Scientific
Research
Publishing

The CDR Economic Impact of an Epigenetic Generational Psycho-Sequela in Formerly Oppressed Communities

Dennis Ridley[1,2], Andrea Nelson[1]

[1]School of Business and Industry, Florida A&M University, Tallahassee, FL, USA
[2]Department of Scientific Computing, Florida State University, Tallahassee, FL, USA
Email: dridley@fsu.edu, andrea.nelson2@famu.edu

Abstract

The purpose of this paper is to identify mechanisms by which a negative epigenetic generational psycho-sequela that is debilitating to formerly oppressed communities can be overcome to facilitate collaboration and therefore rule *of* law and in turn capitalism, democracy and improved standard of living. Recent research identified that while cooperation is an obstacle, collaboration is essential for rule *of* law. Standard of living is measured by real per capita gross domestic product (GDP) adjusted for purchasing power parity (GDPppp). This in turn is a function of capitalism (C), democracy (D) and rule *of* law (R). Rule *of* law protects democracy and creates stability that attracts capital, and democracy creates additional pathways for the optimal deployment of capital to produce goods and services.

Keywords

Collaboration, Epigenetic Generational Psycho-Sequela, Capitalism, Democracy, Rule *of* Law, Economic Growth and Development

1. Introduction

This paper investigates the possibility that environmental stresses experienced by human parents can have a debilitating impact on their grandchildren, negatively impacting their academic, job and economic performances, health, and standard of living. We rely on extrapolation from scientific experiments conducted on mice and primates. This reliance on non-human experiments is a limitation. However, it is common practice in human physiology to conduct preliminary studies on animals. The contribution is that extrapolation to humans may offer

some insights into underperformance by formally oppressed communities, related treatments and cures.

The terms collaboration and cooperation are sometimes confused. In this research we are interested in collaboration and epigenetic generational psycho-sequela epistemological, metaphysical, and axiological insights (Randrup, Druckemiller, & Briggs, 2016), so for clarity of purpose we begin with the definitions immediately below. Because of the novelty of this research, a summary of the CDR economic growth upon which it is based is given in the appendix. A nomenclature of technical terms used in the paper and in the supporting references, is placed at the end of the paper.

Definition. Cooperation is a plan and execution thereof by participants, each with their own personal self-interest and economic gain in mind yet yielding unintended mutual benefits.

Definition. Collaboration is a plan and execution thereof by participants for their intentional mutual benefit of shared goals, objectives, and rewards.

Definition. Epigenetic generational psycho-sequela refers to heritable brain changes in gene expression that occur without modifications at the deoxyribonucleic acid (DNA) sequence level.

The capitalism, democracy, rule *of* law (CDR) model (Ridley, 2020) is a function of rule *of* law, and rule *of* law is not possible without collaboration (Ridley & Nelson, 2022). These are the beginning points for creating gross domestic product and the potential for a good standard of living. As we drill down in this paper, we discover that epigenetic generational psycho-sequela may be related to the ability to collaborate. If true, treatment of this malady is job one.

Middle class potential

The acquisition of wealth in some countries of the world demonstrates its possibilities. Although these countries are primarily in western Europe and North America, they have appeared to a lesser extent in Asia and to an even lesser extent in Africa. The currently rich countries were all once poor prior to the industrial revolution. Some are recent additions to the wealth roster. There is sufficient diversity among them as to discourage any belief that their good fortune is due to human appearance, culture, natural resources or geography.

Still, enormous poverty exists and persists. Ten percent of the worlds people are rich and are getting richer while ninety percent live on two to three United States (US) dollars per day. The rich countries are some one hundred times wealthier than the poor countries. Ridley (2021b), Ridley & Korovyakovskya (2022) and Ridley, Korovyakovskya, & Llaugel (2021) show that the richest countries practice a high level of collaboration and the poorest countries do not. There can be no question about the role of collaboration in science, engineering, and technology for the creation of new devices, products, and services. The purpose of this paper is to investigate the mechanism of how collaboration can be cultivated by alleviating the debilitating impact of negative epigenetic generational psycho-sequela, thereby creating middle-class countries around the world.

The role that laws play is more important to an economy than the number of natural resources or geography. The laws of countries such as the US were developed primarily for the protection of rights in property and resources. The concept of property is poorly understood. It is a commonly held but incorrect belief that property is a physical item. In fact, property is a legal expression of an economically meaningful consensus by people about assets, how they should be held, used and exchanged. Allegiance to the sanctity of the rule *of* law ensures that no one is above the law and all laws are generally and equally applied to every citizen. Governments should not arbitrarily disregard or otherwise impede individual property rights. The protection of property rights allows for the transfer of property and resources by contract. The US court systems enforce those contract rights, thereby reducing the uncertainty associated with participation in the marketplace.

Historically, as most societies moved from close-knit hunter-gatherer societies to trading with strangers in expanding global markets, the economy of some nations evolved and grew while others stagnated or declined (North, 1991). In Western Europe, the formerly robust economies of Spain and Portugal have since declined while the economies of the Netherlands and England have grown (North, 1994). The most recently reported average monthly income for Spain is $2478, and Portugal's is even lower at $1978. In the United Kingdom, the average monthly income is $3782; the Netherlands, which ranks 14th in the world, has an average monthly income of $4698. In North America, the U.S. economy surpasses that of its neighbor Mexico. The average monthly income in the U.S. is $5869, much higher than Mexico that has an average monthly income of only $782 (World Bank, 2021; Worlddata.info, 2021). The foundation of US institutions, such as its constitution, laws, and court systems, was built upon the same property rights protections developed in England (Ridley & Nelson, 2022). Singapore ranks tenth with an average monthly income of $5334 (after adjusting for purchasing power parity Singapore ranks second). At the same time, its Asian neighbor Malaysia, with a common border, has an average monthly income of $911 (World Bank, 2021). There are no identifiable similarities culturally or geographically among the above countries with higher average incomes or among the poorer countries with lower average incomes. Likewise, there is no abundance of natural resources common to the countries with higher average incomes. Instead, the trend is for countries that rank higher on rule *of* law to have higher incomes.

Research question

The question to be answered is what is the relationship between epigenetic generational psycho-sequela and collaboration and what is the precise mechanism by which curing negative epigenetic generational psycho-sequela can bring about collaboration, rule *of* law, capitalism, democracy, and raise standard of living?

Organization

The remainder of the paper is organized as follows. Section 2 is a review of relevant literature. Section 3 examines qualitative relationships between collaboration and various elements of economic growth and development, and how epigenetic generational psycho-sequela may affect collaboration. This is critical to understanding the genesis of the problem. Therefore, we ask the reader to bear with us while we explain a few important biological technicalities which set the stage for better understanding. We also consider the legal requirements for making team sport aimed at developing collaboration skills mandatory in schools. Sections 4 and 5 examine the quantitative relationships and a test of hypothesis. Section 6 summarizes conclusions and suggestions for future research.

2. Related Literature

Collaboration is essential for extraordinary economic development. Randrup, Druckemiller, & Briggs (2016) propose terminology to bridge between isolated communities of collaboration researchers from various fields, defining key terms and making arguments about what collaboration is and is not. Brownell et al. (2006), Callaghan et al. (2011), Sterelny (2011, 2012) and Warneken & Tomasello (2007) conducted experiments on primates and humans that revealed unique human ability to collaborate. Wilson (2015) showed that while insects may cooperate instinctively, they do not collaborate. Alvard (2012) and Tomasello et al. (2012) identified human foraging as a source of collaboration skill. Ridley & de Silva (2019) showed how to evaluate the absence of collaboration and the cost of corruption. Ridley (2022) showed that collaboration is more important than intelligence for economic growth and development. Ridley, Ngnepieba & de Silva (2021) showed that collaboration in academic learning normalized calculus test scores and raised their averages. Ridley & Korovyakovskya (2022) gave supporting mathematical proofs. McCartney (2018) explains how collaboration between the Beatles produced very successful musical compositions. Hibbing, Smith, & Alford (2014) explained how human beings are predisposed to liberalism and conservatism, making collaboration exceedingly difficult. Levitsky & Ziblatt (2018) gave many examples of how democracies have been lost.

Collaboration has an impact on rule of law. Ridley & Nelson (2022) identified the origin of rule of law and its relationship to collaboration. They traced rule of law to 1215 England and Magna Carta. They showed that all pre-Magna Carta law codes were rule *by* law of kings and popes, not rule *of* law wherein no man is above the law. Holt (1992) offers most authoritative analysis of Magna Carta, the great charter, and 1215 English law, politics and administration. Dicey (1885) was the one who first used the term rule *of* law. Haggard, MacIntyre, & Tiede (2008), Braithwaite (2021), Wallace & Goodman-Delahunty (2021), Johnston (2006), Marmor (2004), Sarsfield (2010), Tyler & Trinkner (2017), Hayek (1944), Joireman (2001) and Tyler (2006) all speak to the importance of trust and rule *of* law and their importance to economic growth.

Epigenetics can present an obstacle to collaboration. Nilsson et al. (2022), Beck et al. (2021), King & Skinner (2020), Ben Maamar et al. (2018), Skinner (2014), Skinner et al. (2013) and Crews et al. (2012) showed that transgenerational epigenetic inheritance can negatively impact future generations of an organism. Harlow & Zimmermann (1958) and Harlow, Dodsworth, & Harlow (1965) showed that baby rhesus monkeys that were removed from their mother and not allowed to breastfeed and bond with their mother grew up unable to form relationships with their peers.

Collaboration and therefore positive epigenetics may have a favorable impact on economics. Ridley (2020) proposed a capitalism, democracy rule *of* law (CDR) model in which rule *of* law depends on collaboration. Ridley & Llaugel (2022) give 3D and 4D depictions of the CDR model. Ridley (2021b), Ridley & Korovyakovskya (2022) and Ridley, Korovyakovskya, & Llaugel (2021) showed the relationship between collaboration and wealth by country. North (1991, 1994), Acemoglu, Johnson, & Robinson (2005), Faria et al. (2016), Gwartney, Holcombe, & Lawson (2006), Glaeser et al. (2004), and Kaufmann (2007) explained the importance of institutions for economic growth. One might think of collaboration as an institution. Jeuland & Shugan (1983) and Chopra & Meindl (2001) discuss how collaboration is essential to maximize supply chain surplus, and how cooperation does not. The greatest economic impact of collaboration is in entrepreneurship. Kirzner (1973) argues that entrepreneurship reallocates resources and equilibrates markets. Holcombe (2003) argues that entrepreneurial discoveries lead to more entrepreneurial opportunities.

It is possible that solutions to these epigenetic maladies may be found in team sports. Zuckerman et al. (2021) and Hoffmann et al. (2022) showed that team sports can offer mental health benefits. Easterlin et al. (2019) and Hoffmann et al. (2022) reported that children who played team sports enjoyed better mental health. The foregoing research does not connect epigenetics to psychological malady and the economic consequences thereof. In this paper we show how negative epigenetic psycho-sequela can disable the ability to collaborate, thereby preventing the development of rule of law and suppressing economic growth and development. Then, we propose further studies aimed at treatments and cures of epigenetic maladies, for the promotion of general mental health and for overcoming negative epigenetic psycho-sequela, thereby permitting collaboration, rule of law and raised standard of living.

3. Collaboration through Positive Epigenetic Generational Psycho-Sequela

3.1. Collaboration

Recent experiments and analysis by Brownell et al. (2006), Callaghan et al. (2011), Sterelny (2011, 2012) and Warneken & Tomasello (2007) reveal that there is a positive relationship between collaboration and the extraordinary de-

velopment of humankind. Collaboration is unique to human beings and humanity. Like human beings, animals can cooperate, but they do not collaborate. Chimpanzees are the closest animals to human beings. They are known to hunt cooperatively a little red monkey. Several chimpanzees will organize to cut off its escape routes. But the first chimpanzee to catch the prey takes off with it. That non-collaborative act does not end future hunts as it would with human beings. In the case of large prey, such as ungulates, hoofed mammals, hunted by wolves, sharing is not an issue because there is more than enough to go around. Still, sharing is not equal. There is a pecking order that begins with the strongest most dominant wolf, not the wolf with the greatest imagination and creativity. Insects such as ants and bees appear to be programmed to function as many moving parts of one living organism (Wilson, 2015). They appear to be in service to the reproductive outcomes of the queen. Salmon are individually programmed to locate upstream freshwater patches where they were once hatched years before, and where they can spawn new eggs. This group activity is seasonally driven. Human collective foraging may have played a role in the development of collaboration skills (Alvard, 2012; Tomasello et al., 2012). The human ability to collaborate does not guarantee that they will. One obstacle to collaboration might be the impact of negative epigenetic generational psycho-sequela.

We will now discuss several examples of collaboration, the paradoxes that they imply and dilemmas that they present. We begin with collaboration and capitalism, democracy and rule *of* law in that order as that is how they appear in the CDR economic growth model. In this paper we dwell on rule *of* law because it is the beginning point for CDR economic growth and development. It protects democracy and attracts capital that must be deployed via democratic pathways. Next, we also consider examples related to money, intelligence, team sports, music, supply chains, government, and interfaces to the real world.

Collaboration and capitalism

There are two forms of capital, human capital ideas of imagination and creativity and capital stock of knowledge, machinery, recordings, computers, etc. Collaboration in capitalism is the way in which capital is organized by human beings so as to create wealth. When human beings collaborate, capital is amassed and made available for deployment. Failure to collaborate results in fragments of capital that are ineffective.

Collaboration and democracy

Democracy creates new pathways for the optimal deployment of capital in the creation of wealth. When human beings collaborate in democracy, the pathways and possibilities increase exponentially. Failure to collaborate results in ordinary economic growth at best or in the worst-case poverty. Cooperation alone (not collaboration) results in ordinary economic growth. No collaboration and no cooperation results in poverty.

Collaboration and rule of law

The purpose of the for-profit corporation is to organize capital (capitalism)

for the aim of maximizing profit. Corporate profit is a monotonically increasing function of cooperation and collaboration, where cooperation functions as a subset of collaboration. But rule of law is a dichotomous function of cooperation and collaboration, where cooperation functions to prevent rule of law, and collaboration functions to permit rule of law. Hence the Ridley & Nelson (2022) collaboration rule of law paradox that shows how while cooperation is an obstacle, collaboration is essential for rule of law. A paradox because while cooperation could be thought of as a subset of collaboration (in the corporation), the attainment of rule of law requires advancement straight to collaboration while foregoing cooperation. Rule of law creates stability for attracting capital and protecting democracy. The oldest known law code existing today is the Code of Ur-Nammu (created 2100 BC-2050 BC in Nippur, Mesopotamia (modern day Iraq), now located in archaeological museum (Ni.3191), Istanbul, Turkey). Although it was written in stone, it was succeeded three centuries later by the Code of Hammurabi (1755BC-1750BC), found in Susa, Mesopotamia (modern day Iran), now located in the Louvre Museum, Paris, France). While Code of Ur-Nammu (reigned 2112BC-2095BC) and Hammurabi (1792BC-1750BC) implemented rules related to law, these and subsequent pre-1215 Magna Carta kings were all above the law. That is, rule by law, not rule of law (see also (Holmes, 2003)). Ridley & Nelson (2022) chronicled certain features of historic law and showed that Magna Carta (Holt, 1992) was the genesis of rule of law, unique in that all parties therein were subject to the rule of law and no man was above the law. The first English Parliament was convened in 1215 with the creation and signing of Magna Carta. Absolute monarchies became constitutional monarchies in 1688.

The Ridley & de Silva (2019) collaboration dilemma showed how a collaboration between nation builders and a corrupt dictator can be designed to rid a nation of the dictator. The nation-builders face the dilemma of paying a corrupt dictator an emolument to exit the nation and never return or incurring the cost of living with and serving the dictator indefinitely, a policy that has the appearance of a bribe. But this is similar to what the Barons of England did when they forced the absolute monarchy into a constitutional monarchy following Magna Carta in 1215. If Magna Carta alone did not do it, the regicide of King Charles I in 1649, a brief republican state, and subsequent death of lord protector Oliver Cromwell in 1658, rid England of dictatorship and anyone who might contemplate it. That turned out rather well for England. It has also had a positive outcome everywhere that anglophones have adopted Magna Carta in the legal system of their country.

There are many other additions to and extensions of foundation rule of law that have improved the lives of various people. For example, not unlike the Barons of England who participated in the creation of Magna Carta, Martin Luther King Jr. (1929-1968) collaborated successfully with various local and national leaders and law makers as they demonstrated the need for legal reform of the US

constitution, not the least of which was civil rights for the least amongst us.

Ridley (2020, 2021a) showed that rule *of* law is critical for the CDR index of a country, and the CDR index measures standard of living (see also the 3D depiction in the appendix and the 4D depiction by (Ridley & Llaugel, 2022)). Therefore, collaboration is essential to raising standard of living.

Collaboration and money

One example of a collaboration is the US dollar. The Congressional Coinage Act of 1792 established the United States dollar as the country's standard unit of money. The dollar is fiat currency. Fiat currency because it is a national currency that is not pegged to the price of a commodity such as gold or silver. It is money that is largely based on the public's faith in the currency's issuer, which is the US government central bank. In 2007 Kenya developed the M-Pesa (Swahili for money) mobile phone money transfer service that bypasses banks. The most recent currency, bitcoin, came into existence in 2009. Bitcoin is a digital cryptocurrency asset that uses cryptography to control its creation and management, rather than relying on a central authority. It is an example of even greater collaboration. It is created by the common man, for use by the common man, independently of any banking institution. Bitcoin Beach in El Salvador is an example of where bitcoin has created a local economy within a world economy of common men. Bitcoin is the ultimate collaboration in a very important economic activity.

Collaboration and intelligence

The Ridley (2022) collaboration-intelligence paradox shows that collaboration trumps intelligence as a predictor of standard of living. In separate regressions of GDPppp on collaboration and GDPppp on IQ, both collaboration and IQ were positively statistically correlated with GDPppp. That might lead one to believe that both collaboration and IQ contribute collectively to GDPppp. But when GDPppp is regressed simultaneously on collaboration and IQ, collaboration is statistically significant, and IQ is not. This is quite astonishing. It implies that no amount of intelligence by itself will create high national standard of living. It may produce certain benefits to individuals, but those benefits will not include belonging to a wealthy nation. Wealth will not occur until there is collaboration in their nation, or the individual relocates to a nation where there is collaboration. Wikipedia is an example of worldwide collaboration.

Ridley, Ngnepieba, & de Silva (2021) showed that contrary to commonly held belief, high school AP scores are not normally distributed, they are multi modal non-normally distributed. They then showed how conventional lectures in university calculus classes continued to produce test scores that were multi modal non-normally distributed. But, as they showed, collaboration through active learning methodology not only raised the test scores but normalized the test score distribution. There might have been other unaccounted for factors that accidentally affected test scores and averages. But the effect of collaboration to change the distribution required a profound impact on the relationship between

the students themselves. This effect cannot be contrived. Further to the foregoing empirical demonstration that the outcome from collaborations is normally distributed and the mean is maximized, that is the outcome is optimal, they and Ridley & Korovyakovskya (2022) gave mathematical proofs that different distributions can combine to form a single normal distribution. Such is the doctrine of normal tendency to maximize outcomes. This adds to the evidence for the importance of collaboration, over and above intelligence. Hence our stress on the importance of collaboration. In passing we observe that if collaboration is a maximizing principle, then division is a minimizing principle.

Collaboration and soccer

There are a number of team sports than can be considered for collaboration training. There are also their mental health benefits (Zuckerman et al., 2021; Hoffmann et al., 2022). For example, soccer, football, hockey, baseball, etc. In each case, a star player can receive a standing ovation for their dazzling performance. If that were the objective, then consider it accomplished. But the team can lose if the star does not collaborate with team mates to put the ball in the goal.

There is an interesting observation that we make about soccer, the most popular sport in the world. The recent and current men's French national team is almost entirely populated by players of recent African ancestry. They are very successful, including winning the 2018 world cup. The best professional European club teams employ numerous African nationals. But when the Africans return home to play for their national teams, they and their teams underperform their potential. It appears that under European management and coaching, they collaborate very well. But under African management and coaching collaboration is much less. The facilities are lacking, and the governing bodies are less than collaborative. This implies that success in soccer is not only individual skills related, but it also depends on organizational, managerial, and methodological skills. There appears to be a significant need for the development of collaboration skills in African soccer management. This observation is also true for several country nationals, other than Africans, where collaboration and economic developed are less than in western Europe. But there is some good news. At the time of this writing six African teams qualified for the 2022 world cup and appear to have improved their collaboration skills and degree of success. In a contrary example, Brazilian soccer players excel in Brazilian and in European club teams, as well as in national Olympic and world cup competitions. The facilities are excellent, and teams are well funded. Their ability to collaborate in soccer is nothing short of miraculous. Unfortunately, it is not collaboration but rather corruption that pervades the wider Brazilian society.

Collaboration and music

Individual musicians can cooperate and take turns to play their instrument. They can agree on how much time each player gets to do a solo. It could be proportionate to level of skill. There can be perfect cooperation but there will be no orchestra. A group musical performance is guaranteed to fail if there is no col-

laboration. Classical European and Jazz compositions are also evidence of intense collaborations. A more recent example of exceptional successful collaboration wherein the participants are known to each other is the Beatles. McCartney (2018) explains how collaboration among the Beatles produced a plethora of musical compositions, remarkably, none of which is the same as another. That is, each composition was a new and unique creation, proof of true collaboration. The great musical composers, talent scouts and Motown discographic enterprise managers Quincy Jones (1933-current) and Berry Gordy (1929-current) produced the extraordinary collaborations of the 1960's. Famous groups included Jackson Five, Supremes, Temptations, Miracles, Vandellas, Four Tops, etc., inspiring many more. Other collaborators of Quincy Jones included Elvis Presley, Frank Sinatra and Count Basie. Although many individual performers rose out of this success, one must recognize the contribution of the force of group collaboration.

Collaboration and supply chains

Yet another paradox is that of surplus in a supply chain. The members of a commercial supply chain can choose to pursue maximization of their individual profits, or they can choose to maximize the total profit of the chain. Attempting to maximize their individual profits is an act of cooperation with self interest in mind that unintentionally benefits the connected members of the chain to some degree. But it does not maximize the total chain profit and for that reason does not maximize their individual profits. Maximization of the total profit of the chain is an act of collaboration with intentional shared goals and rewards that actually maximizes individual profits. See Jeuland & Shugan (1983) for a discussion on coordination in distribution channels and profit. Chopra & Meindl (2001) illustrate this paradox with numerical examples.

Collaboration in government

The highest and broadest level of collaboration possible for uniting the efforts of the entire nation occurs in Singapore. Singapore is unique in that the government leaders and workers are remunerated by a bonus system that is tied to national economic performance. The government and private sectors intentionally share national economic performance goals and rewards. Management theory states that rewards are best related to objectives if high performance outcomes are desired. The result is the world's highest GDPppp, about 50% more than that of the USA (see 2014 G vs CDR Index chart in the appendix).

Interfaces to the real world

Ridley, Ngnepieba, & de Silva (2021) acknowledged that "The world is a most complicated place. One might think that the human being is curious to learn all about the world. That they wish to learn and experience all that is real. In fact, human beings are overwhelmed by the complexity and expanse of the world and often choose to avoid reality. To cope, they tend to build interfaces between themselves and the world."

If the negative epigenetic generational psycho-sequela is in fact genetic, not

epigenetic, there might be nothing that can be done to bring different parties together. A differential in intelligence is implied. But different minds can still subscribe to a scientific economic process that can be demonstrated to maximize standard of living. There are many physical and chemical science processes that produce outcomes that are counterintuitive. But through research and schooling in scientific learning and laboratory training and demonstrations, we learn what works, what to do and what not to do. For example, as heat is applied to an open pot of water the temperature can be observed to rise progressively to 100 degC. Prior to relevant schooling, a rational human being is predisposed to believe that the temperature will continue to rise, but it does not. Furthermore, the water starts to disappear. After some relevant schooling and several repeat laboratory experiments, there comes a time when one must put predisposition aside and find something to do with all that steam. A high-speed turbine perhaps? Still, collaboration and rule *of* law are catalysts that must prevail. As mentioned above collaboration trumps intelligence (Ridley, 2022).

In their hypothesis of biology related politics, Hibbing, Smith, & Alford (2014) explain why equally intelligent and credentialed people can argue indefinitely, each one only to conclude that the other person is shallow, misguided, uninformed, and ignorant. If their predispositions to liberalism and conservatism are real, collaboration may appear to be an insurmountable impasse. We propose that applying the scientific problem analysis, diagnosis, and solution method to the capitalism, democracy and rule *of* law decision-making process objectivity, can take precedence over predisposition. And predispositions can be placed aside. This scientific process begins with collaboration. Teamwork exercises may be one solution to this dilemma. Many hands make light work (John Heywood, 1497-1580) and teamwork makes the dream work (Maxwell, 2002). In the US it helps that liberal (democrat) and conservative (republican) predispositions are near equally divided (miraculously much like male/female) in the human population. At first reckoning, this all but guarantees an impasse. But this is accompanied by a very small percentage of swing voters who break the impasse while promoting regular changes in American government and the maintenance of an even keel democracy. Saving democracy. If either one community of these predispositions were to become disproportionately large and overwhelming, it and the politicians they support could simply ignore the wishes of the others. Effectively, losing the democracy. Therein lies the genius of the system of representational democracy and the electoral college to mitigate this effect. For more on threats to democracy see Levitsky & Ziblatt (2018).

3.2. Epigenetic Generational Psycho-Sequela

According to biologists Nilsson et al. (2022), Beck et al. (2021), King & Skinner (2020), Ben Maamar et al. (2018), Skinner (2014), Skinner et al. (2013) and Crews et al. (2012), transgenerational epigenetic inheritance is the transmission of information from one generation of an organism to the next that affects the

traits of offspring without alteration of the primary structure of DNA. In other words, epigenetically. Epigenetics is the study of heritable phenotype changes that do not involve alterations in the DNA sequence. The Greek prefix epi- in epigenetics implies features that are "on top of" or "in addition to" the traditional genetic basis for inheritance. They address the biology of how the body and the brain can be affected, including disease. In this paper we are interested in how exposure to environmental toxicants and stresses can impact epigenetics for generations to come. That is, transgenerational epigenetic inheritance and epigenetic modification. Furthermore, we consider how the effects on the brain may create an unfavorable disposition for collaborating, handling stress, performing in academic and professional endeavors, and in the economy in general. For that reason, we modified the title of the phenomenon to "epigenetic generational psycho-sequela." We will refer to transgenerational and multigenerational simply as generational. But it is understood that the epigenetic effect on biology may be transgenerational and the effect on psychology may be behavioral and multigeneration. We are interested in the epigenetic generational effect and its implication and consequences for psychology of future generations. So, we begin this section by reviewing the concept in terms of biology. Then we consider the psychological effects next.

Biology

Historically, the field of biology has considered genetic determinism. But consider for example the following. In Japan, men experience a high frequency of stomach disease and a low frequency occurrence of prostate disease. American men experience a low frequency of stomach disease and a high frequency of prostate disease. But if a 5-year-old Japanese child is moved to America, in time, he develops a high susceptibility to prostate disease. This cannot be due to a genetic change. What is implied here is that there is an epigenetic effect due to change in environmental factors. This is depicted in Figure 1. Other reasons to believe in environmentally induced epigenetics are that human twins have discordant diseases between them as time goes on and they live apart. There cannot be any mutagenic change in genes.

Other examples of epigenetic outcomes are increased susceptibility to post traumatic stress, impaired healing processes, etc. Examples of environment effects may be famine followed by an abundance of food, exposure to chemicals, or stress, etc. The severity of environmental impact on biological disease depends on regional factors, the frequency of their occurrence and the degree of exposure to them. The exposure need only occur in one generation of the organism to have a transgenerational effect on future generations. The cause of the disease may be nature (or mankind tampering with nature) and the cure may be nurture (or mankind correcting a past error).

Epigenetics are molecular factors and processes around the DNA that regulate genome activity and determine what genes are turned on or off, independently of DNA sequence. The processes are mitotically stable. When a cell divides into
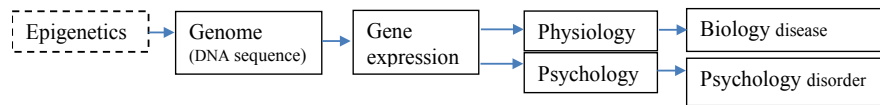
Figure 1. Historical timeline depiction of epigenetics. Source: Own schematic.

two daughter cells, that is called mitosis. The DNA in the parent cell gets replicated. It is exactly the same in the daughter cells. The epigenome also gets replicated. So, it is exactly the same in the daughter cells. Therefore, epigenetics are long term effects.

The epigenetic mechanisms are as follows:

-DNA methylation (small methyl group that is chemically attached to the DNA)

-Histone modifications (DNA are wrapped around proteins called histones)

-Chromatin structure (made up of tight or loose coils or loops)

-Non-coding RNA (stretches of RNA that do not code proteins)

So, it appears that biological disease etiology is environmental epigenetics. There is an ancestral and developmental basis for adult onset of disease phenotype. And non-genetic inheritance is germline dependent. The inheritances (see **Figure 2** (0), (1), (2), (3)) are multigenerational from the first environmentally affected ancestral gestating female (0) to its fetus (1) that will become its offspring, to the primordial germline (2) of the exposed fetus, followed by a transgenerational inheritance to an offspring (3) that is not exposed to the environmental effect. In epigenetic transmission of disease, the germline carries with it an altered methylation pattern which does not get erased. It generates the embryonic stem cell that is going to determine every cell in the body, that will then have a different epigenome from what it is supposed to have. And every cell in the body now has a shifted epigenome and a shifted expression of what genes are turned on or off. So is the whole new organism from just this germline carrying forward this epigenetics (see (Skinner, 2014)). Some biology is subject to change. If this is the case, we should be able to pick any epithelial cell, map its genome and show there is a difference, and map what genes are turned on or off and show there is a difference. Even if the environmental stress is removed, the inheritance is permanent until there is another environmental exposure (see **Figure 3**). That is to say, if one could map the environmental stress to a known disease, then when that disease appears in an offspring, one will know that a parent, grandparent, or great grandparent, etc. was exposed to it. In passing we mention that while an epigenetic outcome may affect the offspring of an oppressed community, it may miss particular individuals. To observe those individuals leading what appears to be normal lives can be misleading in this regard. They may just be one of many from the community. They are likely to be frustrated by the victims of oppressed community and chose to relocate to a different community and achieve exceptional success. All this unwittingly about epigenetic causes and effects.
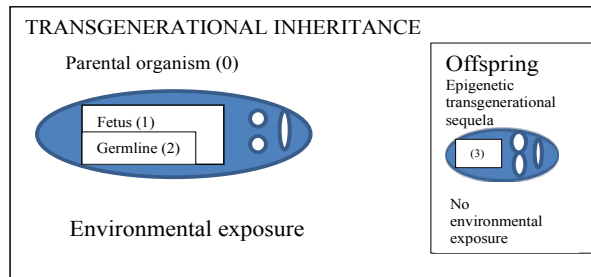
Figure 2. Parent organism exposed to the environment. *Source*: Own schematic.
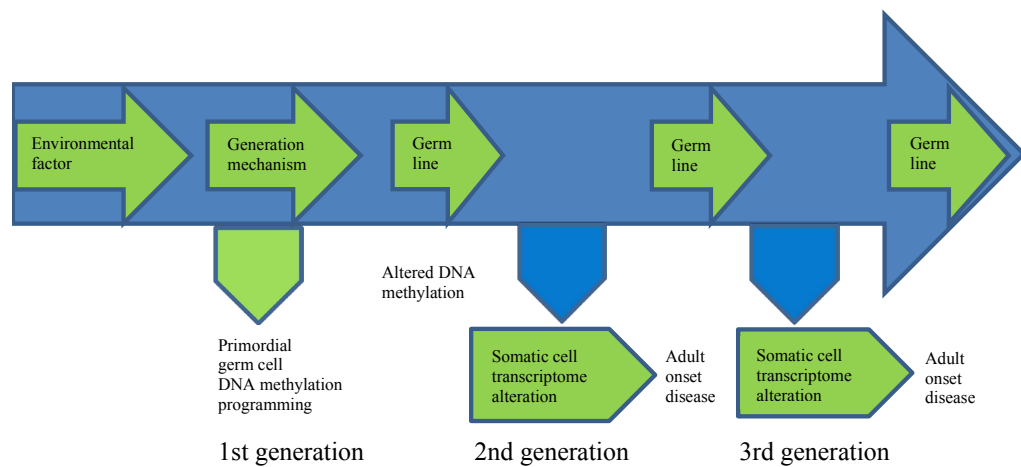
Figure 3. Role of germline in epigenetic transgenerational inheritance. *Source*: https://www.youtube.com/watch?v=erjyk9CbFwI.

Psychology

Epigenetics can also affect the brain. We refer to this as epigenetic generational psycho-sequela. This might take the form of transgenerational behavioral reprogramming, or it may more simply be intergenerational. Typically, this could be caused by exposure to stresses. An ancestral stress does not cause disease, but it induces susceptibility to get a disease. A post-traumatic stress disorder. Epigenetics can change the programming of the brain that causes a behavioral pathology. The following are examples of stress and corresponding pathology pairings.

STRESS EXPOSURE	PATHOLOGY
Maternal separation	Social anxiety, recognition and stress resistance
Traumatic paternal stress (odorant)	Behavioral and neural metabolic responses
Gestational restraint and forced swimming	Preterm birth and prenatal growth and behavior

There is a plethora of epigenetics that might affect the psychology of the offspring. One of these might be the ability to collaborate. A primate with many

similarities to human beings is the monkey. Harlow & Zimmermann (1958) and Harlow, Dodsworth, & Harlow (1965) conducted research in which baby rhesus monkeys were removed from their mother and not allowed to breastfeed and therefore not allowed to bond with their mother. They prevented attachment that develops as a result of the mother providing tactile comfort to infants that have an innate biological need to touch and cling to something for emotional comfort. When the monkeys grew up, they were unable to form relationships with other monkeys. They were aggressive towards other monkeys and engaged in self-mutilation. They were also aggressive towards their own progeny. These effects were permanently damaging. One might speculate that this would be the case with human beings. If that is true and their inability to form relationships has been induced, then it is fair to assume that they will have lost their ability to collaborate. Collaboration is one of the unique qualities of the human being that is responsible for great feats of scientific and engineering innovations that have created our great society. In cases where oppressed communities were subjected to forced labor and separation of mothers, fathers, and children, they would be unable to collaborate. Furthermore, if the environmental stresses involved people getting hurt, physically or emotionally, we know that people who are hurt, hurt people. The limbic area of the brain is responsible for emotion, behavior and survival instinct. The prefrontal cortex of the brain regulates emotion, and plans strategy, collaboration and creativity. It sees oneness over separation. These are the areas of the brain that may have been affected (Neuroscience of Collaboration|blueprintofwe). And these are the areas that must be mobilized to cure the problem. By cure we mean to recover the ability to collaborate. Or at least to heal.

Scientists experiment on mice and monkeys. They are not allowed to experiment on human beings where harmful outcomes are expected. Forced labor (and related family separation) was outlawed in the American territory of Vermont in 1777 and federally in the US in 1865. That is $2022 - 1865 = 157$ years ago. One generation is approximately 25 years (from birth to reproduction). So, we have $157/25 > 6$ generations of observations. Enough to observe that the great-great-great grandchildren of Americans who were victims of forced labor are on average currently much less wealthy than their other American counterparts. That is the reason why we think that there might be an epigenetic transgenerational inheritance. However, this observation is not obtained from a controlled experiment. So, it will have to remain a thought experiment for the time being. An anticerebralist might relegate all this to a correctable intergenerational behavioral malady. Biologists and psychologists might look forward to conducting a controlled experiment.

A significant number of formerly oppressed communities have produced high intellect individuals who pride themselves in explaining the devious and illusive strategies employed by their former oppressor. These scholars comprise erudite historians, psychologists, economists, politicians, theologians, and others. Their

philosophies provide comfort to the less successful and low income formerly oppressed, and garner great admiration from them. They form a mutual admiration support team for denouncing the former oppressor. They devote their time to this very clever pursuit, while remaining poor. These finely tuned lectures that critique the wickedness of former oppressors, no matter how richly deserves, may at best prevent a repetition in the future. It does not cure the current victim. Instead, what the victims need are experiential lessons and activities that teach collaboration and entrepreneurship. At the same time that the victims lament, the descendants of the former oppressor devote their time to building additional pathways to future success. This cycle of relative wealth and poverty continue as the wealth gap increases. The truth about the past inequities becomes quite irrelevant. We say relative because poverty in the USA for example is not nearly as much as elsewhere in the world. America's poor can get by on indoor plumbing, running water, air conditioning, refrigeration, television, automobiles, and the like. Medieval kings did not conceive of these luxuries. It is tempting to continue to enjoy these conveniences while having the moral righteousness to complain of injustice. In this paper, as insensitive as it may at first appear to be, we propose that the formerly oppressed get over it while they devote their time and intellect to ownership of the means of production and wealth creation instead. Beware however, that the time-honored historians who have honed their explanatory detective work and leadership skills, will not be pleased to lose their followers. Some of them have become hustlers who exploit the relationship for their own personal benefit. They will develop equally clever explanations for why our new leadership ideas are naive and possibly devious themselves. The victims are unaware of their affliction and are easily misled regarding their need for treatment as a current solution. We say all this to point out seductive obstacles to collaboration that will lead to a cure for victims of the negative epigenetic generational psycho-sequela.

The next part of the research question is what is the cure for epigenetic generational psycho-sequela that reinstates the human ability to collaborate? Negative epigenetics may not change DNA sequences but left unattended they will not go away. Nor will the performance problems that are associated with them. Furthermore, it may be impossible to reverse the process that created them by an oppositely constructed environment. How does one cope with trauma that one did not even experience. Since the objective is collaboration skill, exercises that require collaboration for measured success can be implemented. It is not sufficient to recognize that collaboration is not occurring and to implore all parties involved. After all, the victim is not currently experiencing the original stress that is the cause and is unaware of it. Intentional deliberate reprogramming is required. In education, time can be allocated to team projects that involve as many children as manageable. Or team music as in the band or the orchestra. A recent psychology study on 6 - 13-year children who played team sports showed that they were least likely to suffer mental disorders (Easterlin et al., 2019).

Those who played no sports were more likely. Those who played an individual sport were most likely. Hoffmann et al. (2022) reported similar results. So essentially what we propose is team activity and team sports like soccer as the least painful way to develop collaboration skills. Unlike football, soccer is equally accessible to boys and girls. It also reaches 22 players at a time, as many as any other sport. This might be the way for a whole community to do battle and to overcome negative epigenetic generational psycho-sequela. A soccer field is large and there is a significant cost. However, given that collaboration is important not only to rule *of* law but also to engineering, scientific, and managerial problem solving and innovation in the corporate world and society in general, it may be that the cost is easily justified. The next section of the paper addresses the need for legislation that may be required to accomplish a cure for negative epigenetics, and the potential income benefit.

3.3. Legislation

Rule of law

It is a commonly held but incorrect belief that the rule of law evolved as a concept to define the political philosophy of governance, including those who governed throughout history, from monarchies and aristocracies to modern-day leaders. That the roots of the rule of law date back from the informal governing structures during the days of hunter-gatherers to the more complex and formal modern-day systems of governance. Philosophical ideas were written throughout history from the Classical Period by Greek and Roman philosophers Aristotle (384-322 B.C.) and Cicero (106-104 B.C.) to British and French philosophers Thomas Hobbes (1588-1679) and Jacques Rousseau (1712-1778) centuries later during the Enlightenment Period. The truth is that prior to Magna Carta, as far back as Ur-Nammu, law was rule *by* law, not rule *of* law and the rulers, monarchs and popes were in fact above the law. Ridley & Nelson (2022) show that the present-day notion of rule *of* law is not an evolution but a revolution attributable to one period in history, one nation and one monarch namely King John, and primarily the Barons of England. The invention was to establish primacy that no one is above the law and that led to the replacement of the absolute monarch with the constitutional monarch. Magna Carta, written in 1215, had the most influence as the original rule *of* law. Many of its principles, such as protecting life, liberty, and property, serve as the basis for the U.S. Constitution. Despite the incorporation of the rule *of* law as an idea and concept important in the goals of governance, Professor A.V. Dicey (Dicey, 1885), who was the Vinerian Professor of English Law at the University of Oxford, was the first to use the term "the rule *of* law" as an expression (Bingham, 2010).

Rule of law and economic development

The rule *of* law is a key indicator of good governance. The quality or strength of adherence to the rule *of* law in a country is a leading indicator of the strength of its economy (see also (Haggard, MacIntyre, & Tiede, 2008)). It is measured by

trust and confidence in the laws, deference to the laws, the protection of property rights, enforcement of contracts, the control of corruption, and the prevention of crime and violence (see also Braithwaite (2021), Wallace & Goodman-Delahunty (2021), Johnston (2006), Marmor (2004), Sarsfield (2010), Tyler & Trinkner (2017)). These factors have become goals of various worldwide organizations such as the United Nations, the European Commission, the World Justice Project, and other organizations interested in economic development in developing countries. The economist Hayek (1944) shows that governance adopting the rule *of* law concept is key to the free market where the government makes formal rules "determining the conditions under which the available resources may be used, leaving to the individuals the decision for what ends they are to be used" without arbitrary interference from the government. These formal rules are "a kind of instrument of production, helping people predict the behavior of those with whom they must collaborate" (Hayek, 1944). Economic growth works best where the legal system is based on the rule *of* law, and the court system enforces the law. On the other hand, where there is no rule *of* law, there are no secure ownership rights in resources, an inability to make plans to exchange resources in the future through contracts, and a lack of confidence in the court system to enforce contracts. This is true for common law and civil law systems (Joireman, 2001). Nations that ignore the concept of rule *of* law do so at their own peril.

Rule of law and institutions

North (1990: p. 3) defines institutions as the rules of the game in a society, or more formally, the humanly devised constraints that shape human interactions. In consequence they structure incentives in human exchange, whether political, social, or economic. Acemoglu, Johnson, & Robinson (2005) said that of primary importance to economic outcomes are the economic institutions in society such as the structure of property rights and the presence and perfection of markets. Also of importance is the control of corruption and the enforcement of contracts. The distribution of political power in a society is determined by political institutions and the distribution of resources. Political institutions allocate *de jure* political power, while groups with greater economic might typically possess greater *de facto* political power. In any case, institutions are the cause of economic success. As a corollary, Ridley & Nelson (2022) showed that establishing the institution of rule *of* law requires collaboration.

We illustrate the distinguishing factor of institutions in the natural experiment of North and South Korea. The only thing separating these two countries is institutions, but the economic outcomes are vastly different. The establishment of rule of law in South Korea is one of the best examples that illustrate the impact of collaboration. And in turn economic development. These countries were formerly one country with common geography, ethnicity and culture. They share the same access to markets and the cost of transportation. Now, they are separated only by their institutions and the 38th parallel. In terms of natural resources North Korea is better endowed with significant reserves of coal, lead,

tungsten, zinc, graphite, magnesite, iron ore, copper, gold, pyrites, salt, fluorspar, and hydropower. The natural resources of South Korea are coal, tungsten, graphite, molybdenum, lead, and the potential of hydropower. Other examples of differences in institutions and economic outcomes are Western and Eastern Europe, and Japan and China. Institutional effects from learning and developing human capital can outweigh genetic effects (Faria et al., 2016). Some former low-income countries have transformed themselves through institutions into high income countries in just a few decades. For example, Poland, Chile, Hong Kong (China), Singapore, and South Korea made the transition in a remarkably short time. Many other countries have ignored the importance of institutions and have remained poor. For further discussion of institutions see Gwartney, Holcombe, & Lawson (2006), and Glaeser et al. (2004).

Trust and confidence in institutions

The rule *of* law plays a vital role in the public's trust and confidence in the American legal system. The strength of the public's positive perception is based on whether legal authorities act by the rule *of* law in their decision-making. The frequency and consistency with which legal authorities act by these principles, the greater is the public's trust and confidence. The greater the public's trust and confidence, the more deferential the public is to legal authorities (Tyler, 2006).

The American public's acceptance of the rule *of* law and deference to legal authorities is based on its unique history as a British colony and the influence Magna Carta had on the drafters of the U.S. Constitution. Despite adopting the rule *of* law as a concept by many other countries, the effect is not the same. The rule *of* law and control of corruption are among six indicators used by the World Bank to determine good governance in 212 countries and territories. Confidence in and deference to the law, the enforcement of contracts, and the prevention of crime and violence measure the rule *of* law. Corruption is measured by the extent to which public power is exercised for private gain (Kaufmann, 2007). Figure 4 illustrates the small percentage of countries primarily located in contiguous North America, which includes the U.S. and Canada but not Mexico, and western Europe that rank high in the rule *of* law and control of corruption indicators. Most remarkable is the widespread lack of rule *of* law and control of corruption. The CDR model below and in the appendix show how rule of law is correlated with standard of living.

According to Hayek (1944), "under the rule *of* law the government is prevented from stultifying individual efforts by *ad hoc* action. Within the known rules of the game the individual is free to pursue his personal ends and desires, certain that the powers of government will not be used deliberately to frustrate his efforts."

The legislation of cures

An interesting question is, can the application of medicinal cures or genetic engineering for epigenetics be made legally mandatory? The Health Insurance Portability and Accountability Act (HIPAA) of 1996 (Public Law 104-191), es-

tablished a national platform of consumer privacy protection and marketplace reform. While infectious diseases pose a danger to society, children who attend school, must by law be vaccinated with vaccines that are approved by the Federal Food and Drug Administration (FDA). Epigenetic maladies are not contagious, and it is not foreseeable that medicinal treatments or genetic engineering will be made mandatory. But the government could set aside a budget for these treatments to be developed and sought voluntarily. The next question is, can team sports in public schools be required for all students through legislation? Academic curricula are legislated because of their importance and economic value to the nation. Team sport that teaches collaboration is also important and valuable to the national economy. What would the legislation look like? If requirement for all is not possible, could a budget for team sports be legislated as reparations for members of the formerly oppressed community? Regarding society at large. Wheresoever people are living in environmentally hazardous areas, US legislation can and does disallow it.
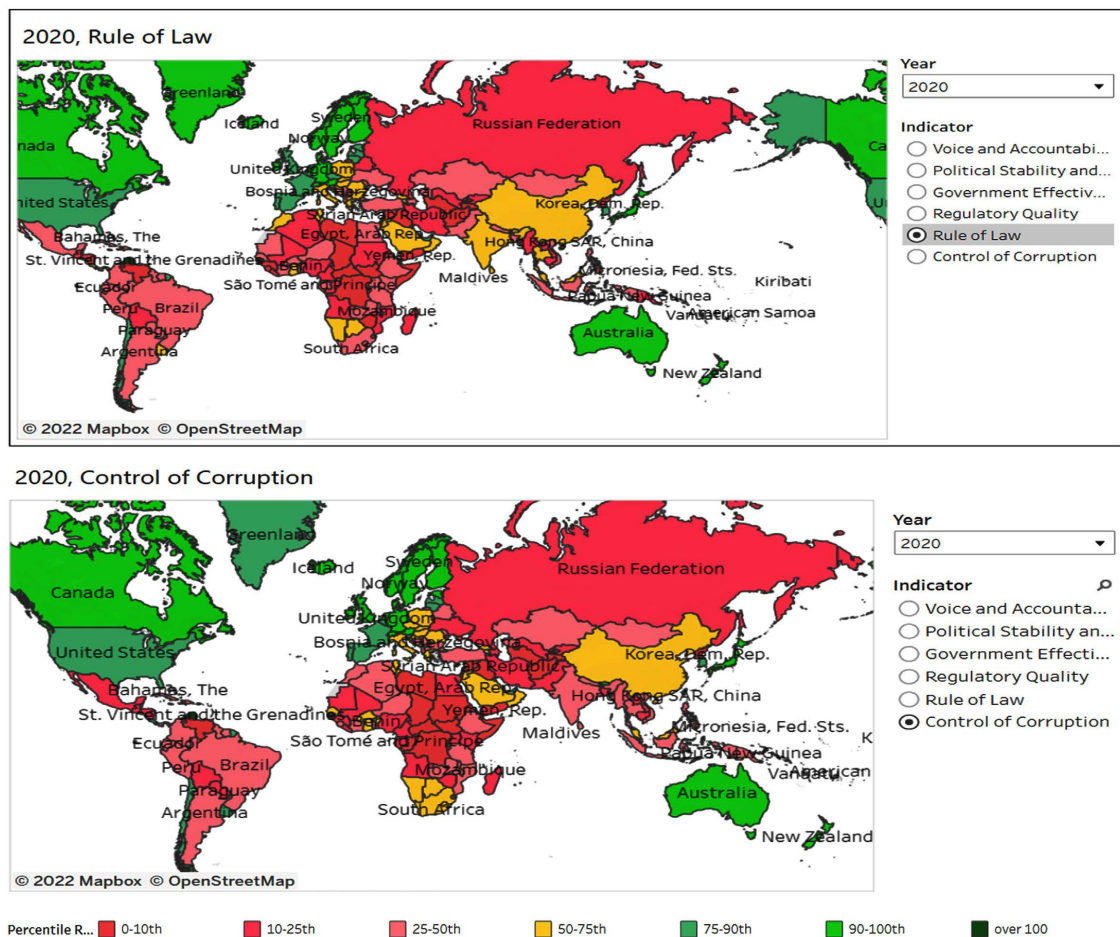
Figure 4. Worldwide Indicators: Rule of Law and Control of Corruption in 2020. *Note: Percentile ranks the percentage of countries worldwide that fall below a country.* Source: Kaufmann D., A. Kraay, and M. Mastruzzi (2010), The Worldwide Governance Indicators: Methodology and Analytical Issues https://doi.org/10.1017/S1876404511200046.

Income benefit

The cost of mandatory music teams and team sport may be much less than the gain in GDP in due course. Let us assume a target outcome of a middle-class income. The world average weighted by population GDPppp in 2014 was $16940 (see appendix). The lowest was $1112 in Malawi and the highest was $83066 in Singapore. Consider a goal to raise GDPppp to the average of $16940. The increase in the GDPppp would be $16940 − $1112 = $15828. About 26% of the world's population are school age children. Considering what is to be gained here ($15828 per capita), it appears that the cost of one year's per capita mandatory team activities is negligible. The expense to be borne by government is 26% of the required amount. The remainder of 74% on collaboration training will be for adults and will be borne by private parties. It is in the best interest of all people, healthy or otherwise, to assist. Every child who is cured and has their ability to collaborate restored can then contribute their human capital to the creation of GDP for the benefit of all.

3.4. The CDR Model

The capitalism, democracy, rule *of* law (CDR) model is a function of rule *of* law. Ridley & Nelson (2022) give a full account of how rule *of* law is dependent on collaboration. The CDR model is given in the appendix of this paper. In this paper we are concerned with the relationship between collaboration and epigenetic generational psycho-sequela. We posit that in order to raise collaboration a country must work to remove negative epigenetic generational psycho-sequela. Some positive aspects of society can only be achieved through collaboration wherein shared goals and rewards are pursued. These lead to innovation, the creation of new products and services and extraordinary economic growth and development. The CDR model and index is a weighted average of capitalism (C), democracy (D) and rule *of* law (R) that jointly with natural resources and geography explain almost all economic growth. In order to raise the real per capita gross domestic product (GDP) adjusted for purchasing power parity (GDPppp) (Ridley, 2020, 2021a) it must raise its CDR index. The CDR index is given by

$$\text{CDR index} = 1.53C + 0.14D + 0.23R - 1.21C \cdot D \cdot R + 0.38N .$$

In the CDR model, the source of wealth is entrepreneurial capital. Capital comprises intangible exogenous human entrepreneurial capital ideas of imagination and creativity, endogenous capital stock of knowledge (skills and memory), and tangible endogenous machinery, recordings, computers, etc. Capitalism is a method of organizing capital for the purpose of profitable investment. It is measured by total market capitalization divided by population. Rule *of* law is an intangible exogenous catalyst that creates stability for attracting capital and protecting democracy. Democracy is an intangible exogenous catalyst that creates new pathways for the optimal deployment of capital. Total capital is converted into production of capital stock, goods and services, which after consumption, depreciation and obsolescence, contributes to wealth. Since capital stock is sub-

ject to continuing depreciation and obsolescence, entrepreneurship must be the true source of new wealth creation. The economic growth that the high CDR economy generates requires increasing acquisition of capital stock of knowledge and skill. So, the workforce must acquire more education. As employees become more educated, they move up the economic ladder. The void that is left behind creates a demand for more entry level workers. Eventually the supply of workers is exhausted, automatons are invented, and immigrants must be sought to fill the vacancies.

Kirzner (1973)'s theory of entrepreneurship says that entrepreneurship reallocates resources and equilibrates markets. It does not say where entrepreneurship comes from. If one were to assume that there is a fixed stock of entrepreneurial opportunities, then as entrepreneurs discover and act on them, markets would equilibrate, and entrepreneurship would diminish. But we know from experience that the opposite is true. Holcombe (2003) says that entrepreneurial discoveries lead to more entrepreneurial opportunities, so the more entrepreneurship there is in an economy, the greater will be opportunities for future entrepreneurship. That implies endogeneity. Even if this were true, it does not explain where the first entrepreneurial idea and action came from? In the CDR model, total capital comprises entrepreneurship (human capital) and capital stock that was derived from prior entrepreneurship. But entrepreneurship is entirely exogenous and is therefore disequilibrating. It is attracted by the rule of law and deployed by democracy. We propose that every child brings its own capital into the world. Some bring much more. And there is a cost to society for any pregnancy that ends without a healthy birth. Sometimes adoption and foster care are called for. But it is well worthwhile if we can access this capital. We are resigned to accept that entrepreneurial ideas are a mystery (Ridley, 2020) simply because we cannot explain them by means of economics or law. Ridley (2020) did compute the percentage of capital that is exogenous entrepreneurship to be 85%, and the percentage that is endogenous capital stock at 15%. Scholastic aptitude tests and intelligent quotient scores do not predict any level of creativity much less each impending creative outcome. Even if entrepreneurship is explainable by biology and neuroscience, or by artificial intelligence and machine learning, these are outside the scope of this paper. Still, negative epigenetic generational psycho-sequela can be an obstacle to entrepreneurship.

Figure 5 is a schematic that illustrates the CDR model with positive and negative epigenetic sequelae. The model is called the CDR model because only C, D and R in the model are policy variables that can be set for optimization. Natural resources and geography are nature variables and are fixed, separate from capital.

4. Data

Proxies for Collaboration and Epigenetic Generational Psycho-Sequela

We now turn our attention to the quantitative evidence in support of our hypo-

thesis that epigenetic generational psycho-sequela is correlated with collaboration. There are no published data for collaboration by country. But collaboration is used synonymously with innovation (Hasting & Meyer, 2020). So we use the world intellectual property organization (WIPO) global innovation index (GII) (Indicator Rankings & Analysis | Global Innovation Index) as a proxy for collaboration. See Table 1.
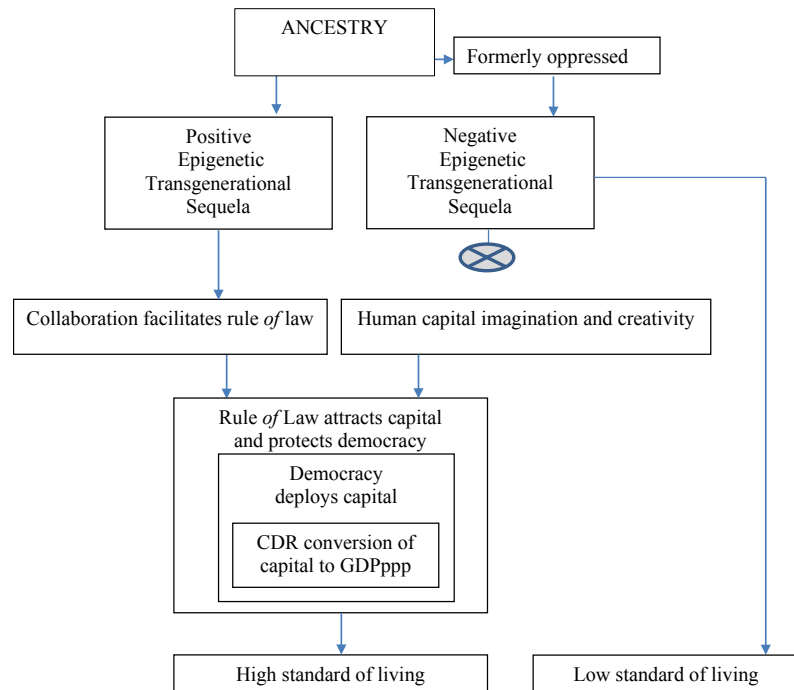
Figure 5. Positive epigenetic transgenerational sequela enables collaboration essential for rule *of* law that attracts capital which is deployed by democracy for GDPppp generation and high standard of living. Source: Own schematic.

Table 1. Happiness index (HI) (2019-2021) by country, Global innovation index (GII), Natural resources and Latitude.

Country	Happiness Index (HI)	Global Innovation Index (GII)	Natural Resources Rents $ (N)	Latitude (L)	Country	Happiness Index (HI)	Global Innovation Index (GII)	Natural Resources Rents $ (N)	Latitude (L)
Argentina	5.967	30.65	847.476	0.3778	Latvia	6.180	43.18	642.411	0.6333
Armenia	5.399	32.81	318.396	0.4444	Lebanon	2.955	28.22	0	0.3722
Australia	7.162	51.98	3584.35	0.3	Lithuania	6.446	41.19	272.59	0.6222
Austria	7.163	51.32	186.56	0.5244	Macedonia	5.199	29.91	495.726	0.4611
Bangladesh	5.155	23.06	115.294	0.2667	Malawi	3.750	23.09	155.68	0.1478
Belgium	6.805	50.5	43.139	0.5661	Malaysia	5.711	43.16	2514.5	0.0256
Bolivia	5.600	22.88	1002.064	0.1889	Mauritius	6.071	31.31	0	0.2241
Botswana	3.471	28.16	545.6	0.2444	Mexico	6.128	35.34	1382.15	0.2556
Brazil	6.293	33.44	985.455	0.1111	Mongolia	5.060	35.9	3945.189	0.511
Bulgaria	5.371	42.65	358.52	0.4778	Morocco	7.415	31.09	289.081	0.3556

Continued

Country					Country			
Canada	7.025	52.98	2338.284	0.6667	Namibia	4.552	28.03	202.464	0.2444
Chile	6.172	37.79	3712.177	0.3333	Netherlands	7.365	63.32	479.6	0.5811
China	5.585	53.06	740.544	0.3889	Nigeria	5.699	22.37	944.424	0.1111
Colombia	5.781	33.78	1388.44	0.0444	Norway	6.309	52.63	7186.762	0.6889
Cote d'Ivoire	5.235	19.96	260.484	0.0889	Oman	5.559	32.8	17012.636	0.2333
Croatia	6.125	40.73	356.099	0.5011	Panama	5.904	32.37	97.73	0.1
Denmark	7.636	58.39	758.625	0.6222	Peru	6.123	31.8	1150.42	0.1111
Dominican Republic	5.737	29.33	70.07	0.2111	Philippines	6.016	31.56	223.168	0.1444
Egypt	4.288	27.16	1190.062	0.3	Poland	6.477	41.67	454.446	0.5778
El Salvador	6.120	25.11	137.02	0.15	Portugal	5.459	45.71	135.345	0.4367
Estonia	6.341	50.51	780.64	0.6556	Romania	6.523	37.59	434.368	0.5111
Finland	7.821	59.63	528.593	0.7111	Russia	6.178	37.9	4596.412	0.6667
France	6.687	54.36	40.538	0.5111	Saudi Arabia	6.480	34.27	24272.304	0.2778
Germany	7.034	58.03	92.432	0.5667	Serbia	6.391	35.46	441.474	0.49
Ghana	4.872	24.52	728.112	0.0889	Singapore	6.630	59.83	0	0.0136
Greece	5.948	38.93	51.908	0.4333	Slovakia	5.194	42.88	141.395	0.5378
Hungary	6.086	44.94	150.114	0.5222	Slovenia	6.476	46.87	89.601	0.5111
India	3.777	35.18	342.672	0.2222	South Africa	7.384	35.13	1204.648	0.3222
Indonesia	5.240	29.8	809.476	0.0556	Spain	7.512	48.68	33.835	0.4444
Iran	4.888	33.44	5128.242	0.3556	Sweden	5.891	63.08	508.409	0.6889
Ireland	7.557	57.19	51.284	0.5889	Switzerland	6.286	68.4	0	0.5222
Israel	7.364	56.79	132.544	0.3478	Thailand	4.744	38	716.634	0.1667
Italy	6.467	46.32	70.262	0.4722	Trinidad and Tobago	4.603	26.95	11066.48	0.1222
Jamaica	5.850	30.39	120.54	0.2017	Turkey	5.084	37.42	118.188	0.4333
Japan	6.039	54.95	0	0.4	Uganda	6.943	25.32	252.07	0.1111
Jordan	4.152	30.77	227.449	0.3444	Ukraine	6.977	38.52	842.057	0.5444
Kazakstan	6.234	31.42	7594.02	0.5333	United Kingdom	5.485	60.13	398.26	0.6
Kenya	4.543	31.07	105.366	0.0111	United States	6.180	59.81	706.81	0.4222
Korea, South	5.935	56.63	0	0.4111	Vietnam	2.955	37.94	588.224	0.1778
					Mean	40.336			
					Standard dev.	12.025			
					Minimum	19.96			
					Maximum	68.40			
					Observations	76			

Source: GII—World intellectual property organization (WIPO) (Indicator Rankings & Analysis|Global Innovation Index); HI—Happiness, benevolence, and trust during COVID-19 and beyond|The World Happiness Report. HI for Oman not available, based on the average for neighbors: Saudia Arabia, United Arab Emerates and Yemen; N-(http://data.worldbank.org/indicator/NY.GDP.TOTL.RT.ZS); L available from La Porta (1999).

There are no published data for epigenetic generational psycho-sequela. The world happiness index (Happiness, benevolence, and trust during COVID-19 and beyond | The World Happiness Report) is the closest proxy for epigenetic generational psycho-sequela. We assume that a high happiness index (HI) indicates normal epigenetics and a low HI, more likely than not, could be an indication of prior negative ancestral epigenetic impression passed on to biological offspring. The following is a modified excerpt from one description "The HI report looks at six different variables that contribute to happiness. In the report, income, trust, life expectancy, social support, freedom, and generosity are considered to determine which states have the best overall well-being and, in turn, are the happiest in the world. Per the latest report, Finland was determined to be the world's happiest country. It isn't just the native-born citizens, either. The immigrants that have come to Finland are among the happiest in the world due to the way of life in this nation. Generosity, trust in the nation's government, and freedom are among the reasons that Finland takes the top spot in this report. Finland was also named the happiest country in the 2018 report. Other nations that topped the list of the happiest countries in the world included Denmark, Norway, Iceland, the Netherlands, Switzerland, Sweden, New Zealand, Canada, and Australia. While these nations top the list, there are other nations that rank poorly. Problems including a lack of freedom, corrupt governments, and poverty contribute to these nation's low rankings. According to the latest report, the least happy countries included South Sudan, Central African Republic, Afghanistan, Tanzania, Rwanda, Yemen, Malawi, Syria, Botswana, and Haiti." While happiness is subjective, income, trust, life expectancy, social support, freedom, and generosity can be measured by economists (Frey & Stutzer, 2002; Stutzer, 2004). See Table 1.

5. Analysis

5.1. Distributional Characteristics

Our investigation begins with an analysis of the distribution of HI and GII data in Table 1. A histogram of HI is given in Figure 6. The shape has the appearance of a normal distribution. A histogram of GII is given in Figure 7. The shape is skewed to the right. We speculate that low levels of collaboration are in part due to negative epigenetic generational psycho-sequela, ceteris paribus. High levels of rule *of* law cannot be achieved without collaboration. Collaboration is a worthwhile, easily available, accessible feature of humanity that many countries have not availed themselves of. But the negative epigenetic generational psycho-sequela must first be overcome.

5.2. Regression Analysis: GII vs HI

Next, we consider the impact of epigenetic generational psycho-sequela on collaboration. A graph of GII versus HI is plotted in Figure 8. From the graph we see that GII is fairly highly positively correlated with HI. As HI increases, so does

GII. The linear correlation coefficient is 0.74. Similarly, the HI values are a composite of variables measured in units of relative measure and has no meaning as an absolute measure. The GII values are relative in rank but have no meaning as an absolute measure.
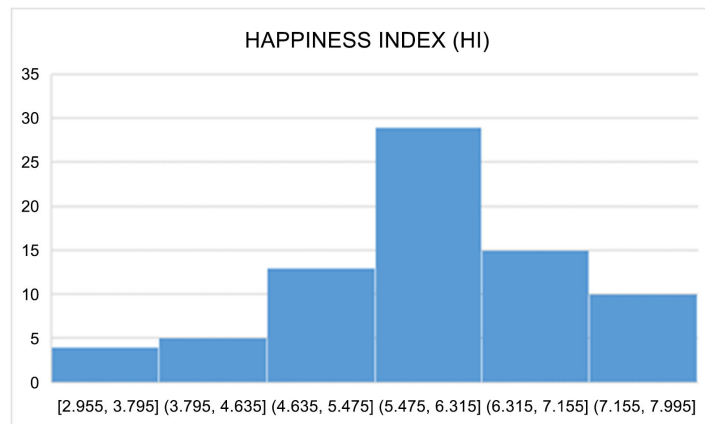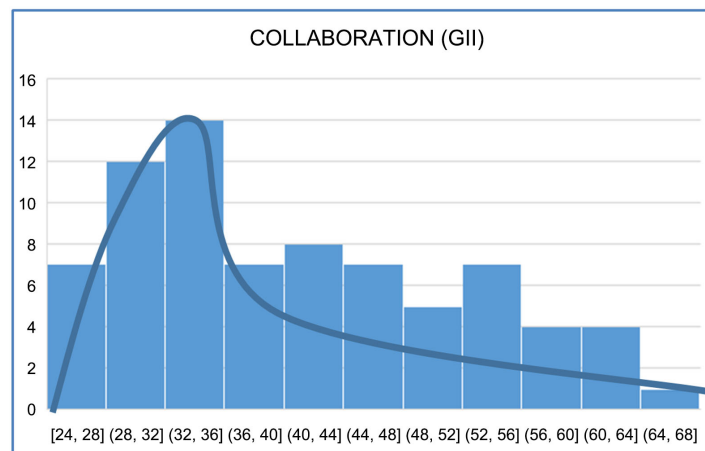

Figure 6. Histogram of happiness index (HI).
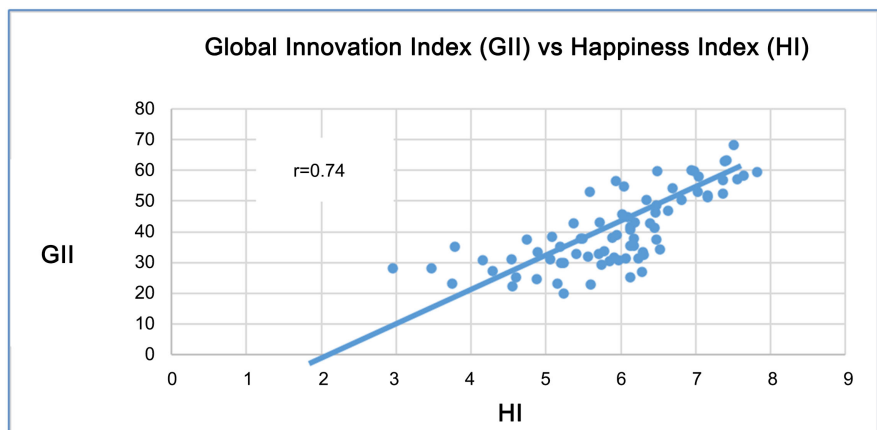

Figure 7. Histogram of GII.

Figure 8. Global Innovation Index (GII) vs Happiness Index (HI).

Consider the model:

$$\text{GII} = \beta_0 + \beta_{\text{HI}}\text{HI} + \beta_{\text{N}}\text{N} + \beta_{\text{L}}\text{L} + \varepsilon \,,$$

where β_0 is the intercept on the GII axis, β_{HI} is the slope of the trend line, and $\varepsilon \sim \mathbb{N}\left(0, \sigma^2\right)$ is a normally distributed random error with a mean of 0 and constant variance σ^2. HI is a reflection of human disposition within the control of the human being, and is therefore an exogenous variable, expected to yield unbiased estimates of the regression coefficients. HI is a policy of choice variable. N represents natural resources and is measured by natural resources rents. L represents latitude and therefore geography and is measured by the absolute distance from the equator (data available from (La Porta, 1999)). N and L are obviously exogenous. Furthermore, they are not policy variables. It is reasonable to think that N and L might be resources for, or otherwise impact economic development. But a country cannot choose its natural resources or geography.

Consider the null hypothesis H$_0$ that $\beta_{\text{HI}} = 0$ and there is no significant relationship, versus the alternative H$_1$ that $\beta_{\text{HI}} \neq 0$ and there is a significant relationship between GII and HI.

$$\text{H}_0 : \beta_{\text{HI}} = 0$$
$$\text{H}_1 : \beta_{\text{HI}} \neq 0$$

The least squares linear regression fit that corresponds to Table 1 and Figure 8 is

$$\text{gii} = -8.10 + 7.13\,\text{HI} - 0.00\,\text{N} + 19.10\,\text{L}$$
$$t = \qquad (7.47)\ \ (-2.30)\ \ (3.89)\quad \text{adjusted } R^2 = 0.65$$
$$r = \qquad 55\%\quad 3\%\quad 7\%$$

where gii is the fitted value. The coefficient of multiple determination adjusted $R^2 = 0.65$. The t statistic $t = 7.47$. Since $t = 7.47 > t_{\alpha=0.01,\upsilon=79-4} = 2.64$, where υ is the number of degrees of freedom, we conclude with a level of significance $\alpha = 1\%$ that there is a statistically significant relationship between GII and HI. The coefficients for N and L are evaluated similarly and found to be statistically significant. There is only a 1% chance that this conclusion is reached erroneously. The partial correlations (r) show the contributions from HI, N and L to explaining the variation in GII. HI contributes 55%. Although N and L are significant, they contribute only 3% and 7% respectively. We therefore conclude that collaboration is dependent on happiness.

A plot of the residuals is shown in Figure 9. It has the appearance of being random. There are no patterns that imply any missing variables. The normal probability plot in Figure 10 is approximately a straight line, suggesting that GII are normally distributed. The histogram in Figure 11 is approximately bell shaped, suggesting that the residuals are normally distributed. The related statistics are: average = 0, standard deviation = 7.0181, skewness (S) = 0.4822, kurtosis (K) = 0.2110 and the Jarque & Bera (1980, 1987) test statistic JB = ($n/6$) (S^2 + (1/4) (K − 3)^2) = (76/6) (0.4822^2 + (1/4) (3.2110 − 3)^2) = 3.09. The theoretical JB

statistic follows a Chi square distribution. With a 0.01 level of significance and 2 degrees of freedom, Chi square = 9.21. Since JB = 3.09 < 9.21, at the specified level of significance, we accept that the residuals are normally distributed.
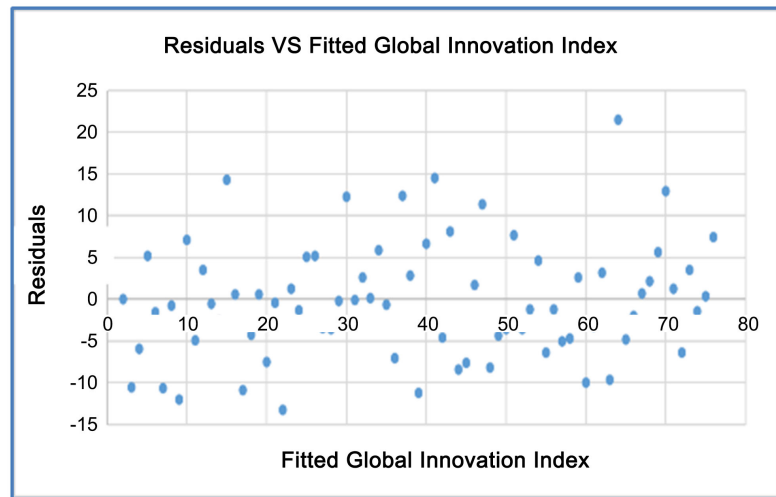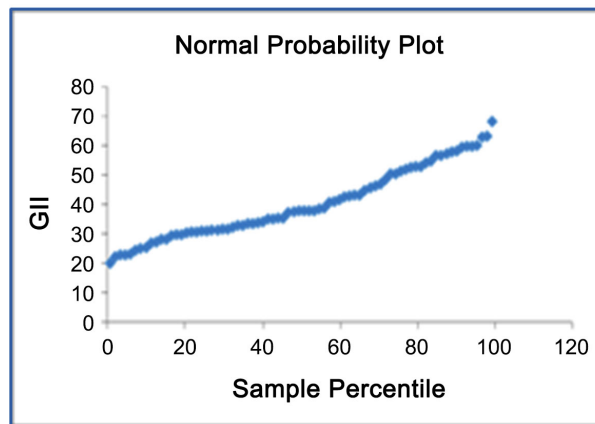

Figure 9. Residuals versus gii.

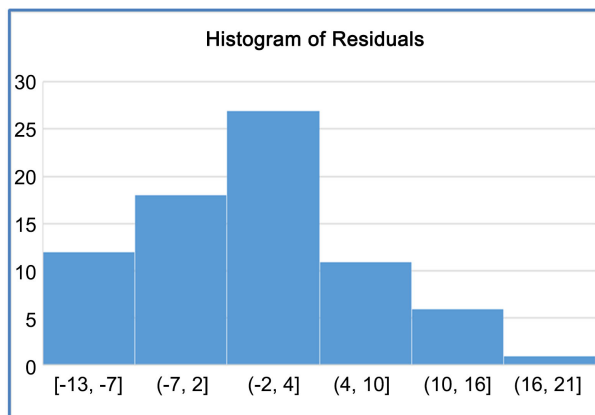**Figure 10.** Normal Probability plot of residuals.

Figure 11. Histogram of Residuals.

6. Conclusion

Negative epigenetic generational psycho-sequela is a biological mechanism that causes harm to the children and grandchildren of formerly oppressed communities. The harm can be physiological and psychological. The result is ill health and reduced standard of living. It presents an obstacle that must be overcome if said progeny are to raise their standard of living. Examples of countries and regions that overcame any critical mass of negative epigenetic generational psycho-sequela are Taiwan region and South Korea after Japanese colonization, England after Roman colonization, and Hong Kong (China), Singapore, United States, Canada, Bermuda and Cayman Islands after English colonization. There may be subpopulations in these countries that were formerly oppressed and whose members can benefit from this research. The recoveries by the above countries were quite remarkable. They may have benefitted from some fortuitous intervention such as munificent leadership and a confluence of events that made for a perfect storm. These countries should be studied carefully. Examples of individuals who overcame any negative epigenetic generational psycho-sequela are the millions of immigrants who move their human capital ideas of imagination and creativity from oppressive countries to the US, in pursuit of liberty and wealth.

It may appear that the government enforcement of music teams and team sports is intrusive. But the government enforces health measures. If music teams and team sport build collaboration skill, then its contributions to wealth and health are worthy of enforcement. People who might otherwise not think to associate might come together through music and sports. An annual benefit of legislating a cure for negative epigenetics of about $15828 per capita is within the realm of possibilities. The cost is negligible.

In summary, to raise standard of living, the perfecta collaboration followed by rule *of* law, in that order, must first be achieved. The trifecta rule *of* law followed by democracy then capitalism, in that order, must be achieved next. Taken together, these form the quadfecta collaboration, rule of law, democracy, capitalism, that must be achieved in order to raise CDR and GDPppp and thereby raise the lot of the least amongst us. The difference between cooperation and collaboration is subtle, and for that reason may at first take appear to be small or semantic. But it is not merely academic and the impact of collaboration on standard of living is enormous. Hitherto, the relative importance of collaboration has been underrated.

If intergenerational maladies are due to a loss of values and the breakdown of the family, the correction might be to simply collaborate in the restoration of the nuclear family. But transgenerational maladies run much deeper in the genome and might inhibit the ability to collaborate. In that case, future research may consider the direct administration of medicinal cures that correct the epigenetic molecular factors and processes around the DNA that regulates genome activity. Genetic engineering is probably the ultimate solution. Genetic engineering of mice dates back 49 years to 1973. Genetic engineering of food dates back 28

years to 1994. The first AAV genetic therapy was luxturna approved in 2017 for the treatment of leber congenital amaurosis. The next was zolgensma approved in 2019 for the treatment of spinal muscular atrophy. There are now many gene therapies approved globally. Pfizer pharmaceutical corporation has declared its dedication to gene therapy as the future of medicine. Genetic engineering would be in addition to team activity training. Consideration could also be given to allostatic load theory. IQ tests are prevalent but only measure the ability to work alone. Consideration can be given to psychometric testing that measures collaboration skill to follow the progress and efficacy of these treatments.

Acknowledgements

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

Acemoglu, D., Johnson, S., & Robinson, J. A. (2005). Institutions as a Fundamental Cause of Long-Run Growth. In *Handbook of Economic Growth* (Vol. 1, 385-472). Elsevier. https://doi.org/10.1016/S1574-0684(05)01006-3

Alvard, M. (2012). Human Social Ecology. In J. Mitani, J. Call, P. M. Kappeler, R. A. Palombit, & J. B. Silk (Eds.), *The Evolution of Primate Societies*. University of Chicago Press.

Beck, D., Ben Maamar, M., & Skinner, M. K. (2021). Integration of Sperm ncRNA Directed DNA Methylation and DNA Methylation Directed Histone Retention in Epigenetic Transgenerational Inheritance. *Epigenetics & Chromatin, 14,* Article No. 6. https://doi.org/10.1186/s13072-020-00378-0

Ben Maamar, M. et al. (2018). Alterations in Sperm DNA Methylation, Non-Coding RNA Expression, and Histone Retention Mediate Vinclozolin Induced Epigenetic Transgenerational Inheritance of Disease. *Environmental Epigenetics, 4,* dvy101. https://doi.org/10.1093/eep/dvy010

Bingham, T. (2010). *The Rule of Law*. Penguin Group.

Braithwaite, V. (2021). Understanding and Managing Trust Norms. *International Journal for Court Administration, 12,* 1-13.
https://www.iacajournal.org/article/10.36745/ijca.425/
https://doi.org/10.36745/ijca.425

Brownell, C., Ramani, G., & Zerwas, S. (2006). Becoming a Social Partner with Peers: Cooperation and Social Understanding in One- and Two-Year-Olds. *Child Development, 77,* 803-821. https://doi.org/10.1111/j.1467-8624.2006.t01-1-.x-i1

Callaghan, T., Moll, H., Rakoczy, H., Warneken, F., Liszkowski, U., Behne, T., & Tomasello, M. (2011). Early Social Cognition in Three Cultural Contexts. *Monographs of the Society for Research in Child Development, 76,* 1-142.

Chopra, S., & Meindl, P. (2001). *Supply Chain Management: Strategy, Planning, and Operation.* Prentice Hall.

Code of Ur-Nammu (created 2112BC-2095BC). *Code of Ur-Nammu.* Wikipedia.

Crews, D., Gillette, R., Manikkam, M., Savenkova, M., & Skinner, M. K. (2012). Epigenetic Transgenerational Inheritance of Altered Stress Responses. *Proceedings of the National Academy of Sciences of the United States of America, 109,* 9143-9148. https://doi.org/10.1073/pnas.1118514109

Dicey, A. V. (1885). *An Introduction to the Study of the Law of the Constitution* (9th edition, p. 188). Macmillan.

Easterlin, M. C., Chung, P. J., Leng, M. et al. (2019). Association of Team Sports Participation with Long-Term Mental Health Outcomes among Individuals Exposed to Adverse Childhood Experiences. *JAMA Pediatrics, 173,* 681-688. https://doi.org/10.1001/jamapediatrics.2019.1212

Faria, H. J., Montesinos-Yufa, H. G., Morales, D. R., & Navarro, C. E. (2016). Unbundling the Roles of Human Capital and Institutions in Economic Development. *European Journal of Political Economy, 45,* 108-128. https://doi.org/10.1016/j.ejpoleco.2016.08.001

Frey, B. S., & Stutzer, A. (2002). What Can Economists Learn from Happiness Research? *Journal of Economic Literature, 40,* 402-435. https://doi.org/10.1257/jel.40.2.402

Glaeser, E. L., La Porta, R., Lopez-de-Silanes, F., & Shleifer, A. (2004). Do Institutions Cause Growth? *Journal of Economic Growth, 9,* 271-303. https://doi.org/10.1023/B:JOEG.0000038933.16398.ed

Gwartney, J. D., Holcombe, R. G., & Lawson, R. A. (2006). Institutions and the Impact of Investment on Growth. *Kyklos, 59,* 255-273. https://doi.org/10.1111/j.1467-6435.2006.00327.x

Haggard, S., MacIntyre, A., & Tiede, L. (2008). The Rule of Law and Economic Development. *Annual Review of Political Science, 11,* 205-234. https://doi.org/10.1146/annurev.polisci.10.081205.100244

Hammurabi (1792BC-1750BC). *Hammurabi.* Wikipedia.

Harlow, H. F., & Zimmermann, R. R. (1958). The Development of Affective Responsiveness in Infant Monkeys. *Proceedings of the American Philosophical Society, 102,* 501-509.

Harlow, H. F., Dodsworth, R. O., & Harlow, M. K. (1965). Total Social Isolation in Monkeys. *Proceedings of the National Academy of Sciences of the United States of America, 54,* 90-97. https://doi.org/10.1073/pnas.54.1.90

Hasting, R., & Meyer, E. (2020). *No Rules Rules: Netflix and the Culture of Reinvention.* Diversified Publishing.

Hayek, F. A. (1944). *The Road to Serfdom* (p. 81). The University of Chicago Press.

Hibbing, J. R., Smith, K. B., & Alford, J. R. (2014). *Predisposed: Liberals, Conservatives, and the Biology of Political Differences.* Routledge.

Hoffmann, M. D., Barnes, J. D., Tremblay, M. S., & Guerrero, M. D. (2022). Associations between Organized Sport Participation and Mental Health Difficulties: Data from over 11,000 US Children and Adolescents. *PLOS ONE, 17,* e0268583. https://doi.org/10.1371/journal.pone.0268583

Holcombe, R. G. (2003). The Origins of Entrepreneurial Opportunities. *The Review of Austrian Economics, 16,* 25-43. https://doi.org/10.1023/A:1022953123111

Holmes, S. (2003). Lineages of the Rule of Law. In J. Maravall, & A. Przeworski (Eds.), *Democracy and the Rule of Law. Cambridge Studies in the Theory of Democracy* (pp.

19-61). Cambridge University Press. https://doi.org/10.1017/CBO9780511610066.002

Holt, J. C. (1992). *Magna Carta* (pp. 276-278). Cambridge University Press. https://doi.org/10.1017/CBO9781107049956

Jarque, C. M., & Bera, A. K. (1980). Efficient Tests for Normality, Homoscedasticity and Serial Independence of Regression Residuals. *Economics Letters, 6,* 255-259. https://doi.org/10.1016/0165-1765(80)90024-5

Jarque, C. M., & Bera, A. K. (1987). A Test for Normality of Observations and Regression Residuals. *International Statistical Review, 55,* 163-172. https://doi.org/10.2307/1403192

Jeuland, A. P., & Shugan, S. M. (1983). Managing Channel Profits. *Marketing Science, 2,* 239-272. https://doi.org/10.1287/mksc.2.3.239

John Heywood (1497-1580). *John Heywood*. Wikipedia.

Johnston, M. (2006). *Good Governance: Rule of Law, Transparency, and Accountability* (pp. 1-32). United Nations Public Administration Network.

Joireman, S. F. (2001). Inherited Legal Systems and Effective Rule of Law: Africa and the Colonial Legacy. *The Journal of Modern African Studies, 39,* 571-596. https://doi.org/10.1017/S0022278X01003755

Kaufmann, D. (2007). *Governance Matters VI: Aggregate and Individual Governance Indicators, 1996-2006* (Vol. 4280). World Bank Publications.

King, S. E., & Skinner, M. K. (2020). Epigenetic Transgenerational Inheritance of Obesity. *Trends in Endocrinology & Metabolism, 31,* 478-449. https://doi.org/10.1016/j.tem.2020.02.009

Kirzner, I. M. (1973). *Competition and Entrepreneurship*. University of Chicago Press.

La Porta, R., Lopez-de-Silanes, F., Shleifer, A., & Vishny, R. (1999). The Quality of Government. *Journal of Law, Economics and Organization, 15,* 222-279. https://doi.org/10.1093/jleo/15.1.222

Levitsky, S., & Ziblatt, D. (2018). *How Democracies Die*. Broadway Books.

Marmor, A. (2004). The Rule of Law and Its Limits. *Law and Philosophy, 23,* 1-43.

Martin Luther King Jr. (1929-1968). *Martin Luther King Jr.* Wikipedia.

Maxwell, J. C. (2002). *Teamwork Makes the Dream Work*. HarperCollins.

McCartney, P. (2018). *Paul McCartney Breaks Down His Most Iconic Songs*. GQ—YouTube.

Nilsson, E., Ben Maamar, M., & Skinner, M. K. (2022). Role of Epigenetic Transgenerational Inheritance in Generational Toxicology. *Environmental Epigenetics, 8,* dvac001. https://doi.org/10.1093/eep/dvac001

North, D. C. (1990). *Institutions, Institutional Change and Economic Performance*. Cambridge University Press. https://doi.org/10.1017/CBO9780511808678

North, D. C. (1991). Institutions. *Journal of Economic Perspectives, 5,* 97-112. https://doi.org/10.1257/jep.5.1.97

North, D. C. (1994). Economic Performance through Time. *The American Economic Review, 84,* 359-368.

Quincy Jones (1933-). *Quincy Jones*. Wikipedia.

Randrup, N., Druckemiller, D., & Briggs, R.O. (2016). Philosophy of Collaboration. In *49th Hawaii International Conference on System Sciences* (pp. 898-907). IEEE. https://doi.org/10.1109/HICSS.2016.115

Ridley, A. D. (2017a). Wealth Is All in the Mind. *International Journalof Social Science & Economic Research, 2,* 3369-3379. http://ijsser.org/uploads/ijsser_02__208.pdf

Ridley, A. D. (2017b). Division of Human Capital Creates Surplus Wealth. *Bulletin of Political Economy, 11,* 1-20.
https://serialsjournals.com/abstract/69526_1_dennis_ridley.pdf

Ridley, A. D. (2020). *The Mystery of Wealth: Capitalism. Democracy. Rule of Law.* Sciendo (De Gruyter).
https://www.amazon.com/s?k=the+mystery+of+wealth+by+ridley&ref=nb_sb_noss
https://doi.org/10.2478/9788395771361

Ridley, A. D. (2021a). Capitalism/Democracy/Rule of Law Interactions and Implications for Entrepreneurship and Per Capita Real Gross Domestic Product Adjusted for Purchasing Power Parity. *Journal of the Knowledge Economy, 12,* 384-411.
https://doi.org/10.1007/s13132-020-00632-6

Ridley, A. D. (2021b). Economic Development via Collaborating Populations. *Theoretical Economics Letters, 11,* 1101-1121.
https://www.scirp.org/journal/paperinformation.aspx?paperid=113266
https://doi.org/10.4236/tel.2021.116070

Ridley, A. D. (2022). Collaboration Trumps Intelligence as a Predictor of Standard of Living. *Research in Applied Economics, 14,* 1-16.
https://doi.org/10.5296/rae.v14i2.19960

Ridley, A. D., & de Silva, A. (2019). Game Theoretic Choices between Corrupt Dictatorship Exit Emoluments and Nation-Building CDR benefits: Is There a Nash Equilibrium? *The American Economist, 65,* 1-27. https://doi.org/10.1177/0569434519878858

Ridley, A. D., & Korovyakovskaya, I. (2022). Economic Growth: The Log Symmetry of Collaborative Learning Populations. *Theoretical Economics Letters, 12,* 1417-1451.
https://doi.org/10.4236/tel.2022.125078

Ridley, A. D., & Llaugel, F. (2022). Generalized Four Dimensional Scientific CDR Economic Growth Model. *Theoretical Economics Letters, 12,* 924-943.
https://www.scirp.org/journal/paperinformation.aspx?paperid=118192
https://www.scirp.org/pdf/tel_2022062911141395.pdf
https://doi.org/10.4236/tel.2022.123050

Ridley, A. D., & Nelson, A. (2022). Collaboration and Rule of Law. *South East Asia Journal of Contemporary Business, Economics and Law, 26,* 194-205.

Ridley, A. D., Korovyakovskaya, I., & Llaugel, F. (2021). Collaboration: Why Some People Do and Some Don't. *Journal of Applied Economics and Business, 9,* 31-53.

Ridley, A. D., Ngnepieba, P., & de Silva, A. (2021). The Doctrine of Normal Tendency in Active Learning Teaching Methodology: Investigations into Probability Distributions and Averages. *SN Social Sciences, 1,* Article No. 144.
https://doi.org/10.1007/s43545-021-00154-1

Sarsfield, R. (2010). What Is the Rule of Law (and Is Not)? Available at SSRN 1667682.
https://doi.org/10.2139/ssrn.1667682

Skinner, M. K. (2014). A New Kind of Inheritance. *Scientific American, 311,* 41-45.
https://doi.org/10.1038/scientificamerican0814-44

Skinner, M. K., Manikkam, M., Tracey, R., Nilsson, E., Haque, Md. M., & Guerrero-Bosagna, C. (2013). Ancestral DDT Exposure Promotes Epigenetic Transgenerational Inheritance of Obesity. *BMC Medicine, 11,* Article No. 228.
https://doi.org/10.1186/1741-7015-11-228

Sterelny, K. (2011). From Hominins to Humans: How Sapiens Became Behaviorally Modern. *Philosophical Transactions of the Royal Society B, 366,* 809-822.

https://doi.org/10.1098/rstb.2010.0301

Sterelny, K. (2012). *The Evolved Apprentice: how Evolution Made Humans Unique* (pp. 1-251). MIT Press. https://doi.org/10.7551/mitpress/9780262016797.001.0001

Stutzer, A. (2004). The Role of Income Aspirations in Individual Happiness. *Journal of Economic Behavior & Organization, 54,* 89-109. https://doi.org/10.1016/j.jebo.2003.04.003

Tomasello, M., Melis, A. P., Tennie, C., Wyman, E., & Herrmann, E. (2012). Two Key Steps in the Evolution of Human Cooperation: The Interdependence Hypothesis. *Current Anthropology, 53,* 673-686. https://doi.org/10.1086/668207

Tyler, T. R. (2006). Does the American Public Accept the Rule of Law—The Findings of Psychological Research on Deference to Authority. *DePaul Law Review, 56,* Article 19.

Tyler, T. R., & Trinkner, R. (2017). *Why Children Follow Rules: Legal Socialization and the Development of Legitimacy.* Oxford University Press. https://doi.org/10.1093/acprof:oso/9780190644147.001.0001

Wallace, A., & Goodman-Delahunty, J. (2021). Measuring Trust and Confidence in Courts. *International Journal for Court Administration, 12,* 1-17. https://doi.org/10.36745/ijca.418

Warneken, F., & Tomasello, M. (2007). Helping and Cooperation at 14 Months of Age. *Infancy, 11,* 271-294. https://doi.org/10.1111/j.1532-7078.2007.tb00227.x

Wilson, E. O. (2015). *Of Ants and Men.* Public Broadcasting Service, PBS.org.

World Bank (2021). *The World by Income and Region* [Data set]. WDI—The World by Income and Region. https://datatopics.worldbank.org/world-development-indicators/the-world-by-income-and-region.html

Worlddata.info (2021). *Average Income around the World* [Data set]. Average Income around the World (worlddata.info)

Zuckerman, S. L., Tang, A. T., Richard, K. E., Grisham, C. J., Kuhn, A. W., Bonfield, C. M., & Yengo-Kahn, A. M. (2021). The Behavioral, Psychological, and Social Impacts of Team Sports: A Systematic Review and Meta-Analysis. *The Physician and Sportsmedicine, 49,* 246-261. https://doi.org/10.1080/00913847.2020.1850152
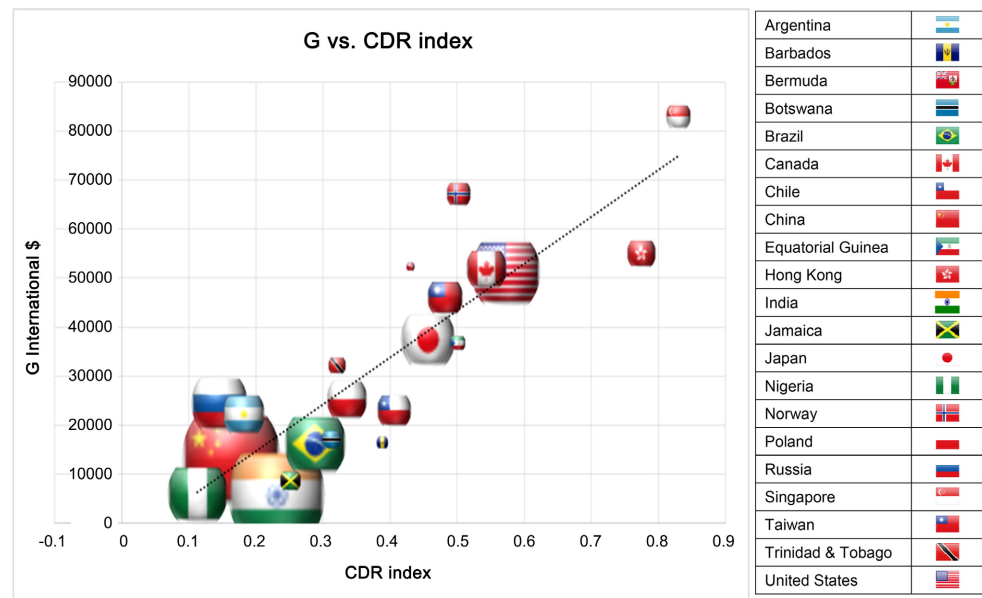
Nomenclature

Active learning	Engages students in the process of learning through activities and/or discussion in class, as opposed to passively listening to an expert. It emphasizes higher order thinking and often involves group activity.
Capital (*source*)	See human capital.
Capitalist	One who deploys one's personal capital so as to maximize one's benefit.
Capital stock	Fixed installed capital less depreciation and obsolescence plus skills and knowledge acquired from entrepreneurs and taught to others.
Capitalism	Mechanism for the collection and assembly of capital.
Catalysis	The creation of alternative pathways to enable a process.
CDR index	The vector inner product (dot product) of the global constant [1.53 0.14 0.23 - 1.21] and the country [C D R $C{\cdot}D{\cdot}R$].
Collaboration	The plan and execution thereof by participants for their intentional mutual benefit of shared goals, objectives, and rewards.
Company	The instrument of capitalism for the profitable investment of capital.
Cooperation	A plan and execution thereof by participants, each with their own personal self-interest and economic gain in mind yet yielding unintended mutual benefits.
Democracy	Private work force idea participation and periodic election of public representatives (catalyst for the process of gene rating G from capital).
Economic development	The improvement in infrastructure and social wellbeing.
Economic growth	The improvement in per capita real gross domestic product adjusted for purchasing power parity.
Endogenous	Generated from within a system.
Entrepreneurship	The process of starting a business, typically a startup company offering an innovative product, process or service.
Exogenous	Generated from outside a system.
Gross domestic product	The monetary value of all the finished goods and services produced within a country's borders in a specific time period (economic growth = change in GDP).
Growth in Wealth	Gross domestic product less consumption, depreciation and obsolescence.
Human capital	Capital human ideas of imagination and creativity and skill (not including physical corporeal labor).
Human labor	Physical corporeal labor (not including capital human ideas of imagination and creativity or skill).
Intelligence	The ability to acquire and apply knowledge and skills.
Lecture	The continuous exposition by an instructor while student activity is limited to taking notes and/or asking occasional and unprompted questions of the instructor.
Limited liability	Limitation of loss to capital invested.
Natural resources rents	Surplus value of natural resources after all costs and normal returns are accounted for.
Normal distribution	A distribution containing a most frequently occurring typical score at its peak (center) and atypical scores with lower and lower frequency as they occur further and further away from the mean.
Property rights	Property is a legal expression of an economically meaningful consensus by people about assets, how they should be held, used and exchanged.
Rule of Law	Reverse of corruption (protection of shareholder and other property rights) (catalyst for the attraction of capital).
Shareholder	An owner of shares in a company.
Virtue	Self-governing human property that promotes fairness and justice without the need for central government.

Appendix: The Source and Mechanism of Wealth

G vs. CDR index

Argentina	
Barbados	
Bermuda	
Botswana	
Brazil	
Canada	
Chile	
China	
Equatorial Guinea	
Hong Kong	
India	
Jamaica	
Japan	
Nigeria	
Norway	
Poland	
Russia	
Singapore	
Taiwan	
Trinidad & Tobago	
United States	

Year 2014 G vs CDR Index for 79 countries (line). Bubble size (21 countries) is the square root of population. This model was re-estimated for panel data and individually for years 1995-2016 with similar results. For additional comments on the countries see Ridley (2017a, 2017b).

Standardized g model

The ordinary least squares g model is specified as follows:

$$g = \beta_0 + \beta_C C + \beta_D D + \beta_R R + \beta_{CDR} C \cdot D \cdot R + \beta_N N + \varepsilon$$

where, the intercept β_0 and the coefficients $\beta_C, \beta_D, \beta_R, \beta_{CDR}, \beta_N$ are all dimensionless, ε is a random, normally distributed error with a mean of zero and constant standard deviation, and where all model variables are standardized as follows:

$$g = \frac{G - \text{lowest } G}{\text{highest } G - \text{lowest } G}$$

G = per capita real gross domestic product per capita (PPP)

$$C(\text{Capitalism})$$

$$= \frac{\text{per capita capitalization} - \text{lowest per capita capitalization}}{\text{highest per capita capitalization} - \text{lowest per capita capitalization}}$$

$$D(\text{Democracy}) = \frac{\text{lowest democracy rank} - \text{democracy rank}}{\text{lowest democracy rank} - \text{highest democracy rank}}$$

$$R(\text{Rule of law}) = \frac{\text{lowest corruption rank} - \text{corruption rank}}{\text{lowest corruption rank} - \text{highest corruption rank}}$$

$$N(\text{Natural resources})$$

$$= \frac{\text{per capita total natural resource rents} - \text{lowest per capita total natural resource rents}}{\text{highest per capita total natural resource rents} - \text{lowest per capita total natural resource rents}}$$

These transformations standardize the variables and ensures upper and lower bounds on $0 \leq g$, C, D, R, CDR, $N \leq 1$.

Democracy and corruption are rank ordered, where the highest = 1 and the lowest = the number of countries. G is measured in \$/capita/year.

$$\hat{g} = 1.53C + 0.14D + 0.23R - 1.21C \cdot D \cdot R + 0.38N$$

t = (6.60) (1.69) (2.60) (4.40) (5.59) F ratio = 81.

Partial correlations (*contributions to* R^2_{adj}):

$$59\% \ 5\% \ 10\% \ 3\% \ 6\% \quad R^2_{adj} = 83\% .$$

where ^ denotes estimated or fitted value and G can be estimated from

$$\hat{G} = \hat{g}\left(\text{highest } G - \text{lowest } G\right) + \text{lowest } G .$$

Highest G = 83066. Lowest G = 1112. Average G is \$16940.

The CDR index = $1.53C + 0.14D + 0.23R - 1.21C \cdot D \cdot R$ comprises positive C, D and R effects and a negative component due to friction from democracy that reduces G from what it might otherwise be if there were perfect agreement amongst decision contributors. C, D and R are policy variables subject to change by policy decision makers, while N is a natural variable that cannot be changed.

Ridley & de Silva (2019) give a complete set of statistical tests to demonstrate the aptness of the CDR model.

Statements and Declarations:

This article does not involve conflicts of interest.

This article does not contain any studies with human participants performed by any of the authors. This article does not contain any studies with animals performed by any of the authors.

This article does not involve any funding.

All data are included in this paper.