0.59	0.33	-0.39	0.18	0.96	0.05	-0.10	-0.05	0.38	0.38	-0.26	0.43	1.00		
(14) Supplemental Ins.	0.47	0.40	-0.33	0.09	0.24	-0.01	-0.25	0.08	0.36	0.42	0.00	0.18	0.32	1.00	
(15) Compulsory Ins.	0.23	0.38	-0.17	-0.06	0.07	0.03	-0.37	-0.15	0.18	0.34	0.24	0.32	0.08	0.53	1.00

Uses natural log of Life Expectancy, z-score of Coordination, Original values Obesity, Debt to GDP, Population Insured, Year, Health Status, GDP per Capita, Age, Post Secondary, Employment Rate, Voluntary, Supplemental and Compulsory Insurance.

The Spearman's Rank demonstrates that the most profound correlation among variables exists between the independent variable Percent Insured, and Perceived Health Status rather than the independent variable thereby confirming the relationship between the independent and dependent variables is not due to correlation. Notably though from the Spearman's rank, it is noticed that the relationship between independent and dependent variables is positive, indicating that when Coordination increases, the Life Expectancy increases in a favorable manner.

4.2.2.3 Homoscedasticity

Homoscedasticity happens when the variance of the error is not constant across observations, thus resulting in inefficient estimates and invalid statistical tests. To test for this, the Breusch-Pagan test is used where the null hypothesis is that the variance of errors is constant and there is no heteroscedasticity.

Table 79: Breusch-Pagan/Cook-Weisberg Test

Breusch-Pagan/Cook-Weisberg Test	
H0: Constant Variance	
Chi2(1)	= 45.35
Prob > chi2	= 0.000

Because of the nature of the Breusch-Pagan test, a statistically insignificant value means that the null hypothesis is rejected and instead affirm there is heteroscedasticity within the model. The remediation for this issue is to run the model with Robust Standard Errors as was done below.

Table 80: Linear Regression Model of Log of Life Expectancy Total and z-score of Coordination with Robust SE

	Coefficient	**Robust Std. Error**	**t**	**P>|t|**	**95% CI**	
Coordination	0.002	0.001	2.120	0.035	0.000	0.005
Percent Population Obesity	-0.001	0.000	-7.600	0.000	-0.001	-0.001
Debt-to-GDP Ratio	0.000	0.000	5.260	0.000	0.000	0.000
Percent Population Insured	0.003	0.000	7.280	0.000	0.002	0.003

Year	0.001	0.000	4.340	0.000	0.001	0.002
Upper Post Secondary Education	-0.001	0.000	-9.480	0.000	-0.001	-0.001
Per. Health Status 15 to 24	-0.001	0.000	-5.710	0.000	-0.001	-0.001
Per. Health Status 45 to 64	0.002	0.000	9.980	0.000	0.001	0.002
Perceived Health Status 65+	0.000	0.000	-3.130	0.002	-0.001	0.000
Age 15 – 24	-0.003	0.001	-5.340	0.000	-0.004	-0.002
Employment Rate	0.001	0.000	3.750	0.000	0.000	0.001
Voluntary Insurance	-0.001	0.000	-5.070	0.000	-0.002	-0.001
Supplemental Insurance	0.000	0.000	6.560	0.000	0.000	0.000
Compulsory Insurance	0.000	0.000	-4.500	0.000	0.000	0.000
Constant	2.045	0.519	3.940	0.000	1.025	3.065

Notes: Uses natural log Total Life Expectancy, z-score of Coordination, Imputed Debt-to-GDP Ratio, Imputed and Transformed Percent of Population Covered by Insurance, Imputed Upper Post Secondary, Imputed Perceived Health Status 45 – 64, Transformed Imputed Perceived Health 15-24, Age, Voluntary, Supplemental and Compulsory insurance. Findings based on n = 407, p-value 0.000, R-squared = 0.844, Root MSE = 0.014.

4.2.2.4 Normality of Residuals

The residuals are obtained within the post-estimation efforts and Skewness and Kurtosis tested to assess whether the residuals themselves are normally distributed. The null hypothesis of this test is that it is normally distributed. From the above section, it was shown that there is heteroscedasticity within the model.

Table 81: Skewness and Kurtosis Test for Normal Data

Skewness and Kurtosis Test for Normal Data

Variable	Obs	Pr(skewness)	Pr(kurtosis)	Adj. chi2(2)	Prob>chi2
Residuals	407	0.000	0.000	33.26	0.000

Based on the P-value, the null hypothesis is rejected and concludes that the residuals themselves are normally distributed.

4.2.2.5 Multicollinearity

The Variance Inflation Factor (VIF) is utilized and finds there are significant issues of correlation between the variables below:

Table 82: Inflation Factor Table

	VIF	1/VIF
Per. Health Status 65+	13.92	0.072
Perceived Health Status 45 – 64	13.70	0.073
Employment Rate	3.14	0.319
Age 15 – 24	2.85	0.351
Percent Population Insured	2.71	0.369
Voluntary Insurance	2.71	0.369
Perceived Health Status 15 – 24	2.53	0.395
Coordination	2.27	0.441
Supplemental Insurance	2.24	0.447
Obesity Rate	2.23	0.448
Compulsory Insurance	2.22	0.450
Upper Post Secondary Education	2.02	0.494
Debt-to-GDP Ratio	1.63	0.615
Year	1.38	0.724
Mean	3.97	

Notes: Uses natural log Total Life Expectancy, z-score of Coordination, Imputed Debt-to-GDP Ratio, Imputed and Transformed Percent of Population Covered by Insurance, Imputed Upper Post Secondary, Imputed Perceived Health Status 45 – 64, Transformed Imputed Perceived Health 15-24, Age, Year, Voluntary, Supplemental and Compulsory Insurance.

Rerunning the model from **Table 80** but omit the Perceived Health Status 65 plus from the next iteration of the model for variance inflation.

Table 83: Linear Regression Model of Log of Life Expectancy with Robust Standard Error

	Coefficient	Robust Std. Error	t	P>|t|	95% CI	
Coordination	0.002	0.001	1.560	0.120	0.000	0.004
Percent Population Obesity	-0.001	0.000	-8.370	0.000	-0.001	-0.001
Debt-to-GDP Ratio	0.000	0.000	5.860	0.000	0.000	0.000
Percent Population Insured	0.003	0.000	8.210	0.000	0.002	0.003
Year	0.001	0.000	4.180	0.000	0.001	0.002
Upper Post Secondary Education	-0.001	0.000	-9.370	0.000	-0.001	0.000
Per. Health Status 15 to 24	-0.001	0.000	-4.560	0.000	-0.001	0.000
Per. Health Status 45 to 64	0.001	0.000	16.030	0.000	0.001	0.001
Age 15 – 24	-0.003	0.001	-6.190	0.000	-0.004	-0.002
Employment Rate	0.000	0.000	2.860	0.004	0.000	0.001
Voluntary Insurance	-0.001	0.000	-6.040	0.000	-0.002	-0.001
Supplemental Insurance	0.000	0.000	6.290	0.000	0.000	0.000
Compulsory Insurance	0.000	0.000	-3.940	0.000	0.000	0.000
Constant	2.131	0.517	4.120	0.000	1.116	3.147

Notes: Uses natural log Total Life Expectancy, z-score of Coordination, Imputed Upper Post Secondary, Imputed Perceived Health Status 45 – 64, density of population demographic, Age, Debt to GDP Ratio, Voluntary, Supplemental and Compulsory Insurance, . Findings based on n = 407, F-Statistic = 146.27, p-value 0.000, R-squared = 0.834, Root MSE = 0.014.

The latest model is still not significant but moving forward and rerunning the VIF to check this updated finding for multicollinearity, the issue is resolved.

Table 84: Variance Inflation Factor Table

	VIF	1/VIF
Age 15 – 24	2.75	0.363
Employment Rate	2.74	0.366
Per. Health Status 45 – 64	2.70	0.370
Voluntary Insurance	2.63	0.380
Percent Total Population Insured	2.61	0.383
Compulsory Insurance	2.21	0.453
Coordination	2.17	0.460
Supplemental Insurance	2.14	0.467
Obesity Rate	2.14	0.468
Perc. Health Status 15 – 24	2.05	0.488
Post Secondary Education	2.02	0.495
Debt-to-GDP Ratio	1.60	0.625
Year	1.38	0.726
Mean	2.24	

Notes: Uses natural log Total Life Expectancy, z-score of Coordination, Imputed Upper Post Secondary, Imputed Perceived Health Status 45 – 64, Compulsory Insurance, Supplemental Insurance, Voluntary Insurance, Obesity Rate, Perceived health status 15 -24, debt-to-gdp ratio.

4.3 Discussion

Recalling that the Coordination Index is a composite of indices summated by z-scores of their distributions, simply inferring from these requires a bit of tact as compared to normal rankings. Further compounding the difficulty in translation is that Life Expectancy dependent variable is also transformed with natural log. Regression analysis ultimately shows that Coordination does not have a significant association with Life Expectancy, however. Going back to the main research question which is concerned with degrees of coordination and can therefore interpret z-scores as they are meant to be: deviations from the mean, the issue of transformed data is avoided. The overall standard deviation of the entire sample for natural log of Life Expectancy is 0.034. Based on **Table 85** below, relative to the mean distribution of Life Expectancy per year that the United States, depending on the year, is nearly a full standard deviation lower than the

rest of the OECD. Meaning: relative to the rest of the OECD, the United States has lower life expectancy almost a full standard deviation below the mean for all OECD countries per year by over a full year of life.

Table 85: Mean Life Expectancy Total Population shown in natural log

Year	United States	Sample	Sample w/o US
2008	4.359	4.368	4.368
2009	4.363	4.371	4.372
2010	4.366	4.374	4.375
2011	4.366	4.378	4.379
2012	4.367	4.380	4.380
2013	4.367	4.384	4.384
2014	4.368	4.387	4.388
2015	4.366	4.386	4.387
2016	4.366	4.389	4.390
2017	4.364	4.390	4.391
2018	4.366	4.392	4.392
Mean	4.365	4.382	4.382

Turning back to the regression model in **Table 75**, the coefficient attached to Coordination represented an increase towards the median Life Expectancy of.0002 for every unit increase in z-score of Coordination. Which means if coordination increases towards to the level of the mean for all of the OECD, Life Expectancy too would increase by approximately a year when converted from a natural log scale.

4.4 Conclusion

To return to the base hypothesis that there is significant variation Life Expectancy for CME vs LME nations due to the premium placed on profits by more LME oriented nations[12,64,155,156] it was demonstrated the statistical significance of Coordination in the linear regression model of Life Expectancy. The remaining question is to ascertain whether there are significant variations in the Life Expectancy by Coordination levels, for which the Levene's Test for equality of

variances is used. In **Table 86** the test unequivocally concludes that there is significant difference in variances between levels of Coordination.

Table 86: Levene's Test for Equality of Variances

Levene's Test for Equality of Variances

Summary of log of Life Expectancy			
Quartile	**Mean**	**Std. Deviation**	**Frequency**
1	4.362	0.037	102
2	4.375	0.040	102
3	4.390	0.025	102
4	4.400	0.016	101
Total	4.382	0.034	407

	Test Statistic	Interpretation
W0	0.000	The p-value test statistic is statistically significant and there is significant variation for values centered at the mean.
W50	0.000	The p-value test statistic is statistically significant and there is significant variation for values centered at the median.
W10	0.000	The p-value test statistic is statistically significant and there is significant variation for values centered using 10% trimmed mean.

Is the variance from the Levene's Test meaningful, as in: can it be inferred that LME's (those more towards the lower quartile rankings of Coordination) have meaningful lower Life Expectancy on a natural log scale? To address this a Chi-Squared analysis between the quartiles and the life expectancy is useful to ascertain that there is not a significant enough basis to reject the null hypothesis in this instance that these two variables are in fact independent. What is left is that the difference between quartiles of Coordination and total expenditure is in fact randomly based association. This is further corroborated by the very high Pearson Chi-Squared statistic of 306, an indication of greater deviation from what would be expected if the two variables were in fact independent. Based on a p-value of 0.026, there is evidence of significant differences in variances among the groups as laid out. However, the model does not distinguish between other potential influences of life expectancy such as genetic influences, social behaviors (i.e., alcohol usage, gun usage, driving habits and others).

Table 87: Chi-Squared Test on Coordination Quartiles and log of Life Expectancy

	Quartile 1	Quartile 2	Quartile 3	Quartile 4	Total
Total	102	102	102	101	407

Pearson chi2(306)	= 355.946	**Pr**	= 0.026

While the Chi-Squared test demonstrates a random association exists between quartiles of coordination and life expectancy, one more question of the data: is there a significant difference between the quartiles for their respective levels of life expectancy? For this a two-sample t-Test finds that for both high and low levels of coordination (quartiles 1 and 4) as well as mid-levels of coordination (quartiles 2 and 3) there is a significant variation in their respective life expectancy per the below which affirms the initial null hypothesis.

Table 88: T-test of Log of Life Expectancy by Coordination Quartile Level

	Obs	Mean	Std. error	Std. dev	95% conf. interval	
1	102	4.362	0.004	0.037	4.355	4.370
4	101	4.400	0.002	0.016	4.397	4.403
Combined	203	4.381	0.002	0.032	4.379	4.388
Diff		**-0.033**	**0.004**		**-0.046**	**-0.030**
T-statistic		**-9.412**				

	P-value	Interpretation
Pr(T<t)	**0.000**	Reject the null, mean difference is significantly greater than or less than zero
Pr(|T| > |t|)	**0.000**	Reject the null, p-value of difference between samples is statistically significantly different from 0
Pr(T > t)	**1.000**	Fail to reject the null, mean difference is not significantly greater than or less than zero

	Obs	Mean	Std. error	Std. dev	95% conf. interval	
2	102	4.375	0.004	0.040	4.367	4.383
3	102	4.390	0.002	0.025	4.385	4.395
Combined	204	4.383	0.002	0.034	4.378	4.387
Diff		-0.015	0.005		-0.024	-0.006
T-statistic		**-3.235**				

	P-value	Interpretation
Pr(T<t)	**0.001**	Reject the null, mean difference is significantly greater than or less

		than zero
Pr(|T| > |t|)	**0.001**	Reject the null, p-value of difference between samples is statistically significantly different from 0
Pr(T > t)	**0.999**	Fail to reject the null, mean difference is not significantly greater than or less than zero

4.5 Limitations

There are several limitations to address. As explained in Chapter 2, mean imputation was heavily leveraged to deal with missing data. While able to fill in those missing data gaps, it does inject some variance and uncertainty into the models. As such, using imputed data poses a limitation. Additionally, Life Expectancy was used as the dependent variable because it had the highest propensity of fit, as seen by Adjusted R-Squared and Root MSE—however, these are not indicative necessarily of the quality-of-Life Expectancy nor of its validity as a measure for use in quality of life. At base measurement of relationship between Life Expectancy and Coordination, as seen in **Table *83*** the relationship makes perfect sense within the confines of the conceptual framework: as coordination increases so too does the life expectancy. Similarly, the lack of standardized measures and definitions across borders presents a complex and confounding issue for how the various covariates can be used across nations. Lastly, the challenges in interpretations of the coefficients and variables through heavy usage of z-scores, natural logs and other transformations present a limitation. However, this is a minor limitation as the main research questions deal with associations and relationships and not the specific coefficients of the regression models themselves.

4.6 Strengths

The vastness of datasets, ranging from economic, political, sociological, legal and health outcomes measures is a strength as no one index exerts undue influence on the outcomes.

Likewise, the compendium of indices comes from a variety of organizations on the political spectrum: ranging from arguably more egalitarian/Left leaning sources such as the OECD data and Social Progress Index to the conservative/Right of the Economic Freedom scores from the Heritage Organization. Finally, the regression fits into the framework as laid out in the conceptual framework and as such adds validity to the findings of the Levene's Test on the variances which is the main research question: market and benefits Coordination is a meaningful measure with regards to performance, and the variances between nations based on levels of Coordination are themselves statistically significant.

Chapter 5: Evaluating the Relationship Between the Coordination Index and Healthcare Delivery Performance in OECD Countries

5.1 Methods

A standard linear regression model is predicated on satisfaction of basic assumptions such as linearity, no autocorrelation, homoscedasticity, normality of residuals, and no multicollinearity. Linearity will be checked by plotting the residuals and looking for a random scattering around zero. Correlation checked via a Spearman's rank; homoscedasticity via the Breusch-Pagan test; normality of residuals via the Shapiro-Wilk test; and Variance Inflation Factor to demonstrate no perfect multicollinearity. The proposed initial model is as follows:

$$E(Y_{del}) = f(\beta_0 + \beta_{ih}X1_{i65} + \beta_{ih}X2_{iTob} + \beta_{ih}X3_{iOb} + \beta_{ih}X4_{iCoor} + \beta_{ih}X5_{iDebt} + \beta_{ih}X6_{iIns} + \beta_{ih}X7_{UHC} + \beta_{ih}X8_{Age} + \beta_{ih}X9_{PerceivedHealthStatus} + \beta_{ih}X10_{Educational\ Attainment} + \beta_{ih}X11_{GDPperCapita} + \beta_{ih}X12_{TotalHospitalsperMillion} + \beta_{ih}X13_{BirthsperK} + \beta_{ih}X14_{LargestPopSegment} + \beta_{ih}X15_{EmploymentRate} + \beta_{ih}X16_{VolIns} + \beta_{ih}X17_{SuppIns} + \beta_{ih}X18_{CompulsIns} + Time + U_{it}))$$

Where, Y_{del} is an outcome variable of primary care and preventative health measures. And:

Dependent Variables

AM_{bg}	= Avoidable Mortality Deaths per 100 000 (both genders) [221]
PM_t	= Asthma and Chronic Obstructive Pulmonary Disease Hospital Admissions per 100 000 (total) [221]
CHF_t	= Congestive Heart Failure and Hypertension Hospital Admissions per 100 000 (total) [221]
D_t	= Diabetes Hospital Admissions per 100 000 (total) [221]
AMI_{tl}	= Acute Myocardial Infarction 30-day mortality per 100 000 (total linked) [221]
HS_{tl}	= Hemorrhagic stroke 30-day mortality per 100 000 (total linked) [221]
IM_{nm}	= Infant mortality, no minimum threshold of gestation period or birthweight per 1 000 live births[221]
MM_{hk}	= Maternal mortality deaths per 100 000 live births[221]
SU_{hd}	= Suicide within 30 days after discharge among patients diagnosed with a mental disorder total standardized rate per 100[221]
BC_{sp}	= Breast cancer five-year net survival percentage[221]
CC_{sp}	= Cervical cancer five-year net survival percentage[221]
CLC_{sp}	= Colon cancer five-year net survival percentage[221]
LC_{sp}	= Lung cancer five-year net survival percentage[221]
$IDTP_p$	= Immunization: Diphtheria, Tetanus, Pertussis percentage of children[221]
IM_p	= Immunization: Measles percentage of children[221]
IHB_p	= Immunization: Hepatitis B percentage of children[221]
II_p	= Immunization: Influenza percentage of adults 65 and over[221]

Key Independent Variable

$X4_{iCoor}$	= Composite Coordination Index

Control Variables

$X1_{i65}$	= Percent of Population over age 65[221]
$X2_{iTob}$	= Tobacco Consumption (% population age 15+ who are daily smokers) [221]

$X3_{iOb}$ = Obesity (Obese population measured percentage of total population)[221]
$X5_{iDebt}$ = National Debt-to-GDP Ratio[222]
$X6_{iIns}$ = Percent of Total Population Covered by Public or Primary Voluntary Health Insurance Coverage[221]
$X7_{UHC}$ = Government/Compulsory Health Insurance Coverage[223]
$X8_{Age}$ = Age as percent of population structured in ranges[221]
$X9_{HealthStatus}$ = Perceived Health Status,[226]
$X10_{Education}$ = Educational attainment,[227]
$X11_{GDP}$ = GDP per Capita as US Dollars per person PPP converted,[228]
$X12_{TotalHospitals}$ = Total number of hospitals per 1 000 000,[229]
$X13_{BirthsperK}$ = Total births per 1 000,[230]
$X14_{LargestPopSeg}$ = Race as measured by the population density of the largest group,[231]
$X15_{EmpRate}$ = Employment rate for people 15 to 64 years[232]
$X16_{VolIns}$ = Voluntary Insurance Rate[234]
$X17_{SuppIns}$ = Supplemental Insurance Rate[234]
$X18_{CompulsIns}$ = Compulsory Insurance Rate[234]
Time = Year
U_{it} = Error term

To finally determine the efficacy of the models a P-value less than or equal to 0.05 for the individual measures within the model, as well as the overall model itself. Further, because the nature of the hypothesis and methods are oriented towards a social sciences inquiry, the R-squared threshold becomes less of a concern as well should the parts of the model themselves be significant.[232]

5.1.1 Data

Recent releases of secondary, publicly available data were collected from: avoidable mortality deaths per 100 000 population,[240] avoidable admissions: respiratory disease, avoidable admissions: uncontrolled diabetes, care for acute exacerbation of chronic conditions, in-hospital mortality following acute myocardial infarction, in-hospital mortality following stroke, unplanned hospital re-admissions for mental disorders, screening, survival and mortality for cervical, breast and colorectal cancers, childhood vaccination rate, and influenza vaccination rates for older adults. Covariates will be: Percent of Population over age 65;[221] Tobacco Consumption (% population age 15+ who are daily smokers);[221] Obesity (Obese population measured percentage of total population);[221] National Debt-to-GDP Ratio;[222] Percent of Total

Population Covered by Public or Primary Voluntary Health Insurance Coverage;[221] Government/Compulsory Health Insurance Coverage;[223] Age as percent of population structured in ranges,[221] Perceived Health Status,[224] Educational attainment,[225] GDP per Capita as US Dollars per person PPP converted,[226] number of hospitals per 1 000 000,[227] births per 1 000,[228] race as measured by the population density of the largest group,[229] employment rate for people 15 to 64 years,[230] insurance type (Voluntary, Supplementary, or Compulsory)[231] and, year. Data was subsequently downloaded, collated in Microsoft Excel Office 365 and then loaded into Stata 17.0. Data was subsequently downloaded, collated in Microsoft Excel Office 365 and then loaded into Stata 17.0.

5.1.2 Measures

5.1.2.1 Covariates

Section 3.1.2.1 dealt with covariates for all the models and mean imputation required to mediate missing values as identified in **Table *51***. Descriptives are shown in the **Table 32** of the original values which can be compared relative to the imputed distributions in **Table 33**.

5.1.2.2 Outcome Variable

The outcome dependent variable will be avoidable mortality deaths per 100 000 population[240] The original intent was to combine multiple measures to be as all-encompassing as possible in some fashion so as not to limit the analysis to a narrow depiction of system quality. However, being mindful of some of the limitations born out in the Coordination variable generation process, consequently it is preferable to instead look to a single dependent variable rather than another composite. First is to look at the descriptive statistics of the potential dependent variables to identify which ones may present significant data gaps. As the goal is the most macro level

measure for either a process or outcome measure: Avoidable Mortality deaths per 100 000 population[240] seems a viable option and does have a high degree of complete records and satisfies the need for an outcome measure.[241]

While the previous chapter dealt with Life Expectancy, and as the concept of which along with Avoidable Mortality are indelibly linked, they do measure different variables. Life Expectancy is based on mortality of a given population and impacted by a litany of factors, as compared to Avoidable Mortality which is a different perspective seeking to capture the number of deaths that could be avoided or prevented with efficacious and timely delivery of healthcare services. While higher avoidable mortality rates would yield better life expectancy findings, they are in fact separate measures and suitable for study as such.

Table 89: Descriptive Summary Statistics Dependent Variables in Original Values

Descriptive Summary

	Obs	Mean	Std. deviation	Min	Max
Avoidable Mortality Total Population	387	238.974	96.492	130.000	597.000

Notes: All variables shown are original values.

5.1.2.1 Missing Values for Avoidable Mortality

As established in Chapter 2, the Little's Test[203–205] is used to determine whether significant differences exist between means of different missing-value patterns[204] which helps inform on the type of missing data. Full findings of the typology work can be found in Appendix I.

Ultimately it is determined that the missing data is in fact MAR and unconditional mean imputation[206]as a method to complete the data. Detailed analysis of imputation methods can be found in Appendix II.

The results of the imputation effort are shown below compared to the original distribution.

Table 90: Descriptive Summary of Mean Avoidable Mortality and Original Values

	Obs.	Mean	Std. dev	Min	Max
Imputed	407	238.974	94.085	130	597
Original	387	238.974	96.492	130	597

Results:

What becomes apparent from an initial read of average avoidable mortality by country from the first year of study to last (2008 to 2018) in is that there is wide variation in initial and final year results, as well as the magnitude of change.

Table 91: Average Avoidable Mortality by OECD Nation (shown in deaths per 100 000)

	2008	2018
Australia	181.000	151.000
Austria	219.000	188.000
Belgium	228.000	178.000
Canada	216.000	174.000
Chile	259.000	204.000
Costa Rica	213.000	217.000
Czechia	332.000	260.000
Denmark	255.000	180.000
Estonia	459.000	320.000
Finland	246.000	188.000
France	192.000	238.974
Germany	221.000	196.000
Greece	238.974	193.000
Hungary	503.000	415.000
Iceland	183.000	147.000
Ireland	234.000	172.000
Israel	179.000	134.000
Italy	178.000	238.974
Japan	184.000	140.000
Korea	248.000	154.000
Latvia	564.000	432.000
Lithuania	597.000	400.000
Luxembourg	191.000	156.000
Mexico	409.000	384.000
Netherlands	193.000	155.000
New Zealand	225.000	238.974
Norway	196.000	238.974
Poland	367.000	287.000
Portugal	221.000	185.000
Slovak Republic	425.000	332.000

Slovenia	277.000	209.000
Spain	189.000	149.000
Sweden	191.000	150.000
Switzerland	169.000	130.000
Türkiye	238.974	238.974
United Kingdom	239.000	204.000
United States	293.000	277.000

Notes: uses Avoidable Mortality per 100 000 from OECD[221]

The trend of variation is similarly borne out by quartile level in **Table *92*** where the increase in Quartile corresponds to further deviation from the mean.

Table 92: Average Avoidable Mortality by Coordination Quartile (shown in deaths per 100 000)

	2008	**2018**
Quartile 1	295.325	275.695
Quartile 2	298.125	261.195
Quartile 3	248.250	200.111
Quartile 4	203.714	183.996

Notes: uses Avoidable Mortality per 100 000 from OECD[221]

Lastly, the correlation between the two variables is demonstrated to be -0.320 which indicates a moderate degree of correlation which is safe to be assumed with a homogenous sample and does not cause consternation.

Table 93: Correlation Matrix of Correlation and Avoidable Mortality

Variables	**(1)**	**(2)**
(1) Coordination Index	1.000	
(2) Avoidable Mortality	-0.320	1.000

Going forward, the models will utilize the Avoidable Mortality on a rescaled basis to deaths per 10 000. Distribution shown below.

Table 94: Descriptive Summary of Rescaled, Mean Avoidable Mortality and Original Values

	Obs.	**Mean**	**Std. dev**	**Min**	**Max**
Rescaled	407	23.897	9.409	13	59.7
Imputed	407	238.974	94.085	130	597
Original	387	238.974	96.492	130	597

5.2 Results

5.2.1 Regression

The first regression model shown below in ***Table 95*** utilizes the original values of the data and none of the imputed values. Doing this allows for meaningful comparison between the values as they were given and those garnered from the imputation methods taken. The model in **Table 100** delivers a very high Adjusted R-squared and a low RMSE suggesting that it explains a good deal of variation within Total Health Expenditure as well as soundly predicting the values from the model to the actual observed values.

Table 95: Linear Regression Model of Avoidable Mortality per 10 000 and z of Coordination Using Original Values

	Coefficient	Std. Error	t	P>|t|	95% CI	
Coordination	-0.215	0.705	-0.310	0.762	-1.641	1.210
Percent Population Obesity	0.418	0.197	2.120	0.040	0.020	0.816
Debt-to-GDP Ratio	-0.089	0.056	-1.590	0.121	-0.202	0.025
Percent Total Population Insured	-13.004	12.149	-1.070	0.291	-37.576	11.569
Government/Compulsory Health	-6.387	3.401	-1.880	0.068	-13.267	0.492
Year	-0.516	0.267	-1.930	0.061	-1.056	0.025
Tertiary Education	2.520	7.105	0.350	0.725	-11.851	16.890
Upper Post Secondary Education	2.326	7.096	0.330	0.745	-12.027	16.678
Below Secondary Education	2.381	7.134	0.330	0.740	-12.050	16.812
Perceived Health Status 15 to 24 years	0.229	0.333	0.690	0.496	-0.445	0.904
Perceived Health Status 25 to 44 years	-0.340	0.311	-1.090	0.280	-0.968	0.288
Perceived Health Status 45 to 64 years	0.037	0.240	0.150	0.879	-0.449	0.523
Perceived Health Status 65+	-0.083	0.133	-0.620	0.537	-0.352	0.186
GDP Per Capita	-0.044	0.023	-1.930	0.061	-0.090	0.002
Percent Population <15	-5.546	6.272	-0.880	0.382	-18.233	7.141
Percent Population 15 – 24	-0.541	1.067	-0.510	0.615	-2.698	1.616
Percent Population 15 – 64	-4.354	6.214	-0.700	0.488	-16.923	8.214
Percent Population 65+	-3.249	6.223	-0.520	0.605	-15.835	9.338
Total Number of Hospitals	-0.068	0.049	-1.390	0.173	-0.167	0.031
Employment Rate 15 - 64	-0.07811	0.227814	-0.34	0.734	-0.53891	0.38269
Percent Use Tobacco	0.412564	0.230264	1.79	0.081	-0.05319	0.878317

Births per 1 000	-24.4632	13.24698	-1.85	0.072	-51.2578	2.331335
Density Largest Segment Population	0.82459	1.053418	0.78	0.438	-1.30615	2.95533
Voluntary Insurance	13.62206	12.24379	1.11	0.273	-11.1434	38.38747
Supplemental Insurance	-0.09386	0.041715	-2.25	0.03	-0.17823	-0.00948
Compulsory Insurance	0.082372	0.036993	2.23	0.032	0.007547	0.157198
Constant	1239.718	1091.995	1.14	0.263	-969.05	3448.485

Notes: Findings based on n = 66. Uses rescaled per 10 000 Avoidable Mortality, z-score of Coordination, Original values Obesity, Debt to GDP, Population Insured, UHC as a dummy variable for percent of population insured, Year, Tertiary, Upper Post, Health Status, GDP per Capita, Age, Employment Rate, Tobacco Usage, Density of Population Segment, Births, and Transformed Below Secondary Education, Voluntary, Supplementary, and Compulsory Insurance. F-Statistic = 26.90, p-value 0.0000, R-squared = 0.947, Adjusted R-Squared = 0.912, Root MSE = 2.139.

Results demonstrate Coordination to have a statistically insignificant relationship with the rescaled Avoidable Mortality for the total population utilizing both the original values and the imputed; however, this is not integral to the overall hypothesis and research question but of consequence, nonetheless.

Table 96: Linear Regression Model of Avoidable Mortality and z-score of Coordination

	Coefficient	Std. Error	t	P>|t|	95% conf. interval	
Coordination	-0.275	0.350	-0.790	0.433	-0.963	0.481
Percent Population Obesity	0.290	0.058	4.970	0.000	0.175	0.381
Debt-to-GDP Ratio	-0.030	0.009	-3.550	0.000	-0.047	-0.010
Percent Total Population Insured	-0.887	0.132	-6.740	0.000	-1.146	-0.391
Government/Compulsory Health	0.560	0.742	0.750	0.451	-0.899	2.313
Year	-0.171	0.107	-1.610	0.109	-0.381	-0.130
Tertiary Education	0.099	0.047	2.090	0.037	0.006	0.163
Upper Post Secondary Education	0.208	0.037	5.580	0.000	0.135	0.107
Below Secondary Education	5.647	6.444	0.880	0.381	-7.024	7.844
Perceived Health Status 15 to 24 years	0.249	0.095	2.620	0.009	0.062	0.260
Perceived Health Status 25 to 44 years	-0.041	0.090	-0.460	0.649	-0.217	0.263
Perceived Health Status 45 to 64 years	-0.350	0.070	-4.970	0.000	-0.489	-0.192
Perceived Health Status 65+	0.033	0.050	0.670	0.503	-0.064	0.117
GDP Per Capita	-0.005	0.005	-1.070	0.287	-0.015	0.015
Percent Population <15	-0.146	4.379	-0.030	0.973	-8.757	9.051
Percent Population 15 – 24	1.770	0.321	5.510	0.000	1.139	2.044
Percent Population 15 – 64	0.189	4.431	0.040	0.966	-8.523	9.098
Percent Population 65+	1.042	4.418	0.240	0.814	-7.646	9.999
Total Number of Hospitals	-0.016	0.022	-0.710	0.480	-0.060	0.065
Employment Rate 15 - 64	-0.09925	0.063892	-1.55	0.121	-0.22488	0.185
Percent Use Tobacco	0.042824	0.078952	0.54	0.588	-0.11241	0.039
Births per 1 000	-2.34191	3.194592	-0.73	0.464	-8.6232	-5.775

Density Largest Segment Population	0.298691	0.338533	0.88	0.378	-0.36694	0.639
Voluntary Insurance	0.37193	0.097088	3.83	0	0.181033	
Supplemental Insurance	-0.03228	0.014645	-2.2	0.028	-0.06107	
Compulsory Insurance	0.005764	0.017221	0.33	0.738	-0.0281	
Constant	362.5807	492.9325	0.74	0.462	-606.636	1503.360

Notes: Uses Rescaled Mean Imputed Original Values of Avoidable Mortality z-score of Coordination, Original values Obesity, Debt to GDP, Population Insured, UHC as a dummy variable for percent of population insured, Year, Tertiary, Upper Post, Health Status, GDP per Capita, Age, Employment Rate, Tobacco Usage, Density of Population Segment, Births, and Transformed Below Secondary Education,. Voluntary, Supplementary and Compulsory Insurance. Findings based on n = 407, F-Statistic = 51.43, p-value 0.000, R-squared = 0.779, Adjusted R-Squared = 0.764, Root MSE = 4.575.

Both models in ***Table 95***and **Table *96*** are consistent in their initial results of the association between Coordination and Avoidable Mortality in that it is not statistically significant. Testing sub theories, however, about the relationship between variables; notably that within the conceptual framework that relationships and correlations exist between the variables by virtue of the institutions and normative values they represent, a correlation matrix and a regression utilizing the model in ***Table 95*** but with Quartiles of z-score rather than the Coordination index itself can help explain this story.

Table 97: Correlation Matrix of Avoidable Mortality per 10 000, z of Coordination, and Covariates Using Imputed and Original Values

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)
(1) Avoidable Mortality																											
(2) Coordination	1.00																										
(3) Percent Population Obesity	-0.32	1.00																									
(4) Debt-to-GDP Ratio	0.35	-0.44	1.00																								
(5) Percent Total Population Insured	-0.33	-0.07	-0.17	1.00																							
(6) Government/Compulsory Health	-0.50	0.36	-0.51	0.16	1.00																						
(7) Year	-0.38	0.24	-0.29	0.13	0.56	1.00																					
(8) Tertiary Education	-0.16	-0.05	0.11	0.12	0.07	-0.03	1.00																				
(9) Upper Post Secondary Education	-0.37	0.45	-0.19	0.15	0.26	0.35	0.27	1.00																			
(10) Below Secondary Education	0.41	0.12	-0.14	-0.17	0.05	-0.09	-0.05	-0.06	1.00																		
(11) Perc. Health Status 15 to 24 years	-0.42	-0.09	-0.07	0.25	0.13	0.08	-0.15	-0.18	-0.75	1.00																	
(12) Perc. Health Status 25 to 44 years	0.02	-0.09	0.34	0.00	-0.09	-0.16	-0.08	-0.10	0.10	-0.15	1.00																
(13) Perc. Health Status 45 to 64 years	-0.26	0.05	0.30	0.10	0.00	0.05	0.02	0.17	-0.04	-0.04	0.81	1.00															
(14) Perceived Health Status 65+	-0.62	0.18	0.10	0.23	0.16	0.25	0.08	0.44	-0.29	0.23	0.43	0.73	1.00														
(15) GDP Per Capita	-0.59	0.30	0.07	0.12	0.14	0.25	0.10	0.56	-0.29	0.20	0.20	0.53	0.91	1.00													
(16) Percent Population <15	-0.51	0.48	-0.30	0.20	0.40	0.21	0.12	0.47	0.08	-0.04	0.06	0.28	0.56	0.64	1.00												
(17) Percent Population 15 – 24	-0.06	-0.29	0.47	-0.22	-0.35	-0.15	-0.07	-0.05	-0.56	0.35	0.14	0.21	0.27	0.27	-0.20	1.00											
(18) Percent Population 15 – 64	0.19	-0.30	0.45	-0.36	-0.46	-0.30	-0.26	-0.19	-0.39	0.23	0.03	0.01	0.06	0.12	-0.34	0.81	1.00										
(19) Percent Population 65+	0.26	-0.04	0.05	-0.41	-0.15	-0.18	-0.28	-0.28	0.22	-0.20	-0.01	-0.17	-0.26	-0.23	-0.30	-0.18	0.22	1.00									
(20) Total Number of Hospitals	-0.10	0.29	-0.46	0.44	0.41	0.24	0.23	0.21	0.38	-0.21	-0.13	-0.09	-0.10	-0.11	0.36	-0.81	-0.88	-0.42	1.00								
(21) Employment Rate 15 - 64	-0.06	0.25	-0.44	0.03	0.15	0.18	-0.05	0.28	0.11	-0.04	-0.42	-0.34	-0.13	-0.03	0.18	-0.25	-0.13	-0.03	0.25	1.00							
(22) Percent Use Tobacco	-0.32	0.56	-0.27	-0.05	0.29	0.29	0.16	0.54	0.18	-0.21	-0.17	0.13	0.34	0.52	0.65	-0.14	-0.18	-0.20	0.25	0.28	1.00						
(23) Births per 1 000	0.10	0.00	-0.25	0.01	0.20	-0.07	-0.28	-0.23	0.22	0.01	0.01	-0.17	-0.30	-0.40	-0.11	-0.27	-0.27	0.09	0.19	0.13	-0.30	1.00					
(24) Density Largest Segment Pop.	-0.36	0.19	-0.44	0.31	0.35	0.11	0.00	0.00	0.08	0.08	-0.14	-0.04	0.12	0.10	0.49	-0.16	-0.17	-0.16	0.24	0.21	0.22	0.09	1.00				
(25) Voluntary Insurance	0.02	-0.28	0.46	-0.27	-0.35	-0.13	-0.17	-0.07	-0.44	0.26	0.19	0.23	0.23	0.20	-0.21	0.96	0.79	-0.17	-0.79	-0.24	-0.13	-0.21	-0.18	1.00			
(26) Supplemental Insurance	-0.37	0.26	-0.40	0.31	0.73	0.48	0.04	0.32	0.05	-0.03	0.06	0.15	0.25	0.22	0.50	-0.33	-0.47	-0.20	0.42	0.13	0.30	0.06	0.16	-0.31	1.00		
(27) Compulsory Insurance	-0.43	0.39	-0.28	0.06	0.27	0.08	0.00	0.46	-0.18	0.15	0.05	0.12	0.33	0.37	0.34	0.08	-0.06	-0.16	0.02	-0.01	0.15	0.01	0.08	0.07	0.22	1.00	

Uses Avoidable Mortality, z-score of Coordination, Original values Obesity, Debt to GDP, Population Insured, UHC as a dummy variable for percent of population insured, Year, Tertiary, Upper Post, Health Status, GDP per Capita, Age, Employment Rate, Tobacco Usage, Density of Population Segment, Births, and Transformed Below Secondary Education, Voluntary, Supplemental and Compulsory Insurance

Table 98: Linear Regression Model of Avoidable Mortality and Quartile of z-score of Coordination

	Coefficient	Std. Error	t	P>|t|	95% conf. interval	
Quartile Coordination	-0.440	0.290	-1.520	0.130	-1.010	0.131
Percent Population Obesity	0.281	0.059	4.800	0.000	0.166	0.397
Debt-to-GDP Ratio	-0.032	0.009	-3.730	0.000	-0.049	-0.015
Percent Total Population Insured	-0.857	0.133	-6.430	0.000	-1.119	-0.595
Government/Compulsory Health	0.423	0.746	0.570	0.571	-1.044	1.889
Year	-0.175	0.105	-1.670	0.096	-0.381	0.031
Tertiary Education	0.098	0.047	2.090	0.037	0.006	0.190
Upper Post Secondary Education	0.198	0.038	5.210	0.000	0.123	0.273
Below Secondary Education	5.036	6.446	0.780	0.435	-7.639	17.710
Perceived Health Status 15 to 24 years	0.252	0.095	2.650	0.008	0.065	0.438
Perceived Health Status 25 to 44 years	-0.040	0.089	-0.450	0.651	-0.216	0.135
Perceived Health Status 45 to 64 years	-0.353	0.070	-5.060	0.000	-0.490	-0.216
Perceived Health Status 65+	0.040	0.050	0.800	0.423	-0.058	0.138
GDP Per Capita	-0.005	0.005	-1.090	0.277	-0.015	0.004
Percent Population <15	-0.242	4.370	-0.060	0.956	-8.834	8.350
Percent Population 15 – 24	1.714	0.323	5.310	0.000	1.079	2.349
Percent Population 15 – 64	0.107	4.420	0.020	0.981	-8.584	8.799
Percent Population 65+	0.952	4.408	0.220	0.829	-7.716	9.619
Total Number of Hospitals	-0.012	0.023	-0.530	0.598	-0.056	0.032
Employment Rate 15 - 64	-0.100	0.062	-1.610	0.109	-0.221	0.022
Percent Use Tobacco	0.027	0.080	0.340	0.737	-0.130	0.183
Births per 1 000	-2.354	3.187	-0.740	0.461	-8.621	3.914
Density Largest Segment Population	0.317	0.336	0.940	0.347	-0.345	0.978
Voluntary Insurance	0.361	0.097	3.730	0.000	0.171	0.552
Supplemental Insurance	-0.034	0.014	-2.380	0.018	-0.063	-0.006
Compulsory Insurance	0.007	0.017	0.400	0.690	-0.027	0.041
Constant	379.802	490.194	0.770	0.439	-584.031	1343.636

Notes: Uses Rescaled Mean Imputed Original Values of Avoidable Mortality, Quartile of z-score of Coordination, Original values Obesity, Debt to GDP, Population Insured, UHC as a dummy variable for percent of population insured, Year, Tertiary, Upper Post, Health Status, GDP per Capita, Age, Employment Rate, Tobacco Usage, Density of Population Segment, Births, and Transformed Below Secondary Education,. Voluntary, Supplementary and Compulsory Insurance. Findings based on n = 407, F-Statistic = 51.73, p-value 0.000, R-squared = 0.780, Adjusted R-Squared = 0.765, Root MSE = 4.565.

The initial model in **Table *96*** above shows a very encouraging adjusted r-squared value indicative of a good fit to the model. Additionally, a low RMSE indicative of predictive capacity further supporting the veracity of the initial model.

Comparing models in **Table *96***and **Table *98*** we find nearly identical results for R-squared, overall significance, adjusted R, and RMSE. Looking deeper at the results, the coefficients themselves are nearly identical with an overall variance of 0.048 when the error term is removed. With regards to the overall significance of the variables, the models differ by an average of 0.003 minimum of 0.149 and a maximum of 0.303. I believe these results, coupled with the final sensitivity analysis in **Table *28*** indicate that the covariates themselves are considerable influencers to eroding the overall significance of the model.

Accordingly, based on these findings as well as the degrees of correlation within the model it is readjusted to omit UHC, Year, Below Secondary Education, Health Status 25 – 44, Health Status 65 plus, GDP per Capita, Age under 15, Age 15 – 64, Age 65 plus, Total Hospitals, Employment Rate, Tobacco Usage, Density of the Largest segment, Births per thousand, Compulsory Insurance based on their being insignificant and correlations in this model and the model rerun.

Table 99: Linear Regression Model of Avoidable Mortality Total and z-score of Coordination

	Coefficient	Std. Error	t	P>|t|	95% conf. interval	
Coordination	-0.327	0.318	-1.030	0.304	-0.952	0.298
Obesity Rate	0.265	0.049	5.430	0.000	0.169	0.361
Debt-to-GDP Ratio	-0.013	0.007	-1.870	0.063	-0.026	0.001
Population Insured	-0.821	0.099	-8.310	0.000	-1.015	-0.627
Tertiary Education	0.079	0.034	2.330	0.020	0.012	0.146
Post Secondary	0.202	0.022	9.040	0.000	0.158	0.246
Per. Health Status 15 – 24	0.246	0.058	4.220	0.000	0.132	0.361
Per. Health Status 45 – 64	-0.388	0.024	-15.940	0.000	-0.436	-0.340
Age 15 – 24	0.638	0.163	3.910	0.000	0.317	0.959
Voluntary Insurance	0.328	0.077	4.270	0.000	0.177	0.479
Supplementary Insurance	-0.030	0.012	-2.470	0.014	-0.053	-0.006
Constant	51.366	10.168	5.050	0.000	31.375	71.356

Notes: Uses Rescaled Mean Imputed Original Values of Avoidable Mortality z-score of Coordination, Original values Obesity, Debt to GDP, Population Insured, Tertiary, Upper Post, Health Status, GDP per Capita, Age, and Voluntary

Supplementary Insurance types,. Findings based on n = 407, F-Statistic = 103.00, p-value 0.000, R-squared = 0.742, Adjusted R-Squared = 0.734, Root MSE = 4.850.

The updated model presents similar findings to the original with equal levels of model fit and significance. A further iteration is run omitting Debt to GDP ratio and the density of the largest segment of the population.

Table 100: Linear Regression Model of Avoidable Mortality Total and z-score of Coordination

	Coefficient	Std. Error	t	P>|t|	95% conf. interval	
Coordination	-0.173	0.308	-0.560	0.575	-0.778	0.432
Obesity Rate	0.276	0.049	5.680	0.000	0.180	0.371
Population Insured	-0.790	0.098	-8.090	0.000	-0.982	-0.598
Tertiary Education	0.078	0.034	2.280	0.023	0.011	0.145
Post Secondary	0.213	0.022	9.910	0.000	0.171	0.256
Per. Health Status 15 – 24	0.254	0.058	4.350	0.000	0.139	0.369
Per. Health Status 45 – 64	-0.398	0.024	-16.690	0.000	-0.445	-0.351
Age 15 – 24	0.769	0.148	5.190	0.000	0.478	1.060
Voluntary Insurance	0.305	0.076	4.010	0.000	0.155	0.454
Supplementary Insurance	-0.029	0.012	-2.400	0.017	-0.053	-0.005
Constant	47.140	9.944	4.740	0.000	27.591	66.689

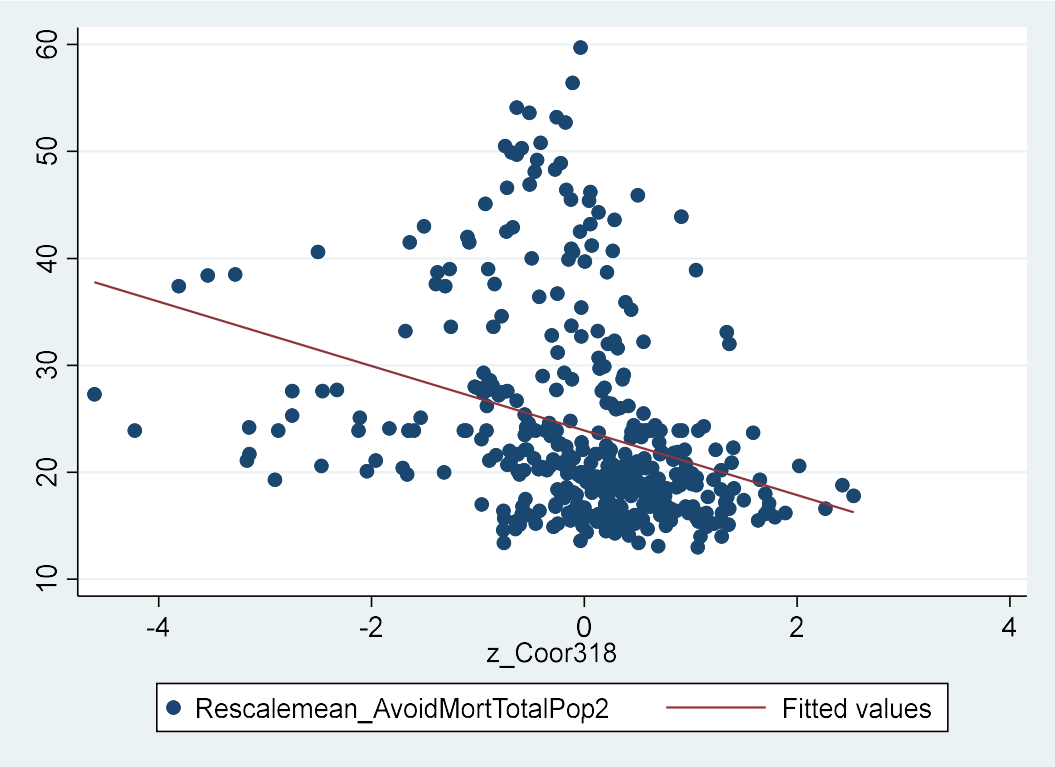
Notes: Uses Rescaled Mean Imputed Original Values of Avoidable Mortality z-score of Coordination, Original values Obesity, Debt to GDP, Population Insured, Year, Tertiary, Upper Post, Health Status, Age and Voluntary Supplementary Insurance,. Findings based on n = 407, F-Statistic = 112.25, p-value 0.000, R-squared = 0.739, Adjusted R-Squared = 0.733, Root MSE = 4.865.

5.2.2 Post Estimation

5.2.2.1 Linearity

To assess whether there is a linear relationship, the transformed values for Avoidable Mortality for the total population and the z-score of Coordination Index are plotted and demonstrate there appears to be a linear relationship with a clustering around the mean and higher degrees of Avoidable Mortality towards the lower of z-score of Coordination.

Figure 8: Scatter Plot of Coordination and Avoidable Mortality Total Population



This justifies the using of Avoidable Mortality and satisfies that a linear relationship does exist between it and Coordination.

5.2.2.2 Correlation

To examine the strength and direction of the association between variables in the model, a Spearman Rank Correlation is used. Just as the linearity suggests that as Coordination increases, a slight inverse relationship of Avoidable Mortality exists.

Table 101: Spearman Rank Correlation Matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) Avoidable Mortality	1.000										
(2) Coordination	-0.430	1.000									
(3) Obesity	0.481	-0.401	1.000								
(4) Population Insured	-0.581	0.349	-0.413	1.000							
(5) Tertiary Education	-0.456	0.418	-0.148	0.373	1.000						
(6) Post Secondary Education	0.408	-0.095	-0.191	-0.128	-0.141	1.000					
(7) Per. Health Status 15 – 24	0.024	-0.163	0.225	-0.125	-0.069	0.076	1.000				

(8) Per. Health Status 45 – 64	-0.530	0.249	0.005	0.343	0.479	-0.341	0.349	1.000			
(9) Age 15 - 24	0.187	-0.124	0.439	-0.242	-0.008	-0.290	-0.033	0.109	1.000		
(10) Voluntary Insurance	-0.543	0.330	-0.391	0.957	0.421	-0.099	-0.050	0.375	-0.264	1.000	
(11) Supplemental Insurance	-0.473	0.404	-0.333	0.244	0.485	-0.249	0.077	0.364	0.003	0.316	1.000

Uses Rescaled Mean Imputed Original Values of Avoidable Mortality z-score of Coordination, Original values Obesity, Population Insured, Year, Tertiary, Upper Post, Health Status, Age, Voluntary and Supplemental Insurance.

The Spearman's Rank demonstrates that the most profound correlation among variables exists between the independent variable population insured, as well as obesity and perceived health rather than the independent variable thereby confirming the relationship between the independent and dependent variables is not due to correlation. Notably though from the Spearman's rank, the relationship between independent and dependent variables is negative, indicative that when Coordination increases, the Avoidable Mortality decreases, suggesting something to the effect of diminishing returns perhaps within the sample population.

5.2.2.3 Homoscedasticity

Homoscedasticity happens when the variance of the error is not constant across observations, thus resulting in inefficient estimates and invalid statistical tests. To test for this, the Breusch-Pagan test where the null hypothesis is that the variance of errors is constant and there is no heteroscedasticity is used.

Table 102: Breusch-Pagan/Cook-Weisberg Test

Breusch-Pagan/Cook-Weisberg Test	
H0: Constant Variance	
Chi2(1)	= 121.40
Prob > chi2	= 0.000

Because of the nature of the Breusch-Pagan test, a statistically insignificant value means that the null is rejected and instead affirm there is heteroscedasticity within the model. The remediation for this issue is to run the model with Robust Standard Errors as was done below.

Table 103: Linear Regression Model of Avoidable Mortality Total Population and z-score of Coordination with Robust SE

	Coefficient	Robust Std. Error	t	P>|t|	95% CI	
Coordination	-0.173	0.289	-0.600	0.551	-0.742	0.396
Obesity Rate	0.276	0.042	6.580	0.000	0.193	0.358
Population Insured	-0.790	0.106	-7.440	0.000	-0.998	-0.581
Tertiary Education	0.078	0.030	2.590	0.010	0.019	0.137
Post Secondary	0.213	0.021	10.240	0.000	0.172	0.254
Per. Health Status 15 – 24	0.254	0.050	5.120	0.000	0.157	0.351
Per. Health Status 45 – 64	-0.398	0.029	-13.610	0.000	-0.455	-0.340
Age 15 – 24	0.769	0.163	4.710	0.000	0.448	1.089
Voluntary Insurance	0.305	0.073	4.170	0.000	0.161	0.448
Supplementary Insurance	-0.029	0.008	-3.470	0.001	-0.045	-0.013
Constant	47.140	10.175	4.630	0.000	27.136	67.144

Notes: Uses rescaled and imputed Original Values of Avoidable Mortality, z-score of Coordination, Original values Obesity, Population Insured, Tertiary, Upper Post, Health Status, Age, Voluntary and Supplemental Insurance. Findings based on n = 407, p-value 0.000, R-squared = 0.739, Root MSE = 4.865.

5.2.2.4 Normality of Residuals

The residuals are obtained within the post-estimation efforts and a Skewness and Kurtosis test done to assess whether the residuals themselves are normally distributed. The null hypothesis of this test is that it is normally distributed. Based on the findings it can be concluded that the variances are normally distributed.

Table 104: Skewness and Kurtosis Test for Normal Data

Skewness and Kurtosis Test for Normal Data

	Obs	Pr(skewness)	Pr(kurtosis)	Adj. chi2(2)	Prob>chi2
Residuals	407	0.000	0.018	33.85	0.000

Based on the P-value, the null hypothesis is rejected and the conclusion is that the residuals themselves are not normally distributed.

5.2.2.5 Multicollinearity

To test whether the independent variables are highly correlated with one another which would impede the ability to understand the individual effects, the Variance Inflation Factor (VIF) is done and finds no significant issues of correlation between the variables below:

Table 105: Inflation Factor Table

	VIF	1/VIF
Population Insured	2.54	0.393
Voluntary Insurance	2.50	0.400
Per. Health Status 45 – 64	2.12	0.472
Obesity Rate	1.99	0.502
Tertiary Education	1.96	0.509
Per. Health Status 15 – 24	1.85	0.541
Age 15 – 24	1.76	0.567
Coordination	1.62	0.616
Supplemental Insurance	1.56	0.640
Post Secondary Education	1.49	0.671
Mean	1.94	

Notes: Uses rescaled and imputed Original Values of Avoidable Mortality, z-score of Coordination, Original values Obesity, Population Insured, Tertiary, Upper Post, Health Status, Age, Voluntary and Supplemental Insurance.

5.3 Discussion

Recalling that the Coordination Index is a composite of indices summated by z-scores of their distributions, simply inferring from these requires a bit of tact as compared to normal rankings. The potential challenge is skirted by going back to the main research question which is concerned with degrees of coordination and can therefore interpret z-scores as they are meant to be: deviations from the mean. The overall standard deviation of the entire sample avoidable mortality is 9.409 on the per 10 000 rescaling. From the rescaling it can be inferred that relative to the mean distribution of Avoidable Mortality per year that the United States, depending on the year, is nearly a half standard deviation less favorable than the rest of the OECD. Meaning: relative to the rest of the OECD, the United States has a higher rate of avoidable deaths per 10

000 by about a half a standard deviation (about 4 per 10 000) below the mean for all OECD countries per year.

Table 106: Mean Avoidable Mortality Total Population (shown in deaths per 10 000)

Year	United States	Sample	Sample w/o US
2008	29.300	26.903	26.836
2009	28.600	26.176	26.108
2010	28.000	25.449	25.378
2011	27.900	24.284	24.183
2012	27.200	24.073	23.986
2013	27.600	23.578	23.467
2014	27.500	22.808	22.678
2015	27.400	22.519	22.383
2016	28.100	22.476	22.319
2017	28.100	22.294	22.133
2018	27.700	22.313	22.164
Mean	27.945	23.897	23.785

Turning back to the regression model, the coefficient attached to Coordination represented a change of 0.275 in Avoidable Mortality per 10 000 for every unit increase in z-score of Coordination. Which means that an effort to increase coordination would represent a reduction of Avoidable Mortality (deaths which can be systematically addressed with improvements to the delivery system) of approximately 3 per 100,000 when converted and taken in concert with the association between Coordination and Avoidable Mortality.

5.4 Conclusion

The baseline models in **Table *99*** and **Table *100*** show that Coordination is not associated with Avoidable Mortality when all covariates are utilized, when the model is adjusted to remove insignificant predictors, collinearity and using Robust Standard Errors, the finding is still consistent that Coordination is not statistically significant. Suggesting, again, per the conceptual framework that there are relationships within the variables at play. To return to the base

hypothesis that there is significant variation in Avoidable Mortality for CME vs LME nations due to the premium placed on profits by more LME oriented nations[12,64,155,156] it was demonstrated the statistical significance of Coordination in the linear regression model of Avoidable Mortality. What is left is to ascertain whether there are significant variations in Avoidable Mortality by Coordination levels, for which the Levene's Test for equality of variances is used. **Table 107** utilizing the transformed distribution shows that there is no significant difference in variances between levels of Coordination.

Table 107: Levene's Test for Equality of Variances for Avoidable Mortality (shown in deaths per 10 000)

Levene's Test for Equality of Variances

Summary of Transformed Avoidable Mortality			
Quartile	**Mean**	**Std. Deviation**	**Frequency**
1	28.548	10.189	102
2	26.134	11.577	102
3	21.688	6.551	102
4	19.173	4.598	101
Total	23.897	9.409	407

	Test Statistic	**Interpretation**
W0	0.000	The p-value test statistic is statistically significant and there is significant variation for values centered at the mean.
W50	0.000	The p-value test statistic is statistically significant and there is significant variation for values centered at the median.
W10	0.000	The p-value test statistic is statistically significant and there is significant variation for values centered using 10% trimmed mean.

Is the variance from the Levene's Test meaningful, as in: can one infer that LME's (those towards the lower quartile rankings of Coordination) have meaningful higher (less favorable) Avoidable Mortality? To address this, a Chi-Squared analysis between the quartiles and the avoidable mortality is run to ascertain that there is not a significant enough basis to reject the null hypothesis in this instance that these two variables are in fact independent. What is left is that the difference between quartiles of Coordination and the transformed distribution of avoidable mortality is in fact randomly based association. This is further corroborated by the very high

Pearson Chi-Squared statistic of 576, an indication of greater deviation from what would be expected if the two variables were in fact independent. Based on the p-value of 0.159, there may not be evidence of significant differences in variances among the groups as laid out. However, the model does not distinguish between other potential influencers of avoidable mortality such as genetic influences, social behaviors (i.e., alcohol usage, gun usage, driving habits and others).

Table 108: Chi-Squared Test on Coordination Quartiles and Avoidable Mortality (shown in deaths per 10 000)

	Quartile 1	Quartile 2	Quartile 3	Quartile 4	Total
Total	102	102	102	101	407
Pearson chi2(579)		= 612.958	**Pr**	= 0.159	

While the Chi-Squared test demonstrates a random association exists between quartiles of coordination and transformed avoidable mortality. This result holds true as well for the untransformed avoidable mortality. However, one more question of the data remains: is there a significant difference between the means of the quartiles for their respective levels of avoidable mortality? For this we a two-sample t-Test is used and find that for high and low levels of coordination (quartiles 1 and 4) in **Table 109** there is a significant variation in their respective means avoidable mortality per the below which affirms the initial null hypothesis that between quartiles 1 and 4 and between 2 and 3 the difference between samples is statistically significantly different from 0.

Table 109: T-test of Transformed Avoidable Mortality by Coordination Quartile Level (shown in deaths per 10 000)

	Obs	Mean	Std. error	Std. dev	95% conf. interval	
1	102	28.548	1.009	10.189	26.546	30.549
4	101	19.173	0.458	4.598	18.265	20.081
Combined	203	23.884	0.645	9.190	22.612	25.155
Diff		**9.375**	**1.111**		**7.183**	**11.566**

T-statistic	8.435

	P-value	Interpretation
Pr(T<t)	1.000	Fail to reject the null, mean difference is not significantly greater than or less than zero
Pr(|T| > |t|)	0.000	Reject the null, p-value of difference between samples is statistically significantly different from 0
Pr(T > t)	0.000	Reject the null, mean difference is significantly greater than or less than zero

	Obs	Mean	Std. error	Std. dev	95% conf. interval	
2	102	26.134	1.146	11.577	23.860	28.408
3	102	21.688	0.649	6.551	20.401	22.975
Combined	204	23.911	0.675	9.644	22.580	25.243
Diff		4.446	1.137		1.849	7.043

T-statistic	3.376

	P-value	Interpretation
Pr(T<t)	0.999	Fail to reject the null, mean difference is not significantly greater than or less than zero
Pr(|T| > |t|)	0.001	Reject the null, p-value of difference between samples is statistically significantly different from 0
Pr(T > t)	0.000	Reject the null, mean difference is significantly greater than or less than zero

5.5 Limitations

There are several limitations to address. As explained in Chapter 2, the mean imputation was heavily leveraged to deal with missing data for the Coordination Index. While able to fill in those missing data gaps, it does inject some variance and uncertainty into the models. As such, using imputed data poses a limitation. Additionally, Avoidable Mortality was utilized as the dependent variable because it had the highest propensity of fit, as seen by Adjusted R-Squared and Root MSE—however, these are not indicative necessarily of the quality of Avoidable Mortality nor of its validity as a measure for use in health system performance and may be seen as an oversimplification of a delivery system. Related to this point is that there is a lack of standardization in reporting measures and definitions across borders that presents a complex and confounding issue to be resolved. Lastly, the challenges in interpretations of the coefficients and

variables through heavy usage of z-scores, natural logs and other transformations present a similar limitation. However, this is a minor limitation as the main research questions deal with associations and relationships and not the specific coefficients of the regression models themselves.

5.6 Strengths

The vastness of datasets, ranging from economic, political, sociological, legal and health outcomes measures is a strength as no one index exerts undue influence on the outcomes. Likewise, the compendium of indices comes from a variety of organizations on the political spectrum: ranging from arguably more egalitarian/Left leaning sources such as the OECD data and Social Progress Index to the conservative/Right of the Economic Freedom scores from the Heritage Organization. Finally, the regression fits into the framework as laid out in Figure 16 and as such add validity to the findings of the Levene's Test on the variances which is the main research question: market and benefits Coordination is a meaningful measure with regards to performance, and the variances between nations based on levels of Coordination are themselves statistically significant.

6. Conclusion

The overarching goal of this effort was to assess whether the various methods for delivering healthcare on a national scale among the OECD nations, and based on their level of coordination (i.e., CME and LME traits), produce significant differences in cost, quality, and system performance. The central hypothesis of this was that since LMEs are primarily driven by market competition, as firms must sustain their profitability,[135] there will be significant positive variation and yearly growth in expenditure, and significant negative variation in quality and performance

measures over time under LME operations due to competition over prices and reductions in quality compared to CME markets. To achieve these aims meant first to establish a more encompassing Coordination Index that captures multiple measures across economic equality,[54,129] education,[12,92,130] political institutions,[12,70,85,92,128,130–132] market concentration,[57,64,85,132] and employment stability[12,13,70,90,133,134] and not merely the existence of UHC and distinguish OECD nations by CME and LME status based on indicators of the GINI coefficient of the market income for the working age population;[135] Overall Index of Economic Freedom[136] (an average of all measures); Overall Freedom in the World Score[137] (sum of Political Rights and Civil Liberties measures); Labor Market Institutions Index;[135] Strictness of Employment Protection;[138] Social Progress Index;[139] Programme for International Student Assessment (PISA) Scores,[171] and World Integrated Trade Solutions Market Concentration[140] to update and re-establish CME and LME nation groups from the Varieties of Capitalism framework[12] based on a Coordination Index. Using publicly available data, this study used regression testing to ascertain whether meaningful and significant differences exist between quartile rankings of Coordination. This chapter provides a summation of the findings and offers frameworks for policy considerations going forward as well as future studies to continue to make meaningful gains within the space of cross-national ecological studies.

6.1 Summary of Findings

Overall findings from this study demonstrate that Coordination is significantly associated with cost, quality and system performance. A positive association was found to exist between cost, quality and performance and intimates that increases in levels of Coordination do not have a deleterious effect on those measures.

6.1.1 Aim 1: Expanding the Definition of Market Coordination and Developing a Coordination Index for Measurement

Findings from this aim suggest that the composite Coordination Index has a higher predictive capability in relation to the natural log of Total Health Expenditure than models composed of GINI, education, or the Labor Relations Index alone as demonstrated by a higher Adjusted R-squared and lower Roote MSE in sensitivity analysis shown in **Table 25**. Further, all 8 models used for sensitivity analysis had statistical significance at the $p<0.001$ level. The Coordination Index itself returned a Cronbach's Alpha greater within the range of between 0.65 and 0.70 as per standard practice[177–180] indicating a more than sufficient degree of reliability. Countries identified as having a lower (1 or 2) quartile placement are more oriented towards Liberal Market Economies versus those in the upper quartiles (3 or 4), being more Coordinated Market Economies. Lastly, to combat the practical impacts of the fluidity of the definition of Coordination and the ensuing Quartiles year over year, **Table *31*** demonstrates that the changes in groupings year over year does not pose a statistically significant difference to the sample.

6.1.2 Aim 2: Evaluating the Relationship Between the Coordination Index and Health Expenditures in OECD Countries

Findings from this aim point to Coordination having a statistically significant positive association with the natural log of Total Health Expenditure in baseline assessment at the $p<0.05$ level, as well as when adjusted for insignificant covariates and collinearity a significant positive association is found with the natural log of Total Health Expenditure per capita demonstrated through linear regression with debt-to-GDP-Ratio, UHC, Tertiary Education, GDP per Capita, Population age 15 – 24, Employment Rate, Density of the Largest Segment and Compulsory Insurance with all being statistically significant at the $p<0.05$ level. Further, findings demonstrate

there being a statistically significant variation at the $p<0.01$ level in mean Total Health Expenditures per capita over time by quartile ranking of Coordination with higher quartile levels of Coordination having higher mean natural log of Total Health Expenditures. Practically it was shown that the impact of increasing the z-score of Coordination on the natural log of Total Health Expenditure (Coef: 0.036) presents an increase in spending to the degree of $1.036 (in thousands) once converted and on a per capita basis. Furthermore, it was found that Coordination produced a mean difference between higher quartile rankings and lower quartiles of Coordination that is significant ($p<0.01$), and secondly that a statistically significant ($p<0.01$) difference exists amongst variances by quartiles of Coordination.

6.1.3 Aim 3: Evaluating the Relationship Between the Coordination Index and Health Outcomes in OECD Countries

Findings from this aim suggest that Coordination does not have a statistically significant positive association with the log of Life Expectancy demonstrated through linear regression with Obesity, Debt to GDP Ratio, Percent of Population Insured, Year, Post Secondary Education, Perceived Health Status 15 – 24, 45 – 64, and Age 15 – 24, Employment Rate, Voluntary, Supplemental and Compulsory Insurance being not statistically significant at the $p<0.05$ level. Further, findings demonstrate there being a statistically significant variation at the $p<0.01$ level in mean log of Life Expectancy over time by quartile ranking of Coordination with lower quartile levels of Coordination having lower log of Life Expectancy. Practically it was shown that the impact of increasing the z-score of Coordination on the log of Life Expectancy (Coeff: 0.002) presents an increase in life expectancy of approximately 1 year once converted. Furthermore, it was demonstrated that Coordination produced a statistically significant mean difference between quartile rankings of Coordination for quartiles 1 and 4 ($p<0.01$) and quartiles 2 and 3 ($p<0.01$).

Secondly, that a statistically significant ($p<0.01$) difference exists amongst variances by quartiles of Coordination for Life Expectancy.

6.1.4 Aim 4: Evaluating the Relationship Between the Coordination Index and Healthcare Delivery Performance in OECD Countries

Findings from this aim demonstrate that Coordination does not have a statistically significant negative association with Avoidable Mortality in baseline assessment demonstrated through linear regression with Coordination and covariates at the $p<0.05$ level. Similarly, when the model is adjusted for insignificant covariates and collinearity, the findings remain there not being a statistically significant association with Avoidable Mortality and Coordination. Further however, findings demonstrate there being a statistically significant variation at the $p<0.01$ level in Avoidable Mortality per 10 000 over time by quartile ranking of Coordination with lower quartile levels of Coordination having higher Avoidable Mortality rates. Practically it was shown that the impact of increasing the z-score of Coordination on the transformed Avoidable Mortality (Coeff: 0.275) presents a decrease of Avoidable Mortality of approximately 3 per 100 000 when converted. Furthermore, it was found that Coordination produced a statistically significant difference in the mean of Avoidable Mortality (0.000, $p<0.01$) for quartiles 2 and 3 as well as quartiles 1 and 4 (0.000, $p<0.01$). Secondly, that a statistically significant ($p<0.01$) difference exists among variances by quartiles of Coordination for Avoidable Mortality.

6.2 Policy Implications

Findings from this study illustrate that Coordination across the realms of health, human services, education, housing, labor, urban development, the environment, and fair market economic practices are a critical component to increasing quality and system performance within healthcare. Currently, however we see a distancing from international norms in domestic politics

and continued investment in neoliberal values that place at a premium continued "corporate domination of society" [242] while vehemently and vociferously arguing that there is no alternative course of action, and this continuance of a pseudo-free-market approach is the only viable model.[242] It is precisely in "It is precisely "in its oppression of nonmarket forces that we see how neoliberalism operates not only as an economic system, but as a political and cultural system as well." [242] However, this study demonstrates that "competition need not be the central operating principle of mankind."[243] While the analysis around costs in Chapter 3 did ultimately demonstrate that increasing equities by increasing efforts to Coordination did raise costs, it is worth noting the limitations of the model do not capture the transaction costs, infrastructure, contracting and other rent-seeking data points that were theorized to be controlled for by the chosen indices. To ensure meaningful improvements in the areas of healthcare quality and system performance, future health policy must recognize the importance of enabling extramural areas of policy reform integral in fostering social democracy "promoting public education, social security, and expanded health care."[244]

Continued support for the institution of a democracy requires robust civic engagement, public schools, voluntary associations, and trade unions,[242] and further enabling protections to sustain control against nefarious economic forces and market actors that seek to limit opportunity, prohibit wealth redistributions, and dismantle the welfare state.[245] Nationally, as part of the continued neoliberalist campaign to reduce government and promote trickle-down economics,[13] seen through the Reagan, Bush "thousand points of light,"[245] Clinton[242,246,247] and Trump "deconstructing the administrative state" [245] administrations, and abroad in the Thatcher years of the UK's "Big Society"[245] that these threaten the masses of society, when it is the very job of government "to increase both freedom and security."[248] Future policy must look at addressing

the pillars of: income equality, laws and regulation to promote equity, political pluralism, workers' rights and protections, social welfare and social values, and education in concert with healthcare quality and system performance. Democracy as an institution and economies themselves are "not self-sustaining or self-righting, and capitalists themselves cannot provide the steering the economic requires."[245] It should be a strategic national priority to enhance the aforementioned pillars as a means of fostering national and economic security. It is firmly established that the welfare state, despite political argument does not preclude economic growth: "Sweden, Finland, and Norway have all succeeded in having about as much growth in per capita incomes as, or even faster growth than, the United States and with far greater equality."[249] To sustain ongoing improvements in healthcare delivery and outcomes, national and international health policy must continue to advance in achieving social and financial equities for all. The very basis of a welfare state is caveated on acknowledgement of an individual's dignity, "the individual is recognized as uniquely valuable that the state seeks to interfere with the normal functions of society to assure him certain inherent and inalienable rights"[250] for which that individual then contributes back to the production of society. Failure to improve healthcare in conjunction with the other values of a Welfare state and CMEs risks enfeebled outcomes to the former.

6.3 Future Research Priorities

My goal was to explore and identify a better way to assess across nations how market dynamics impact cost, quality and health system performance. With any good effort, it often unearths additional questions and reveals false assumptions of models. One of the most critical limitations outlined in Chapter 3 is that the Coordination index did not adequately capture the value of group and national purchasing to limit transaction costs, infrastructure, contracting and other rent-

seeking behaviors that expected to be controlled by the chosen indices. Future research must find a better understanding of and variable approximation or creation of what a single-payer model or national purchasing scales offer in terms of cost controls. Additionally, the goal was not in identifying causation between Coordination and cost, quality and health system performance. A future aim should look at potentially leveraging a Randomized Controlled Trial (RCT) to assess the cause-and-effect nature of these macro forces.

This study evaluates international systems and being proactive on anticipated criticisms neglects to look at the impacts within the national borders of the United States. Consequently, a future effort should overlay private and public insurance status as a variable for assessing whether Coordination at the state level is as relevant to healthcare cost, quality and performance within the United States and the OECD, where significantly sized sample populations exist.

Additionally, despite the overtly draconian, short-sighted, and genuinely maliciously spirited move by the current administration to remove all notices of diversity, equity, and inclusion (DEI) from all government databases and materials, it remains an omnipresent principle within the practice of public health research. Future research should look at the impacts of race, gender, education, sexuality and the like in the United States and the OECD, where significantly sized sample populations exist.

6.4 Concluding Thoughts and Additional Context

This study was conducted under the backdrop of a change in Presidential administration for the United States. While typically and expectedly, new administrations have new priorities, they do not upend standing values and government institutions. The initial actions taken by the new administration, when viewed by a reasonably minded pragmatist of rational and objective mind,

finds the current administration less than fulsome in its depiction of truth, values and institutions on its present course. Hannah Arendt, one of the most influential political theorists and powerful critics of regimes wrote: "never has our future been more unpredictable, never have we depended so much on political forces that cannot be trusted to follow the rules of common sense and self-interest—forces that look like sheer insanity, if judged by the standards of other centuries."[251] Her observation on political forces is existential and agnostic to any notion of the current administration as it predates them by 70-plus years—but remains salient and exceptional in its relevance still. Similar to the concept of Coordination in this study, Arendt would advocate that "human dignity needs a new guarantee which can be found only in a new political principle, in a new law on earth, whose validity this time must comprehend the whole of humanity".[251]

The notion of human dignity is under attack. The argument that an attempt to "change social outcomes through public spending and social programs rewards failure, fuels dependency, and subsidizes the losers"[243] is the rhetoric of neoliberal-economic-totalitarianism. This rhetoric assigns a valuation on a human being rather than viewing all people as being rightful members of society. It is worth noting that in his US Senate Confirmation Hearing for Secretary of Health and Human Services on January 29th and 30th 2025, Robert F. Kennedy Jr., could not answer in the affirmative when asked by Senator Bernard Sanders whether or not all Americans have the right to healthcare,[252] Ironically, in his retort to Senator Sanders, Mr. Kennedy invoked moral hazard as the reason why it would be unfair to give healthcare to all. Mr. Kennedy quipped that people who smoke and need healthcare services are taking from the pooled resources of others.[253] Mr. Kennedy has a history of dependency and other very public-facing health problems of his own. Under his own testimony of moral hazard, Mr. Kennedy would maybe ineligible for health insurance were it not for his immense financial resources and ability to purchase his own

insurance products.[252] I am sure if asked whether the government should regulate his choice of food, for which he said President Trump should rightly be able to eat a McDonald's cheeseburger and Diet Coke,[253] he and President trump would insist regardless of their ability to pay they deserve to receive care if needed despite the moral hazard of the cheeseburger and Diet Coke. And that is the essence of our age: "the defining political economic paradigm of our time—it refers to the policies and processes whereby a relative handful of private interests are permitted to control as much as possible of social life in order to maximize their personal profit."[242] The continuation of this model of economics perpetuates poverty and threatens political and national stability.[254,255] Witness the immediate aftermath of the signing of the North American Free Trade Agreement (NAFTA) in 1992: workers from Honeywell, GE, Ford, Volkswagen and other major domestic manufacturing hubs summarily removed and in the wake: Congress passed a massive new anticrime package as if recognizing the social and economic polarization they were injecting into America.[242] The neoliberal agenda is a deeply destabilizing national and global force, for which amicable returns to liberal democracy are nonexistent.[246]

However, the quagmire of neoliberalism is a pervasive one, remaining significantly relevant in modern political culture for 100 years since the New Deal.[19] Neoliberals regularly shout that "governments are inefficient institutions that should be limited so as not to hurt the magic of the natural 'laissez-faire' market"[242] while simultaneously muting debate on the matter. But "it is the inability to have honest and candid discussions and debates about neoliberalism that is one of its most striking features."[242] Further insuring that being immune from a debate or conversation we thereby but guarantee "there will be no change for the better."[242]

One cannot help but pause at the abounding and staggering amounts of ironies swirling about. Between the "Fork in the Road,"[256] threats of 25% tariffs against the country's largest trading

partners and the ensuing trade war,[257] and a firing of the Consumer Financial Protection Bureau's director[258] we are hard-pressed to see the social utility of these actions and are morally obliged to recognize the perversion of any such ideologies as "market regulation" and denounce these actions as "a piece of prodigious insanity, in which all rules of logic and principles of economics were turned upside down."[251,259] Why? People who need protection, jobs, fair wages, and controls against excessive prices are, by very reductive reasoning, those without such protection for whom higher consumer prices and less transparent business practices thrive upon and continue to marginalize. The very political doctrine of neoliberalism is designed to "undermine education and health, increase inequality, and reduce labor's share in income; that much is not seriously in doubt."[242] Further, the notion that government hurts corporations is dizzyingly ironic given how "they[government] lavishly subsidize corporations […] and expect governments to funnel tax dollars to them […] protect their markets for them from competition, but they want to assure that governments will not tax them or work supportively on behalf of non-business interests, especially on behalf of the poor and working class."[242] This irony was seen also in the Great Recession where "those who advocated for free markets […] were more than willing to accept government assistance—including massive bailouts."[249]

To again reference Arendt, this study "has been written against a background of both reckless optimism and reckless despair. It holds that Progress and Doom are two sides of the same model; that both are articles of superstition, not faith."[251] Even without getting into questions surrounding the legality of actions pursuant to the Presidential certification proceedings in 2021, that an "assault on society and social justice over the neoliberal decades is most familiar in the project of dismantling and disparaging the social state in the name of free, responsibilized individuals."[245] This movement, of sorts, to push government and to transform into a business

makes those not in the seats of power the targets. It is worth again noting the irony that those who run the business have a history of running their own businesses, Jared Kushner, Elon Musk and have a history of exploitation: "especially the kinds owned by his [Jared Kushner] father and father-in-law, citizen-customers would become its unprotected, exploitable, and manipulable objects of gain."[245] While Mr. Musk never paid his Twitter employees who accepted his "Fork in the Road" offer.[260] Superstition and faith[251] as machinations and tools of the insidious, who with their "tyrannical spirit, want[ing] to play bishop and banker everywhere"[245,261] use it to formulate the basis of what Dorothy Parker would dub "a new fresh hell." The tying together of demonizing the social and welfare state, attacking equality, nationalism, traditional morality "conjoin moral righteousness with nearly celebratory amoral and uncivil conduct. They endorse authority while featuring unprecedented public social disinhibition and aggression. They rage against relativism, but also against science and reason, and spurn evidence-based claims, rational argumentation, credibility, and accountability. They disdain politicians and politics while evincing a ferocious will to power and political ambition."[245] This has become the Frankenstein's monster of the catastrophic present.[245] The "contemptuous indifference"[251] of this "schizofascism"[262] of ersatz authoritarianism is predatory and impedes upon all notions of coordinated market economies and the underlying relationship to health as well as moral virtues. This is a brave new world in which we live and where money alone is the sole protection. The simple truth is that growing inequality means shrinking opportunity.[249]

The neoliberal will challenge notions of equality, diversity, anti-discrimination, and our set values, this is their strategy. It will continue to endear the white supremacist to them, despite their disdain and contempt for the poor working class. Adding to the running total of ironies is that this neoliberal agenda erodes the nation's place in the world with our peers and threatens our

very security and democracy. The ancient Greeks warned that inequality brought instability, and that demagogues exploit free speech to install themselves as tyrants.[248] James Madison himself too warned that capitalist pursuits by a government meant "substituting the motive of private interest in place of public duty […] a real domination of the few under an apparent liberty of many."[242] In his 1938 address to Congress, President Franklin Delano Roosevelt said as much the same: "the liberty of a democracy is not safe if the people tolerate the growth of private power to a point where it comes stronger than their demographic state itself."[263] Europe fell prey to this movement and instituted mass reforms to balance that instability.[264–266] Again, the job of government "is to increase both freedom and security."[248] These political decisions must be judged by an ethical criterion[267] since they threaten the very ethics they're meant to dismantle. The neoliberal belief that they are fulfilling on some grandiose agenda to justify the "vast suffering […] with great progress is to accept a kind of hermetic masochism."[267] The final irony is that the original neoliberals of Hayek, Friedman, von Mises and the like would "have loathed both the crony capitalism and international oligarchical power […] they would have deplored the manipulation of public policy by major industries and capital sectors and would have hated, too, the politicalizations of enterprise. Above all, they dreaded political mobilizations of an ignorant, aroused citizenry and looked to market and moral discipline and a severely leashed democracy to pacify and contain it."[245]

Our obstacle is not science but political discourse. The remedy is broader acceptance on universal norms and the dignity for us all. Critics and cynics will be quick to attempt to dismantle this effort and say I am imposing a framework of subjective values, but in order to reach political and practical conclusions, we must add to the compendium of value premises,[268] "they [value premises] are needed even in the theoretical stage of establishing knowledge about

facts and factual relationships."[268] Particularly when we know that "the welfare state as a principal institution in the construction of different models of post-war capitalism"[269] one must overlay values when evaluating why, on an a posteriori basis, leaders reject such inconvenient truths and what is the social utility of such actions, if any, or is it in the interest of only a few. And until we as a society accept the universal dignity of all, I fear that substantive advancements and the sustaining of the healthcare delivery system will be in jeopardy and ineffective.

Appendix I: Missing Data Typology

A simple statistical test for whether data is missing completely at random exists in the Little's Test[203–205] which tests whether significant differences exist between means of different missing-value patterns.[204] A first iteration of this test yielded the following:

Table 110: Little's MCAR Test for GINI post-2012 definition, Social Progress, PISA scores, Strictness of Employment and Labor Relations Indices

Number of Observations	= 404
Chi-square Distance	= 130.484
Degrees of Freedom	= 78
P-value	= 0.000

The p-value being significant indicates that the presence of missing data is not MCAR—which is instinctively known given how PISA for instance is taken cyclically. Similarly, intuitively there will be correlation within the indices which is probably feeding the non-convergence. Ultimately, this confirms the notion that a more robust model is warranted versus simple imputation. Still, it must be determined whether the missing data type is MNAR or MAR for which we logistic regression within the dataset[203] is used to look for significant associations between the complete data and the missing dummy variable to indicate an MAR type. Making a dummy variable for the missing values as identified above and produce the following:

Table 111: Logistic Regression of Missing GINI pre-2012 Definition, Index of Economic Freedom, Freedom House, HHI, and Year

	Coefficient	Std. Error	z	P>|z|	95% CI	
Economic Freedom	0.065	0.028	2.310	0.021	0.010	0.121
Freedom House	-0.034	0.022	-1.530	0.125	-0.078	0.010
HHI	0.650	1.560	0.420	0.677	-2.407	3.707
Year	0.736	0.070	10.480	0.000	0.598	0.873
Constant	-1481.181	141.479	-10.470	0.000	-1758.475	-1203.888

Notes: Uses original values for Economic Freedom, Freedom House, HHI, and Year. Findings based on n = 407, likelihood ratio chi-square test = 240.840, p-value 0.000, pseudo R2 = 0.445

Repeating the above logistic regression for GINI post-2012 definition, Social Progress Index, PISA tests, Labor Relations Index and Strictness of Employment and find a significant relationship with Year in every model. Consistent with the outcome of the Little's test. At this point, it seems more likely to be MAR than MNAR, however, the fact that Year is the only significant variable is still not as assuring as hoped for and can lastly look at T-tests for further information on the relationship.[203] Finding again relationships between the missing dummy variables for Social Progress, PISA tests, and Strictness of Employment with Year indicative that for these variables the missing values are due to unobserved factors and MNAR typology. For the GINI definitions however, non-significant p values on T-tests which means one cannot reject the null and instead conclude MAR type missing values.

In this instance, since all of the indices in question represent continuous variables but with non-infinite ranges, unconditional mean imputation[206]will be used—due to the correlation between these indices, a chained equation model is common.[270]

Utilizing logistic regression with a dummy variable for missing values of the Labor Relations Index and find a significant relationship between the missing Labor Relations dummy and Freedom House Index, indicative of an MAR type.[203] Further corroborated by the Little's Test for MCAR, wherein the null hypothesis is that the missing data is MCAR, as such Labor Relations is maybe MNAR.

Table 112: Logistic Regression of Missing Labor Relations Index

	Coefficient	Std. Error	z	P>|z|	95% CI	
Economic Freedom	-0.012	0.022	-0.520	0.600	-0.055	0.032

Freedom House	-0.156	0.032	-4.920	0.000	-0.218	-0.094
HHI	1.519	1.462	1.040	0.299	-1.347	4.386
Year	0.152	0.038	4.030	0.000	0.078	0.226
Constant	-289.637	75.653	-3.830	0.000	-437.914	-141.360

Notes: Uses original values for Economic Freedom, Freedom House, HHI and Year. Findings based on n = 407, likelihood ratio chi-square test = 76.360, p-value 0.000, pseudo R2 = 0.148

Table 113: Little's MCAR Test for Labor Relations Index with Total Freedom House, HHI, and Year

Number of Observations	= 407
Chi-square Distance	= 53.0639
Degrees of Freedom	= 4
P-value	= 0.000

For PISA specifically retesting omitting the other data sets previously included and find Little's Test informative as it says the data for PISA scores, because of the p value being greater than 0.05, directs that the data types are MCAR.

Table 114: Little's MCAR Test for PISA Math with Total Freedom House, HHI and Year

Number of Observations	= 407
Chi-square Distance	= 6.510
Degrees of Freedom	= 4
P-value	= 0.164

Looking specifically now at the Labor Relations Index, Social Progress Index and the PISA Scores and evaluate their mean, standard deviations and variances and find suggestions of over dispersion for the PISA scores and Labor Relations and under dispersion for Social Progress Index.

Table 115: Test for Overdispersion

Variable	Obs	Mean	Std. Dev.	Variance
Labor Relations Index	134	5.761	3.949	15.597
Social Progress Index	296	82.315	5.502	30.270
PISA Math	147	490.701	30.311	918.773

PISA Reading	146	491.096	24.510	600.722
PISA Science	147	494.667	28.575	816.539

Using first with a simple Regression of Social Progress Index again with Economic Freedom, Freedom House, HHI and Year and test for overdispersion with the Breusch-Pagan test and find a p-value of 0.0250, indicative of heteroskedasticity within Social Progress Index, and repeating for PISA Math (p-value 0.2912), PISA Reading (p-value 0.1394), PISA Science (p-value 0.2234), and Labor Relations Index (p-value 0.8764). All confirming heteroskedasticity. Transforming these variables with a Box Cox transformation and rerun at later steps in attempt for mean imputations again. For the Labor Relations Index, since it does have 0 values, adding an additional step of a constant 0.00001 to preserve the distribution but remove the 0 values[218]is necessary. Additionally, to preserve the ordinal nature of the Labor Relations Index,[167] this construct of 0.00001 artificially increases the value for lower levels of Labor Relations Index.

Appendix I: Missing Data Typology Avoidable Mortality

As established in Chapter 2, the Little's Test[203–205] is used to determine whether significant differences exist between means of different missing-value patterns[204] which helps inform the type of missing data.

Table 116: Little's MCAR Test for Avoidable Mortality, Index of Economic Freedom, Freedom House, HHI, Obesity Rate, Percent of Population 65+ and UHC

Number of Observations	= 407
Chi-square Distance	= 31.605
Degrees of Freedom	= 6
Prob > chi-square	= 0.000

The Little's MCAR Test indicates that the missing values for Avoidable Mortality may not be at random. A dummy variable is created for the missing Avoidable Mortality data and utilize logistic regression within the dataset[203] and looking for significant associations between complete data and the missing dummy variable to indicate an MAR type.

Table 117: Logistic Regression for Avoidable Mortality, Index of Economic Freedom, Freedom House, HHI, Obesity Rate, Percent of Population 65+ and UHC

	Coefficient	Std. Error	z	P>|z|	95% CI	
Economic Freedom	-0.044	0.044	-0.990	0.321	-0.130	0.043
Freedom House	-0.046	0.031	-1.490	0.136	-0.105	0.014
HHI	-10.162	8.376	-1.210	0.225	-26.580	6.255
Obesity Rate	0.115	0.049	2.340	0.019	0.019	0.211
Pct. Population 65+	0.021	0.088	0.240	0.814	-0.151	0.192
UHC	1.589	0.724	2.200	0.028	0.171	3.008
Constant	1.072	2.973	0.360	0.718	-4.755	6.899

Notes: Uses original data values for Economic Freedom, Freedom House, HHI, Percent of Population Obese, Percent of Population 65 Plus and Government/Compulsory as the binary UHC variable. Findings based on n = 407, likelihood ratio chi-square test = 26.890, p-value 0.000, pseudo R2 = 0.169.

Limited significant p-values exist and the results are not overly informative. Next is to turn to spot check the data and find that of all 37 nations, 28 of the 37 are complete records, 3 nations have 10 records, 4 nations have 9, and 2 nations total have either 8 or 6 records which suggests that the bulk missing records come from just a few individual nations and not a systematic mechanism. As such, the missing data is in fact MAR.

Appendix II: Imputation Detailed Analysis

Appendix II: GINI Index

Table 118: Descriptive Summary of Mean Imputed GINI Index post-2012 and Original Values

	Obs.	Mean	Std. dev	Min	Max
Imputed	407	0.314	0.503	0.22	0.494
Original	346	0.314	0.547	0.22	0.494

Table 119: Normality Test of Imputed GINI Index post-2012 and Original Values

Skewness and kurtosis tests for normality

	Obs	Pr(skewness)	Pr(kurtosis)	Adj chi2(2)	Prob>chi2
Imputed	407	0.000	0.000	69.64	0.000
Original	346	0.000	0.000	49.21	0.000

Shapiro-Wilk Test for Normality

	Obs	W	V	Z	Prob>z
Imputed	407	0.911	24.844	7.650	0.000
Original	346	0.915	20.543	7.143	0.000

A Box Cox transformation is used of the new mean imputation data and produces a Theta of -1.388691. The data transformed and rechecked for normality to find it improves the results.

Table 120: Normality Test of Imputed Transformed GINI Index post-2012 and Original Values

Skewness and kurtosis tests for normality

	Obs	Pr(skewness)	Pr(kurtosis)	Adj chi2(2)	Prob>chi2
Imputed and Transformed	407	0.002	0.398	9.26	0.010
Original	346	0.000	0.000	49.21	0.000

Shapiro-Wilk Test for Normality

	Obs	W	V	Z	Prob>z
Imputed	407	0.975	7.120	4.674	0.000
Original	346	0.915	20.543	7.143	0.000

Appendix II: Social Progress Index

Table 121: Descriptive Summary of Mean Imputed Social Progress Index and Original Values

	Obs.	Mean	Std. dev	Min	Max
Imputed	407	82.315	4.690	64.77	89.96
Original	296	82.315	5.502	64.77	89.96

The distribution of data is checked and found to be normally distributed.

Table 122: Normality Test of Imputed Social Progress Index and Original Values

Skewness and kurtosis tests for normality

	Obs	Pr(skewness)	Pr(kurtosis)	Adj chi2(2)	Prob>chi2
Imputed	407	0.000	0.000	91.90	0.000
Original	296	0.000	0.000	48.75	0.000

Shapiro-Wilk Test for Normality

	Obs	W	V	Z	Prob>z
Imputed	407	0.882	32.921	8.321	0.000
Original	296	0.892	22.739	7.329	0.000

A Box Cox transformation is used of the new mean imputation data and produces a Theta of 7.420112. The data transformed and rechecked for normality to find it has not improved the outcome.

Appendix II: PISA Reading

Table 123: Correlation of PISA Scores

	(1)	(2)	(3)
(1) PISA Math	1.000		
(2) PISA Reading	0.885	1.000	
(3) PISA Science	0.928	0.935	1.000

Table 124: Descriptive Summary of Mean Imputed PISA Reading and Original Value

	Obs.	Mean	Std. dev	Min	Max
Imputed	407	491.096	14.647	420	539
Original	146	491.096	24.510	420	539

The distribution of data is checked and found to be normally distributed.

Table 125: Normality Test of Imputed PISA Reading and Original Values

Skewness and kurtosis tests for normality

	Obs	Pr(skewness)	Pr(kurtosis)	Adj chi2(2)	Prob>chi2
Imputed	407	0.000	0.000	113.40	0.000
Original	146	0.000	0.052	14.930	0.001

Shapiro-Wilk Test for Normality

	Obs	W	V	Z	Prob>z
Imputed	407	0.827	48.370	9.237	0.000
Original	146	0.950	5.698	3.939	0.000

A Box Cox transformation is used of the new mean imputation data and produces a Theta of 5.882873. The data transformed and rechecked for normality to find it had the inverse impact on results and do not utilize it.

Appendix II: PISA Science

Table 126: Correlation of PISA Scores

	(1)	(2)	(3)
(1) PISA Math	1.000		
(2) PISA Reading	0.885	1.000	
(3) PISA Science	0.928	0.935	1.000

Table 127: Descriptive Summary of Mean Imputed PISA Science and Original Value

	Obs.	Mean	Std. dev	Min	Max
Imputed	407	494.667	17.136	415	554
Original	147	494.667	28.575	415	554

The distribution of data is checked and found to be normally distributed.

Table 128: Normality Test of Imputed PISA Science and Original Values

Skewness and kurtosis tests for normality

	Obs	Pr(skewness)	Pr(kurtosis)	Adj chi2(2)	Prob>chi2
Imputed	407	0.000	0.000	113.66	0.000
Original	147	0.000	0.056	15.160	0.000

Shapiro-Wilk Test for Normality

	Obs	W	V	Z	Prob>z
Imputed	407	0.799	56.333	9.600	0.000
Original	147	0.945	6.264	4.155	0.000

A Box Cox transformation is used of the new mean imputation data and produces a Theta of 5.305234. The data transformed and rechecked for normality to find it had the inverse impact on results and do not utilize it.

Appendix II: PISA Math

Table 129: Correlation of PISA Scores

	(1)	(2)	(3)
(1) PISA Math	1.000		
(2) PISA Reading	0.885	1.000	
(3) PISA Science	0.928	0.935	1.000

Table 130: Descriptive Summary of Mean Imputed PISA Math and Original Value

	Obs.	Mean	Std. dev	Min	Max
Imputed	407	490.701	18.177	400	554
Original	147	490.701	30.311	400	554

The distribution of data is checked and found to be normally distributed.

Table 131: Normality Test of Imputed PISA Math and Original Values

Skewness and kurtosis tests for normality

	Obs	Pr(skewness)	Pr(kurtosis)	Adj chi2(2)	Prob>chi2
Imputed	407	0.000	0.000	148.34	0.000
Original	147	0.000	0.008	24.230	0.000

Shapiro-Wilk Test for Normality

	Obs	W	V	Z	Prob>z
Imputed	407	0.758	67.531	10.032	0.000
Original	147	0.901	11.270	5.485	0.000

A Box Cox transformation is used of the new mean imputation data and produces a Theta of 6.285912. The data transformed and rechecked for normality to find it had the inverse impact on results and do not utilize it.

Appendix II: Strictness of Employment Index

Table 132: Descriptive Summary of Mean Imputed Strictness of Employment Index and Original Values

	Obs.	Mean	Std. dev	Min	Max
Imputed	407	2.312	0.573	0.488	3.560
Original	386	2.312	0.588	0.488	3.560

The distribution of data is checked and found to be normally distributed.

Table 133: Normality Test of Imputed Strictness of Employment Index and Original Values

Skewness and kurtosis tests for normality

	Obs	Pr(skewness)	Pr(kurtosis)	Adj chi2(2)	Prob>chi2
Imputed	407	0.000	0.023	27.190	0.000
Original	386	0.000	0.084	23.550	0.000

Shapiro-Wilk Test for Normality

	Obs	W	V	Z	Prob>z
Imputed	407	0.966	9.503	5.362	0.000
Original	386	0.966	8.968	5.211	0.000

A Box Cox transformation is used of the new mean imputation data and produces a Theta of 1.729389. The data transformed and rechecked for normality to find it had the inverse impact on results and do not utilize it.

Appendix II: Labor Relations Index

Table 134: Descriptive Summary of Mean Imputed Labor Relations and Original Value

	Obs.	Mean	Std. dev	Min	Max
Imputed	407	5.761	2.260	0	11
Original	134	5.761	3.949	0	11

Table 135: Normality Test of Imputed Labor Relations Index and Original Values

Skewness and kurtosis tests for normality

	Obs	Pr(skewness)	Pr(kurtosis)	Adj chi2(2)	Prob>chi2
Imputed	407	0.003	0.000	27.000	0.000
Original	134	0.304	0.000	64.600	0.000

Shapiro-Wilk Test for Normality

	Obs	W	V	Z	Prob>z
Imputed	407	0.919	22.551	7.420	0.000
Original	134	0.975	2.621	2.171	0.015

To preserve the ordinal nature of the Labor Relations Index,[167] the construct of 0.00001 is added to artificially increase the value for lower levels of Labor Relations Index. A Box Cox transformation is used of the new mean imputation data and produces a Theta of .6792847. The data transformed and rechecked for normality to find it had the inverse impact on results and do not utilize it.

Appendix II: Debt-to-GDP Ratio

Table 136: Descriptive Summary of Mean Imputed Debt to GDP Ratio and Original Value

	Obs.	Mean	Std. dev	Min	Max
Imputed	407	79.539	44.756	8.472	234.381
Original	393	79.539	45.548	8.472	234.381

Table 137: Normality Test of Imputed Debt to GDP Ratio and Original Values

Skewness and kurtosis tests for normality

	Obs	Pr(skewness)	Pr(kurtosis)	Adj chi2(2)	Prob>chi2
Imputed	407	0.000	0.000	55.46	0.000
Original	393	0.000	0.001	51.27	0.000

Shapiro-Wilk Test for Normality

	Obs	W	V	Z	Prob>z
Imputed	407	0.924	21.155	7.268	0.000
Original	393	0.923	20.963	7.234	0.000

A Box Cox transformation is used of the new mean imputation data and produces a Theta of 0.3026875. The data transformed and rechecked for normality to find it had the inverse impact on results and do not utilize it.

Appendix II: Percent of Total Population Insured

Table 138: Descriptive Summary of Mean Imputed Percent of Population Insured and Original Value

	Obs.	Mean	Std. dev	Min	Max
Imputed	407	97.871	3.944	67.5	100.2
Original	372	97.871	4.126	67.5	100.2

Table 139: Normality Test of Imputed Percent of Population Insured and Original Values

Skewness and kurtosis tests for normality

	Obs	Pr(skewness)	Pr(kurtosis)	Adj chi2(2)	Prob>chi2
Imputed	407	0.000	0.000	228.43	0.000
Original	372	0.000	0.000	200.77	0.000

Shapiro-Wilk Test for Normality

	Obs	W	V	Z	Prob>z
Imputed	407	0.696	85.138	10.583	0.000
Original	372	0.694	78.930	10.360	0.000

A Box Cox transformation is used of the new mean imputation data and produces a Theta of 32.77268. The data transformed and rechecked for normality to find it had little impact on results and do not utilize it.

Appendix II: Avoidable Mortality

Table 140: Little's MCAR Test for Avoidable Mortality, Index of Economic Freedom, Freedom House, HHI, Obesity Rate, Percent of Population 65+ and UHC

Number of Observations	= 407
Chi-square Distance	= 31.605
Degrees of Freedom	= 6
Prob > chi-square	= 0.000

The Little's MCAR Test indicates that the missing values for Avoidable Mortality may not be at random. A dummy variable for the missing Avoidable Mortality data is created and utilized in logistic regression within the dataset[203] to look for significant associations between complete data and the missing dummy variable to indicate an MAR type.

Table 141: Logistic Regression for Avoidable Mortality, Index of Economic Freedom, Freedom House, HHI, Obesity Rate, Percent of Population 65+ and UHC

	Coefficient	Std. Error	z	P>|z|	95% CI	
Economic Freedom	-0.044	0.044	-0.990	0.321	-0.130	0.043
Freedom House	-0.046	0.031	-1.490	0.136	-0.105	0.014
HHI	-10.162	8.376	-1.210	0.225	-26.580	6.255
Obesity Rate	0.115	0.049	2.340	0.019	0.019	0.211
Pct. Population 65+	0.021	0.088	0.240	0.814	-0.151	0.192
UHC	1.589	0.724	2.200	0.028	0.171	3.008
Constant	1.072	2.973	0.360	0.718	-4.755	6.899

Notes: Uses original data values for Economic Freedom, Freedom House, HHI, Percent of Population Obese, Percent of Population 65 Plus and Government/Compulsory as the binary UHC variable. Findings based on n = 407, likelihood ratio chi-square test = 26.890, p-value 0.000, pseudo R2 = 0.169.

Limited significant p-values are found and the results are not overly informative. Turning next to spot check the data and find that of all 37 nations, 28 of the 37 are complete records, 3 nations have 10 records, 4 nations have 9, and 2 nations total have either 8 or 6 records suggests that the bulk missing records come from just a few individual nations and not a systematic mechanism.

Table 142: Descriptive Summary of Mean Imputed Avoidable Mortality and Original Value

	Obs.	Mean	Std. dev	Min	Max
Imputed	407	238.974	94.085	130	597
Original	387	238.974	96.492	130	597

Table 143: Normality Test of Imputed Avoidable Mortality and Original Values

Skewness and kurtosis tests for normality

	Obs	Pr(skewness)	Pr(kurtosis)	Adj chi2(2)	Prob>chi2
Imputed	407	0.000	0.000	84.04	0.000
Original	387	0.000	0.000	76.05	0.000

Shapiro-Wilk Test for Normality

	Obs	W	V	Z	Prob>z
Imputed	407	0.816	51.358	9.380	0.000
Original	387	0.811	50.419	9.314	0.000

A Box Cox transformation is used of the new mean imputation data and produces a Theta of -1.320963. The data transformed and rechecked for normality to find it had little impact on results and do not utilize it.

Appendix II: Percent of Population Tobacco Consumption

Viewing Tobacco Consumption as ratio data, it is anticipated there not being a linear relationship between variables and confirm as much with a correlation matrix.

Table 144: Correlation Matrix of Smoking

Variables	(1)	(2)	(3)	(4)
(1) Tobacco Consumption	1.000			
(2) Percent of Population 65+	0.242	1.000		
(3) UHC	-0.096	0.304	1.000	
(4) Year	-0.372	0.212	-0.003	1.000

Notes: Uses original values for Percent of Population Tobacco Consumption, Percent of Population 65+, Government/Compulsory as the binary UHC variable, and Year.

Due to the weak correlations, limitations on the breadth of the data and nonlinearity within the available data unconditional mean imputation[206] for Tobacco Consumption is utilized.

Table 145: Descriptive Summary of Mean Imputed Percent of Population Using Tobacco and Original Values

	Obs.	Mean	Std. dev	Min	Max
Imputed	407	18.050	3.899	6.400	39.700
Original	232	18.050	5.169	6.400	39.700

The distribution of data is checked and found to be normally distributed.

Table 146: Normality Test of Imputed Percent of Population Using Tobacco and Original Values

Skewness and kurtosis tests for normality

	Obs	Pr(skewness)	Pr(kurtosis)	Adj chi2(2)	Prob>chi2
Imputed	407	0.000	0.000	47.350	0.000
Original	232	0.004	0.068	10.160	0.006

Shapiro-Wilk Test for Normality

	Obs	W	V	Z	Prob>z
Imputed	407	0.928	20.230	7.161	0.000
Original	232	0.985	2.528	2.150	0.016

Notes: N = 407 total nations, across 11 years of observations for 407 observations. Source: OECD Tobacco Consumption (% population age 15+ who are daily smokers);[221] 2008-2018

A Box Cox transformation is used of the new mean imputation data and produces a Theta of 0.654296. The data transformed and rechecked for normality to find it had the inverse impact on results and do not utilize it.

Appendix II: Perceived Health Status

Due to the weak correlations (the most profound being with Obesity at just 0.409), limitations on the breadth of the data and nonlinearity within the available data unconditional mean imputation[206] for Perceived Health Status is used.

Table 147: Descriptive Summary of Mean Imputed Percent Health Status Good to Very Good age 15 to 24 and Original Values

	Obs.	Mean	Std. dev	Min	Max
Imputed	407	90.418	5.615	45.500	98.600
Original	354	90.418	6.022	45.500	98.600

The distribution of data is checked and found to be normally distributed.

Table 148: Normality Test of Mean Imputed Percent Health Status Good to Very Good age 15 to 24 and Original Values

Skewness and kurtosis tests for normality

	Obs	Pr(skewness)	Pr(kurtosis)	Adj chi2(2)	Prob>chi2
Imputed	407	0.000	0.000	249.170	0.000
Original	354	0.000	0.000	204.92	0.000

Shapiro-Wilk Test for Normality

	Obs	W	V	Z	Prob>z
Imputed	407	0.728	76.182	10.319	0.000
Original	354	0.738	64.653	9.864	0.000

A Box Cox transformation of the new mean imputation data is done and produces a Theta of 9.172771. The data transformed and then rechecked for normality and find it does not improve the normality distribution and will not be used.

Table 149: Normality Test of Transformed Mean Imputed Percent Health Status Good to Very Good age 15 to 24

Skewness and kurtosis tests for normality

	Obs	Pr(skewness)	Pr(kurtosis)	Adj chi2(2)	Prob>chi2

Transformed Imputed	407	0.034	0.209	6.040	0.049

Shapiro-Wilk Test for Normality

	Obs	W	V	Z	Prob>z
Transformed Imputed	407	0.989	3.035	2.644	0.004

The process is repeated for Health Status Good to Very Good for age 25 to 44, 45 to 64, and 65 plus and check for normality. The final imputations use the mean imputation models for 25 to 44, 45 to 64 and 65 plus.

Appendix II: Educational Attainment

Due to the weak correlations (the most profound being with Age under 15 at 0.486), limitations on the breadth of the data and nonlinearity within the available data unconditional mean imputation[206] for Educational Attainment is used.

Table 150: Descriptive Summary of Mean Imputed Below Secondary Education and Original Values

	Obs.	Mean	Std. dev	Min	Max
Imputed	407	24.434	16.198	6.100	71.800
Original	390	24.434	16.548	6.100	71.800

The distribution of data is checked and finds that it is normally distributed.

Table 151: Normality Test of Below Secondary Education and Original Values

Skewness and kurtosis tests for normality

	Obs	Pr(skewness)	Pr(kurtosis)	Adj chi2(2)	Prob>chi2
Imputed	407	0.000	0.001	72.040	0.000
Original	390	0.000	0.003	66.020	0.000

Shapiro-Wilk Test for Normality

	Obs	W	V	Z	Prob>z
Imputed	407	0.824	49.278	9.281	0.000
Original	390	0.821	48.206	9.211	0.000

A Box Cox transformation is used for the new mean imputation data and produces a Theta of -0.2519234. The data are transformed and rechecked for normality and found to improve the normality distribution.

Table 152: Normality Test of Transformed Mean Imputed Below Secondary Education

Skewness and kurtosis tests for normality

	Obs	Pr(skewness)	Pr(kurtosis)	Adj chi2(2)	Prob>chi2
Transformed Imputed	407	0.000	0.002	55.78	0.000

Shapiro-Wilk Test for Normality

	Obs	W	V	Z	Prob>z
Transformed Imputed	407	0.902	27.343	7.879	0.000

The process is repeated for Upper Secondary and Tertiary levels of Education. The final imputations use the non-transformed values for Upper Secondary and Tertiary Education.

Appendix II: Number of Hospitals

Due to the weak correlations (the most profound being with Obesity at 0.462), limitations on the breadth of the data and nonlinearity within the available data unconditional mean imputation[206] for the Number of Hospitals is used.

The final results of the imputation effort are shown below compared to the original distribution.

Table 153: Descriptive Summary of Mean Imputed Total Number of Hospitals and Original Values

	Obs.	Mean	Std. dev	Min	Max
Imputed	407	29.477	13.808	8.630	76.070
Original	366	29.477	14.563	8.630	76.070

The distribution of data is checked and found to be normally distributed.

Table 154: Normality Test of Total Number of Hospitals and Original Values

Skewness and kurtosis tests for normality

	Obs	Pr(skewness)	Pr(kurtosis)	Adj chi2(2)	Prob>chi2
Imputed	407	0.000	0.000	64.07	0.000
Original	366	0.000	0.003	50.930	0.000

Shapiro-Wilk Test for Normality

	Obs	W	V	Z	Prob>z
Imputed	407	0.902	27.285	7.874	0.000
Original	366	0.901	25.168	7.643	0.000

A Box Cox transformation is done of the new mean imputation data and produces a Theta of 0.0569787. The data are transformed and when rechecked for normality it is found that it does not improve the distribution and will not be used.

Appendix II: Employment Rate

Due to the weak correlations (the most profound being with Disability Adjusted Life Years at -0.556), limitations on the breadth of the data and nonlinearity within the available data unconditional mean imputation[206] for the Number of Hospitals is utilized.

Table 155: Descriptive Summary of Mean Imputed Employment Rate 15-64 years and Original Values

	Obs.	Mean	Std. dev	Min	Max
Imputed	407	66.961	7.411	44.200	86.500
Original	404	66.961	7.438	44.200	86.500

The distribution of data is checked and found to be normally distributed.

Table 156: Normality Test of Employment Rate 15-64 years and Original Values

Skewness and kurtosis tests for normality

	Obs	Pr(skewness)	Pr(kurtosis)	Adj chi2(2)	Prob>chi2
Imputed	407	0.025	0.855	5.050	0.080
Original	404	0.026	0.929	4.950	0.084

Shapiro-Wilk Test for Normality

	Obs	W	V	Z	Prob>z
Imputed	407	0.991	2.513	2.195	0.014
Original	404	0.991	2.589	2.265	0.012

A Box Cox transformation is used with the new mean imputation data and produces a Theta of 1.809813. The data are transformed and rechecked for normality and found to not improve the distribution and will not be used.

Appendix II: Voluntary Insurance

Due to the weak correlations, limitations on the breadth of the data and nonlinearity within the available data unconditional mean imputation[206] is utilized.

Table 157: Descriptive Summary of Mean Imputed Voluntary Insurance and Original Values

	Obs.	Mean	Std. dev	Min	Max
Imputed	407	97.617	5.018	67.500	100.000
Original	361	97.617	5.329	67.500	100.000

The distribution of data is checked and found to be normally distributed.

Table 158: Normality Test of Voluntary Insurance and Original Values

Skewness and kurtosis tests for normality

	Obs	Pr(skewness)	Pr(kurtosis)	Adj chi2(2)	Prob>chi2
Imputed	407	0.000	0.000	235.34	0.000
Original	361	0.000	0.000	197.94	0.000

Shapiro-Wilk Test for Normality

	Obs	W	V	Z	Prob>z
Imputed	407	0.578	117.954	11.360	0.000
Original	361	0.581	105.297	11.028	0.000

A Box Cox transformation is used with the new mean imputation data and produces a Theta of 27.35912. The data are transformed and rechecked for normality and found to not improve the distribution and will not be used.

Appendix II: Supplemental Insurance

Due to the weak correlations, limitations on the breadth of the data and nonlinearity within the available data unconditional mean imputation[206] is utilized.

Table 159: Descriptive Summary of Mean Imputed Supplemental Insurance and Original Values

	Obs.	Mean	Std. dev	Min	Max
Imputed	407	32.357	25.059	0.000	97.900
Original	273	32.357	30.616	0.000	97.900

The distribution of data is checked and found to be normally distributed.

Table 160: Normality Test of Supplemental Insurance and Original Values

Skewness and kurtosis tests for normality

	Obs	Pr(skewness)	Pr(kurtosis)	Adj chi2(2)	Prob>chi2
Imputed	407	0.000	0.644	29.730	0.000
Original	273	0.000	0.000	42.72	0.000

Shapiro-Wilk Test for Normality

	Obs	W	V	Z	Prob>z
Imputed	407	0.922	21.817	7.341	0.000
Original	273	0.898	20.047	7.005	0.000

Appendix II: Compulsory Insurance

Due to the weak correlations, limitations on the breadth of the data and nonlinearity within the available data unconditional mean imputation[206] is utilized.

Table 161: Descriptive Summary of Mean Imputed Compulsory Insurance and Original Values

	Obs.	Mean	Std. dev	Min	Max
Imputed	407	25.353	21.849	0.000	91.600
Original	208	25.353	30.600	0.000	91.600

The distribution of data is checked and found to be normally distributed.

Table 162: Normality Test of Compulsory Insurance and Original Values

Skewness and kurtosis tests for normality

	Obs	Pr(skewness)	Pr(kurtosis)	Adj chi2(2)	Prob>chi2
Imputed	407	0.000	0.001	52.020	0.000
Original	208	0.000	0.000	31.950	0.000

Shapiro-Wilk Test for Normality

	Obs	W	V	Z	Prob>z
Imputed	407	0.922	21.903	7.350	0.000
Original	208	0.903	14.973	6.239	0.000

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