

The impact of infant mortality on societal happiness

by

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Abstract

Happiness has come to be seen as a valuable tool to measure the impact of societal changes. In this study, the issue of infant mortality is examined to assess its impact on societal happiness. Using a cross-sectional regression model, the impact of reducing the infant mortality rate on societal happiness is examined for more than 100 of the world's nations in the most recent year for which data is available, 2023. This is done first because research has demonstrated that infant mortality strongly impacts the individual happiness of those directly impacted. It is also because there is a long history of infant mortality rates being used in the research literature as a pathway to understand the level of deprivation within a nation. For these reasons, assessing whether reductions in infant mortality yield significant positive returns on societal happiness should help clarify whether eradicating poverty, increasing access to health resources, or lessening issues of malnutrition are actions that increase the happiness level of not just the individuals directly impacted but the overall level of happiness within nations. Results show that increases in the infant mortality rate do not significantly decrease societal happiness. This shows that this study's research hypothesis that nations with lower rates of infant mortality have higher levels of societal happiness should be rejected. This study, however, finds that a \$1,000 increase in per-capita GDP for nations with a median level of per-capita GDP (\$4,790) significantly increases ($p < .01$) the societal happiness of citizens of those nations (+0.576 points). This alternate finding suggests that per-capita GDP, which is a different proxy for deprivation, may be an even stronger tool for researchers when examining deprivation and its impacts. It also provides evidence that governments could increase the happiness of their citizens by reducing deprivation levels.

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Chapter 1 - Introduction

How to effect societal change has long been an area of focus for sociologists and others in the research community. To measure progress, tools like gross domestic product (GDP) have frequently been employed, driven by a belief in human rationality that holds that, among the options that budgets allow, humans will without fail make the wisest choice. Research, however, has begun to demonstrate how frequently this economic theory fails to depict reality (Opaluch & Segerson, 1989; Pollay, 2014; Sirgy et al., 2012; Van Tuinen, 2011). In addition, tools like GDP do not account for the impact of important components of social progress like equality and health (Atkinson, 1983; Costanza et al., 2009; Harris & Roach, 2021). Senator Robert F. Kennedy famously encapsulated the critiques of GDP, saying it “measures everything...except that which makes life worthwhile” (Kennedy, 1968).

With time, the discontent with the practice of assessing social progress through an economic lens has only increased (Stiglitz et al., 2009). As a result, people have begun to search for more accurate and comprehensive quality-of-life measures. One measure that has been proposed is happiness. Research has shown that it can serve as an objective measure of people’s quality of life (Helliwell et al., 2012), and thus it is increasingly being used to assess the importance of addressing a wide array of social problems.

One such social problem that is likely keeping many from a state of happiness is the heartbreaking and all-too-pervasive global health issue of infant mortality. Data from the World Health Organization (WHO) indicate that in 2023 approximately 4.8 million children died before they reached the age of 5 years, and roughly 2.3 million died in their first 28 days of life (WHO, 2026a). Both researchers and policymakers have given much attention to the number of deaths that occur in childhood. The most commonly used metric is the infant mortality rate, which

measures “the number of deaths of infants under one year of age per 1,000 live births in a given year” (WHO, 2026b). It has proven beneficial both as a direct indicator of the magnitude of suffering being caused by such deaths and also as a proxy for deprivation.

Infant Mortality and Happiness

As a direct indicator of suffering, medical research has demonstrated a strong, causal relationship between infant mortality and reductions in happiness. The negative effect on happiness has been shown, for example, to be quite strong for parents who lose their children (Meij et al., 2005; Lawrence et al., 2022) with 57 percent to 78 percent of parents still having “traumatic grief reactions” eighteen months after the death of a child (Dyregrov et al., 2003, p.143) and a majority of parents reporting that, even after more than 12 years, the deaths continued to negatively impact their lives (Dyregrov, 1999). Such deaths have also been shown to have negative consequences for more than just the parents. For example, the impact on the happiness levels of siblings has also been shown to be quite negative and significant (Lohan & Murphy, 2006), with the deaths increasing their own risk of death (Van Dijk et al., 2019). The impact even extends to grandparents, with the negative emotions experienced including “disbelief, anger, guilt, anxiety, depression, concern for their bereaved adult children and surviving siblings, exhaustion, and bitterness” (De Frain et al., 1992, p.165). In addition, the levels of unhappiness engendered by infant deaths often weaken or destroy social bonds, with studies reporting increases in the rates of marital dissolution (Parkes, 1998; Najman et al., 1993) and in the inability of people impacted by the death of a child to function in social and work settings (October et al., 2018). These wide-ranging impacts highlight the significant negative relationship between infant mortality and happiness.

While the negative relationship between infant mortality and the happiness of those directly impacted by infant deaths has been established, it is less certain whether people, on average, care about deaths happening to strangers. For example, it has been noted that there are many affluent people who have more than enough money to cover their necessities throughout life, and yet they use their excess money not to end hunger but rather on luxury gadgets and international trips (Singer, 2013). These actions have been equated to a “stealthy violence that consigns large numbers of people to lead short and limited lives” (Li, 2010, p.1). Several arguments have been made as to why this sentiment may exist. Some argue that those who are affluent have personality traits that make them “greedy, ruthless, exploitative, [and] aggressive” while others argue that poverty, deprivation, and death are unavoidable realities of life, much like a natural law of existence, and thus unworthy of attention or concern (Landes, 2024, p.74). Whatever the reason, it does appear that for some acting in one’s own self-interest brings more happiness than saving others from deprivation and death, but the exact number of people in each nation who hold such views is not certain.

Given the varied reactions, it is unclear whether addressing this issue is a priority for societies. This is especially true as actions to reduce the rate of infant deaths are likely to come with trade-offs that, for example, may reduce, through mechanisms such as taxes, the money each individual is able to spend on him or herself. To achieve an understanding of the preferences of societies, it is necessary for the aggregate impact of all the diverse individual pathways to happiness to be assessed. Achieving this requires widening the focus beyond just the direct or indirect impact on the individual to a more complete assessment of how changes in the infant mortality rates impact the happiness of society as a whole.

Infant Mortality and Deprivation

As an indirect indicator of deprivation, the infant mortality rate is frequently used as a proxy for a country's overall health conditions and level of well-being (Gonzalez & Gilleskie, 2017; Speranza, 2023), as it is known to well reflect “the social, economic and environmental conditions” into which children are born (WHO, 2026b). Causal factors of infant mortality include diarrhea, pneumonia, malaria, and malnutrition, and the metric overall has been shown to have great utility in highlighting “unmet human health needs in sanitation, medical care, nutrition, and education” (Chiotis, 2022, p.5). For example, research in England using this tool was able to demonstrate the harmful impact of inadequacies in health care infrastructure (Odd et al., 2024). Conversely, policies that promote a strong social safety, even at fairly low levels of GDP per capita, have been shown to increase happiness levels (Easterlin, 1974). In part for these reasons, changes in infant mortality rates are frequently used to measure social advancement, including by the United Nations (UN) to measure nations' progress toward their Millennium Development Goals (UN, 2026). The fact that the infant mortality rate is often used as a proxy for the social condition of a nation offers yet another reason to measure its impact on happiness at the societal level.

Infant Mortality in this Study

As the infant mortality rate is a variable that allows researchers to understand the ramifications of infant deaths and also to better understand the level of deprivation in a nation, this variable seemingly has great utility. This study, therefore, seeks to take advantage of this variable's ability to represent the complex array of factors driving this condition and use it to assess the importance of remedying the broad condition of deprivation (of monetary, health, and

other resources) by quantifying its impact on societal happiness. This approach is supported theoretically by the voluminous research detailing the negative relationship between infant mortality and happiness.

If it can be determined that reducing the infant mortality rate would yield significant positive returns in terms of societal happiness, then governments would be wise to take action, given that it is widely believed that governments have a responsibility to improve the happiness of their citizens. Thomas Paine (1792) expressed this idea when he argued that “whatever the form or constitution of government may be, it ought to have no other object than the general happiness”. Still, it is also understood that governments cannot pursue all worthy endeavors, as governmental actions invariably cost money and government resources are not unlimited (Grindle, 2012). Moreover, citizens fund actions, in most cases, through taxes. If governments take steps to effect change but in areas that do not wind up making citizens happier, then the populace is likely to conclude that the government was wasteful in its spending. This may result in large negative shifts in societal happiness, as happiness levels have been shown to be quite responsive to monetary losses (Vendrik & Woltjer, 2006). If, however, the actions of governments are in line with the priorities of citizens, it is likely that societal happiness would increase first through the direct impact on happiness from achieving the hoped-for goal and second through allaying citizen concerns over wasteful spending.

For some though, reducing wasteful spending is not about making sure governments select the appropriate social ill to address but rather about keeping governments from even attempting to address societal problems. This perspective is expressed in the words of former U.S. President Carter who argued that “government cannot solve our problems...Government cannot eliminate poverty, or provide a bountiful economy, or reduce inflation or save our cities

or cure illiteracy” (Auerbach, 1996, p.495). For adherents of this view, any government action is largely wasteful, and therefore the best way to increase the happiness of citizens is by keeping from governments the resources necessary to attempt such changes. The breadth of this view is reflected in public opinion surveys that frequently show that many people favor reducing the tax burden and returning money to individuals and families (Berens & Gelepithis, 2019).

These different orientations to life and to the role of government help illustrate how complex and nuanced are the drivers of societal happiness. Research helps explain why this is the case, as it has been shown that some people have a eudaimonic orientation to happiness that predisposes them to want to help others even if “the results are in the future, the recipient cannot be seen, and the helping is personally costly”, while others have a hedonistic orientation to happiness that has them helping only when “the results are immediate, the recipient can be seen, and the helping is not personally costly” (Pearce & Huta, 2023, p.524). To some degree, age has been shown to impact one’s orientation. For example, the eudaimonic orientation has been found to be more prevalent in older adults with younger adults less likely to have a disposition that derives happiness from benevolence (Hubbard et al., 2016).

While these different orientations to happiness exist within each nation (Larsen & McKibban, 2008; Veenhoven, 2010), the statistical distribution of these orientations across nations has been found to be roughly the same (Mathews, 2012; Exton et al., 2015). Thus, there are not differing standards of happiness but rather shared drivers of happiness that are common throughout the world (Veenhoven, 2008). Because of this, it is possible to examine the factors driving differences in happiness at the aggregated level of a society, in other words, by studying how factors impact societal happiness (Raudenská, 2023; Gonçalves et al., 2024).

Examining happiness at the societal level is valuable as it should help fill a gap in the literature. At the individual level, the direct and quite negative impact of infant deaths, and the deprivation that it represents, has already been well demonstrated by psychologists and medical researchers. Research has also shown that people who are not directly impacted usually have quite varying emotions regarding infant deaths and the broader condition of having some live in a state of deprivation. Thus, further research at this level is unlikely to significantly advance the sociological research base. However, very few, if any, studies to date have attempted to quantify the impact of infant mortality on happiness across all members of society, including those directly impacted and those without a direct connection to the deaths or states of deprivation. It is, therefore, unclear how the varied happiness outcomes that are engendered by infant deaths (and the presence of deprivation) shape the societies in which humans choose to live. Given all of the negative outcomes of infant mortality and the broad range of direct (i.e. suffering) and indirect (i.e. deprivation) concepts captured by the infant mortality rate variable, examining how responsive societal happiness is to reductions in the infant mortality rate appears very deserving of careful study.

It is believed that humans will, on average, be happier living in societies with low rates of deprivation. This study assesses that by testing the hypothesis that nations with lower rates of infant mortality have higher levels of societal happiness, using a variable for societal happiness that was derived from a sampling approach that ensures the values represent the average happiness level across the entire adult population in each nation. This representativeness ensures that all the diverse pathways to happiness are taken into account as partial determinants of the overall happiness score for each nation, thereby adding further support for the choice to conduct this analysis at this level of aggregation. By determining whether reducing the infant mortality

rate increases societal happiness, this study will answer whether the majority of citizens in each nation derive happiness from actions to reduce infant mortality and deprivation more broadly. If so, this would suggest that governments would be wise to take action to reduce the infant mortality rate, as it would show that the issue is meaningful to their citizenry.

This study proceeds by first reviewing the existing literature to elucidate the theories of happiness (Chapter 2). In Chapter 3, this study's research question will be clearly articulated, and in Chapter 4, details will be presented about the methodological approach, the data sources, and the key variables. Then, in Chapter 5, attention will turn to a reporting of the key results. Finally, in Chapter 6, this study will discuss the theoretical and practical implications of the results and highlight any limitations of the findings.

Chapter 2 - Literature Review

Perspectives on Happiness

Happiness is a concept that permeates the human experience. However, it has been defined differentially across time and cultures, with discrete categorizations linked to factors like sensory pleasure and eudaimonia (Csikszentmihalyi, 1990; Diener et al., 1995; Lu & Gilmour, 2004; Seligman, 2011). The multitude of ways that happiness can be defined has prompted discussions about the utility of happiness in research (Jugureanu et al., 2014). Some argue for its use but hold that the definitions need to be amended, as they see the most frequently used definitions as being normative (i.e. expressing the values and beliefs of Western society) (Ahmed, 2007; Becker and Maracek 2008; Christopher & Howe, 2014; Cromby & Willis, 2014; Held, 2005; Sugarman 2007) or reductionistic (Haybron, 2000; Jacobsen, 2007; Van Dierendonck et al., 2008; Lepine, 2022; Lomas et al., 2022). A review of the major theoretical perspectives on happiness is presented here, as a first step in demonstrating the utility of this concept as a tool to measure social progress.

Set-Point Theory

One theory of happiness holds that it is determined by genetics and early personality development (Lykken & Tellegen, 1996). For much of the late twentieth century, this view was the dominant perspective in research on happiness (Headey, 2010). Everyone, according to this theory, has a level of happiness that is essentially constant throughout life, and life events have, at best, only a transitory effect on happiness. Thus, there is no value in attempting to change happiness levels, as one's level of happiness will unavoidably return to baseline. From this

perspective, there is little reason to attempt to improve societal conditions as this will not increase societal happiness (Veenhoven, 1994).

With time, these assumptions have begun to be challenged. For example, research has concluded that things like improvements in one's appearance can dramatically increase happiness levels, and likewise, negative events, like the death of a child or prolonged unemployment, can lead to a lasting decline in well-being (Lucas et al., 2004; Wortman & Silver, 1987). Thus, the growing consensus is that one's level of happiness is not fixed, but rather quite malleable in the face of significant life events (Anusic et al., 2014; Lucas, 2007; Lucas et al., 2003). As a result, there has been a movement away from set-point theory in search of alternative, more-encompassing formulations.

Hedonistic Theory

Another theory, hedonistic theory, holds that happiness is largely an expression of momentary feelings. Jeremy Bentham (1907) famously described happiness as derived from pleasure and the minimization of pain—a hedonistic calculus that he thought generally governs human behavior. Moreover, this happiness is seen as being rooted in sensory pleasures (Sizer, 2010), positioning happiness within the realm of emotional or psychological experiences of euphoria or jubilation (Haybron, 2008; Jacobsen, 2014). This perspective has adherents in psychology, where the pursuit of sensory pleasures is seen as a main driver of human behavior, and philosophy, where a good life is often depicted as a pleasurable life (Veenhoven, 2003).

This theory also has its critics, with Nettle (2005), for example, somewhat pejoratively categorizing it as first-level happiness. That is, many thinkers see this definition of happiness as derived from actions that are best described as reprehensible in nature (Porter, 2014). Beyond

that, other scholars critique the theory as they see pleasure as a necessary but not sufficient determinant of happiness, citing as examples heroin addicts who they describe as experiencing pleasure but not living an existence marked by happiness (Sizer, 2010). Still others, citing people like monks who do not pursue pleasure but seem to live happy lives, argue that pleasure is not even a prerequisite for happiness (Feldman, 2002).

Desire-Satisfaction Theory

Desire-satisfaction theory is another theoretical perspective that is closely related to hedonistic theory that holds that happiness is derived from the satisfaction of desires. Davis (1981) formulates the feeling of happiness (or unhappiness) as a function of how many desires have been attained in the moment and how badly each was wanted. Desire-satisfaction theory differs from hedonistic theory in that desires are not limited to sensory pleasures but rather allowed to encompass a broad array of pursuits that may not even result in the attainment of a pleasurable state (Heathwood, 2019). Thus, broadly speaking, satisfaction of a desire, whether the desire be for a glass of water or to live in France, will bring happiness. The desires need not even be clearly conceived and articulated in advance of the satisfaction of the desire (Heathwood, 2022). For example, if a child attempted and achieved a goal of which a parent wasn't aware, it is reasonable to think that the parent would be happy that the child succeeded even though the parent did not expressly articulate the desire.

Critiques of this theory have largely focused on the contradictions that are seemingly inherent in this theory. Some have argued, for example, that depressed people may want to end their lives but that logically no happiness could come from satisfying such a desire (Spaid, 2020). This has led others to argue that the satisfaction of a desire should be considered as

engendering happiness only if the person who holds the desire can clearly demonstrate how the satisfaction of the desire yields something that is not wrong but rather objectively good (Bruckner, 2016; Anscombe, 1956).

Affective-State Theory

The affective state theory of happiness defines happiness as a positive emotional state that is driven by how one feels (Haybron, 2000). From this perspective, happiness is seen as something that is inferred from one's mood base, how one feels most of the time. If one's mood base is generally positive, then this theory argues that the person would believe him or herself to be happy (Schwarz & Strack, 1991). Individuals are said to largely interpret experiences in ways that accord with the mood base (Lepine, 2022). The mood base is detailed as being derived from frequency counts of positive and negative affect experiences (Diener et al., 2009), with a greater frequency of positive experiences signaling the individual's strong adaptation and integration into the flow of life (Veenhoven, 2009).

This theory is related to set-point theory in that one's mood may be, in part, related to an innate disposition. However, affective state theory also allows for emotions and moods to be the result of experiences and therefore malleable (Haybron, 2000). The perspective is also related to hedonistic theory in that moods may be the result of pleasures. Affective state theory, however, holds that the pleasures are not derived from sensory pleasures but from much more consequential experiences that are central to one's being (Haybron, 2001; Welsch & Kühling, 2014). The mood base that controls happiness in affective state theory is thus argued to be less volatile than the drivers of hedonistic happiness, as moods are seen to be anchored across time with short-term shifts discounted as anomalous (Haybron, 2001).

Sociological Theories

Sociological theories like social constructionist theory see happiness not as driven by genetics, as is postulated in set-point theory, but by cultural norms that are created and sustained through social interactions and discourse (Veenhoven, 2008). For example, the positive input of friends and/or family may generate happiness by conveying the message that one is loved and that one belongs. Even strangers can have an impact through interactions that either foster trust or weaken feelings of safety (McMahon, 2014). Durkheim as well spoke to this, but through a focus on how the absence of these social bonds, anomie, negatively influences happiness (Durkheim, 1951).

A different sociological perspective defines happiness not subjectively but rather relative to an objective standard. This view sees happiness as derived not from the transitory emotions of the hedonistic perspective but from a more stable condition (Greco et al., 2015; Bartram, 2012) that is encapsulated in the concept of eudaimonia, the idea that one is making a difference in the world by living “a prosperous and virtuous lifestyle” (Greco et al., 2015, p.20). If one’s life conforms to the standard, then one is said to be in possession of this precious quality (Diener, 1984).

The eudaimonic perspective is somewhat related to affective state theory in that happiness revolves around consequential outcomes, such as maximizing one’s potential (Bartram, 2012; Carlisle & Hanlon, 2007; Kanasz, 2013; Schnittker, 2008; Thin, 2012). If people do not see themselves as leading a life of value, their happiness will certainly be impacted. To see this, we need only look to the American classic movie *It’s a Wonderful Life* to see how the knowledge that one is helping others can lift the spirit.

Other sociological theories reject objective definitions of happiness. According to social comparison theory, whether one is living a good life is a subjective determination made by each individual through benchmarking (Festinger, 1954). If the chosen benchmark is an individual with relatively less, the result is likely to be increased levels of happiness. Conversely, comparing oneself against those who have achieved more has been shown to lead to reduced levels of happiness (Lewallen & Behm-Morawitz, 2016; Verduyn et al., 2020; Vogel et al., 2014).

Other sociological perspectives, like those from the Frankfurt School, reverse the causal flow in explaining how happiness is generated. In critical theory, it is entities like the media and corporations who define what brings an individual happiness through the creation of false needs (Celikates & Flynn, 2023). This, these thinkers argue, perverts the definition of happiness, transforming it from being engendered by lofty qualities like eudaimonia back to hedonistic pursuits, tied to the pursuit of pleasure, mostly through the consumption of non-necessary consumer goods (Kellner, 1983; Garlitz & Zompetti, 2023).

Happiness in the Current Study

When people around the world are asked about what makes them happy, they detail a wide range of factors (Nussbaum & Sen, 1993; Eddington & Shuman, 2005; Skidelsky & Skidelsky, 2012; Cieslik, 2015; Frawley, 2015), with different people detailing a different combination of salient factors (Larsen & McKibban, 2008; Veenhoven, 2010). However, none of the theories heretofore presented fully captures the breadth of factors that engender happiness (Jacobsen, 2007; Van Dierendonck et al., 2008; Lepine, 2022; Lomas et al., 2022).

The theory that comes closest to doing so is the cognitive evaluation theory of happiness. This theory sees happiness as derived through a subjective evaluation of one's life that may be influenced by experiences of the heart but is also determined by reflections and appraisals processed through the brain (Deaton, 2018). That is, this theory acknowledges and includes the sensory pleasures detailed in hedonistic theory and the more consequential positive/negative moods that are central to affective-state theory (Ningjian, 2025), but it also broadens happiness by considering not just those immediate feelings and emotions but also the individual's cognitive reflections on those feelings/emotions (Reisenzein & Schönplflug, 1992). Cognitive evaluation theory also subsumes the ideas of social comparison theory and eudaimonia, allowing happiness to be derived through comparisons with the lived experiences of others and/or an objective standard of the good life (Veenhoven, 2009; Sacco, 2022). Thus, this theory richly depicts the complex interplays that explain the human experience of happiness.

This theory, at times, uses subjective well-being or life satisfaction as labels for the concept of happiness. Research, however, has shown that people do not seem to differentiate among these labels with nearly identical results reported (Helliwell et al., 2015), as no matter which of these linguistic labels is used, people tend to evaluate their lives in the same way--by cognitively developing a standard that subjectively seems appropriate and then comparing their lives to it (Pavot & Diener, 1993). While the standard may differ for each individual, the salient factors of each person's standard are largely the major drivers of happiness contained within cognitive evaluation theory that were detailed just above. Therefore, this theoretical perspective depicts happiness in a way that strongly mirrors how each person reports their own level of happiness (Mazur et al., 2018; Helliwell, 2020), which, it is argued, is necessary "to fully understand, measure, and promote people's experience of the happy life" (Al Nima et al., 2024,

p.2). For these reasons, theories like cognitive evaluation theory that define happiness as derived from an individual's assessment of his or her subjective well-being are seen as best representing the scientific definition for happiness (Diener, 2021).

This study, therefore, adopts cognitive evaluation theory's view of happiness. This has several benefits. First, by accepting that a broad array of drivers impacts happiness, a wide assortment of issues considered theoretically and empirically pertinent to happiness can be assessed in this study, including the direct and indirect impacts of infant deaths and people's different orientations to helping others. Moreover, conceptualizing happiness in this way keeps the definition of happiness from being contorted into a normative construct that forces the happiness of all to be evaluated through the preferred lens of the researcher. Another benefit of this approach is that the risk of model misspecification is reduced, as cognitive evaluation theory depicts the mechanisms through which happiness is produced in a manner that closely aligns with people's own accounts of what drives their happiness. In addition, the Cantril Ladder tool, which is detailed in the Methods section and used to generate this study's dependent variable, is rooted in this broad theoretical perspective.

Importantly, that dependent variable is obtained from a sampling approach which ensures that the diversity in each nation is represented in the sample. That means that the survey responses likely have captured all of the different factors driving happiness in direct proportion with how prevalent they are in society. Thus, when these individual response scores are transformed into an average score for each nation, an understanding of the preferences of societies becomes possible through an analysis at the societal level of aggregation.

Studying societal happiness is beneficial as it enables advancements in the sociological research base. While the impact on individual happiness of infant deaths and deprivation has

been studied at length, few, if any, studies have stepped back and tried to understand how the impacts on those directly affected, indirectly affected, and not affected come together to drive the happiness of societies. It is hypothesized that humans are happier living in societies with low rates of deprivation. If the overall happiness of societies can be shown to increase in tandem with reductions in infant deaths and deprivation, governments likely would act on this meaningful issue.

However, it may be that the majority is only interested in the conditions of the self. This would be demonstrated by a result showing that reducing the infant mortality rate does not increase societal happiness. If the happiness of the majority is driven by other factors and thus societal happiness is not correlated with reductions in infant mortality, the results would still be meaningful. At minimum, they would help illuminate for people interested in reducing deaths and deprivation the magnitude of resistance they are likely to face in effecting such social change. Therefore, understanding the impact on societal happiness of reducing suffering and deprivation in a nation will help enhance our understanding of societies and their current priorities.

Chapter 3 - Research Hypothesis

Given all of the negative outcomes of infant mortality and the broad range of direct (i.e. suffering) and indirect (i.e. deprivation) concepts captured by the infant mortality rate variable, examining how responsive societal happiness is to reductions in the infant mortality rate appears very deserving of careful study. Furthermore, very few, if any, studies to date have attempted to quantify the impact of infant mortality on happiness across all members of society, including those directly impacted and those without a direct connection to the deaths or states of deprivation. This study, therefore, aims to fill this gap in the literature by testing the following hypothesis:

H: Nations with lower rates of infant mortality have higher levels of societal happiness.

By testing this hypothesis at the aggregate level of societal happiness, the complex interplay of forces impacting the average level of happiness in nations is better able to be assessed. Moreover, if reducing the infant mortality rate increases societal happiness, then support will be provided for actions to reduce infant mortality and deprivation more broadly.

While a major concern of an analysis at this level of abstraction is related to the risk of possibly overlooking the great suffering of some minority group that may result from discriminatory or targeted government actions, this study attempts to minimize that risk through a cross-country analysis that utilizes as explanatory variables salient factors tied to happiness that are common across all nations.

Chapter 4 - Methods

Measuring Happiness

Models have been developed to measure the impact of various factors thought to underlie people's happiness, in the hope that this will lead to improvements in the lived condition of humanity. One of the earliest tools was the Affect Balance Scale, which is a tool designed to examine the emotional state of individuals by subtracting the score for the presence of negative emotions from the score for positive emotions to get an affect score for the individual (Bradburn, 1969). Later research called into question this approach, with the key critique being that negative and positive affect should not be treated as independent. Consequently, scales like the Affectometer 2 that attempts to measure "the balance of positive and negative feelings in recent experience" were constructed (Kammann & Flett, 1983, p.259). Issues though arose with these scales as well. For example, Affectometer 2 scores were found to vary greatly depending on how questions were worded (Stochl et al., 2016). In addition, the scales were seen as incomplete, as they did not measure all known components of happiness (Tennant et al., 2007).

A model that aims to more fully capture the drivers of happiness is the subjective well-being (SWB) model. It measures happiness through a subjective self-reporting of the impact of salient factors (Diener, 1984; Diener et al., 1985), including not only the frequency of positive and negative affect but also one's level of satisfaction with the totality of life and reported satisfaction in domains like health and relationships (Pavot & Diener, 2008; Lucas & Diener, 2008). Information is elicited through a multi-question assessment that requires respondents to position their answers on a 7-point Likert scale (Pavot & Diener, 2008). The score for each question is then tallied to generate an overall happiness score. Critics of this model generally

hold that the questions that are asked inescapably impose an artificial weighting, resulting in potentially biased results (Van Beuningen, 2012).

Another model that was developed is the PERMA model (Mayo et al., 2019). This model depicts happiness as containing elements like hedonism and eudaimonia and allows individuals to exhibit non-homogenous beliefs in regards to how each element influences happiness (Seligman, 2011). Happiness is said to be predicted through five attributes. The first, positive emotions, is a measure of how hopeful and joyful one feels. The second, engagement, measures how absorbed one is in the activities in which one engages. The third, relationships, measures the number of substantive connections one has with family and/or friends. The fourth, meaning, measures the degree to which one feels connected to beliefs or pursuits that are larger than the individual, and the fifth, achievement, measures how much success the individual feels they have attained in life (Kovich et al., 2023). When comparing this model with the SWB model, researchers found that they both yield similar measures of happiness and both suffer from similar limitations (Goodman et al., 2018).

Yet another model is Ryff's model of Psychological Well-being. As happiness is seen as being multidimensionally determined, this model attempts to measure happiness across six dimensions (Kafka & Kozma, 2002). The first dimension relates to how positive are people's feelings about their good and bad qualities while the second dimension examines whether the individual has high quality relationships (Garcia et al., 2023). The third dimension measures the happiness derived from an individual's capabilities, and the fourth is related to the individual's ability to control his or her environment (Ryff & Singer, 2008). The fifth and sixth dimensions are related to feelings of purpose and success in life, respectively (Springer et al., 2011). The validity of this model has been called into question, primarily because empirical research has

demonstrated that four of the six dimensions of this model are capturing and thus overweighting the same underlying driver of happiness (Springer & Hauser, 2006).

All these models, like the theories previously discussed, have also been critiqued for their restrictive formulations that, it is argued, do not take into account the full complement of inputs into happiness but rather portray happiness through reductionist frameworks (Haybron, 2000; Jacobsen, 2007; Van Dierendonck et al., 2008; Lepine, 2022; Lomas et al., 2022). These critiques have arisen as research has shown that these restrictive definitions do not well align with how people understand happiness (Frawley, 2015). The happiness that people report appears to be influenced by a multitude of factors (i.e. the fleeting and the lasting / the base and the lofty / the personal and the external) (Cieslik, 2015; Nussbaum & Sen, 1993; Skidelsky & Skidelsky, 2012). Maslow (1943) famously detailed the range of factors affecting happiness, from the base to the abstract, through his hierarchy of needs.

To address the issue of definitional mismatch, recent research has attempted to develop models that admit a broader definition of happiness. To do so, some researchers have moved away from the reliance on self-report data toward textual-analysis approaches that examine social media utterances and photos, citing as benefits not only the broader definitions of happiness that this approach allows but also the time and money that is saved from not having to collect data (Bollen et al., 2011; Dodds et al., 2011; Quercia et al., 2012). Concerns though have been raised about the ability of such approaches to accurately assess the emotion from the source data (Abdullah, 2015).

Moreover, much comparative research has found that an individual's happiness can best be assessed through self-report measures (Andrews & Crandall, 1976; Sandvik et al., 1993; Ryff & Keyes 1995; Lucas, 2018; Hudson et al., 2020). Thus, many researchers continue to use self-

report data, while working to develop scales that are broader in scope. Research has shown that single-item, self-report measures of happiness are quite effective in capturing the wide heterogeneity underlying respondents' views of happiness (Nagy, 2002; Bergkvist & Rossiter, 2007; Van Beuningen, 2012; Krzyżaniak-Luiza & Atroszko, 2015; Allen et al., 2022). This is because these measures prompt an individual to subjectively evaluate the totality of their life experiences while considering all salient factors (Veenhoven, 2009).

One single-question tool that is being increasingly employed is the Cantril Scale. This approach asks each respondent to report their level of happiness with life and does not force the respondent into making judgements based on the criteria deemed important by the researcher. Rather, the respondent is free to make an assessment about his or her level of happiness based on his or her own definition of what brings value to life (Helliwell et al., 2017). This latitude, it has been demonstrated, enables Cantril Ladder designs to capture all of the possible factors influencing happiness, like affect, eudaimonia, wealth, and health, while not creating an arbitrary weighting of these components of happiness (Eddington & Shuman, 2005; Bartels & Boomsma, 2009; OECD, 2025).

Results using this scale have demonstrated its utility in measuring happiness (Mazur et al., 2018; Helliwell, 2020). Results also show that respondents' answers do not vary if the form of the question that is asked is changed from a reporting of one's "happiness" with life to a reporting of one's "satisfaction" with life (Helliwell et al., 2015, p.16). In addition, the Cantril Scale has been shown to elicit reliable and valid results in studies that examine happiness across nations (Raudenská, 2023; Gonçalves et al., 2024) and therefore to be an effective approach in studies that examine the drivers of societal happiness (Exton et al., 2015; Yin et al., 2023).

Measuring Happiness in the Current Study

Research has shown that individuals across society are somewhat differentially impacted by the various components of happiness (Larsen & McKibban, 2008; Veenhoven, 2010). That is, within each society, happiness for each individual is likely derived from a somewhat different combination and weighting of factors. Overall though, the statistical distribution of factors that make people happy has been found to be roughly the same for all nations (Mathews, 2012; Exton et al., 2015). Thus, there are not differing “cultural standards of the good life”, but rather a shared and similarly constructed idea of happiness that is common throughout the world (Veenhoven, 2012, p.464). Because of this, it has been shown that the factors driving differences in happiness can be examined at the aggregated level of a society—societal happiness (Raudenská, 2023; Gonçalves et al., 2024).

Research has also shown that happiness is best seen as being influenced by a variety of factors, including past/present experiences, envisioned outcomes, social interactions, momentary pleasures, affect, and overall satisfaction with life (Eddington & Shuman, 2005; Cieslik, 2015; OECD, 2025). As the Cantril Ladder approach is capable of capturing the impact of this breadth of factors on happiness and as results using this approach have been shown to reliably and validly measure happiness (Mazur et al., 2018; Helliwell, 2020), happiness scores collected using this tool are central to this study. It is believed that they likely best reflect the average happiness scores across nations and across time.

Data

As not all the nations of the world report data, the data included in this study cover 111 of the 195 nations of the world or 57% of the total (Figure 4.1). While this arguably could create

some issues with generalizing to the entire world from results produced using this sample, the nations for which there are data available represent a robust sample across many salient dimensions. For example, this sample contains many of the world's poor, middle-income, and rich countries. There is also good geographic coverage with nations in the study being drawn from six of the seven continents.

Figure 4.1. Nations included in the study



Variables

The variables that were selected for use in this study are presented in this section. First, detailed information about the variable that records the happiness levels of nations across time is presented. Then, the key variable of interest (i.e. the infant mortality rate) is introduced, along with an explication of how it is measured. Finally, the range of variables that were selected as control variables are presented along with their definitions.

Dependent Variable – Societal Happiness

The dependent variable for this study, societal happiness, is derived from survey research conducted by the Gallup Organization in collaboration with the Wellbeing Research Centre at the University of Oxford in the United Kingdom (UK). To produce the societal happiness scores, they first randomly sample approximately 1,000 people in each nation, in each year using an approach that is designed to ensure its representativeness across the entire adult population in that year in each nation. Then, with the sample determined, they use the Cantril Ladder approach and ask the following question:

Please imagine a ladder with steps numbered from 0 at the bottom to 10 at the top. The top of the ladder represents the best possible life for you and the bottom of the ladder represents the worst possible life for you. On which step of the ladder would you say you personally feel you stand at this time? (WHR, 2026)

To aggregate these individual responses into an average score for each of more than 130 countries surveyed, the Gallup Organization and Wellbeing Research Centre first bring together the results acquired over three years or roughly 3,000 responses per country and calculate the mean response value over that period. That means that data collected over the period from 2022 to 2024 were used to publish the results that came out in 2025. Given the balanced nature of the data by year and the mathematical choice to calculate the average score, data are best seen as representative of the midpoint year of the collection timespan, that is 2023. These scores have been published in the years from 2012 to 2025, with the underlying data thus representative of the years from 2010 to 2023. In this study, as the goal is to understand whether reducing the

infant mortality rate will increase societal happiness, recency is important, as the most recent data are likely to be most representative of the conditions and thinking of the people living now. Thus, this study will examine how changes in the infant mortality rate impacted societal happiness in the year 2023.

Use of Lagged Independent and Control Variables

All of the independent and control variables used in this study enter the regression model as lagged values of one year relative to the societal happiness scores for 2023. That is, the independent variables represent the conditions in the year 2022. This was done first because, as detailed above, the dependent variable, the societal happiness score for nations in 2023, was created by taking an average of the scores recorded for the years 2022, 2023, and 2024. Given that a third of the weighting of the score for 2023 is derived from answers given in 2022, using 2023 values for the independent variables would be an implicit endorsement of the idea of backward causation. However, it is not believed that events in 2023 can impact outcomes in 2022. Therefore, using values for the independent variables from 2022 ensures that the causal path is a forward one.

In addition, research has shown that knowledge diffusion takes months or longer to permeate society (Basayeva et al., 2016; Pochekutova, 2023). This means that if, for example, the infant mortality rate in a nation decreases in 2022, the knowledge of that change will not be immediately known throughout the entire nation. Some may learn the news quickly, but for others, the information may not reach them until much later. The use of lagged variables aligns with this idea of non-complete, non-instantaneous transfer of information, allowing the changes occurring in 2022 to have some impact in the same year but also acknowledging that for some

the news of the changes may not have been obtained until 2023 or even 2024. For these reasons, it is believed having the independent and control variables, which are detailed below, enter as lagged variables strengthens the theoretical foundation for the model employed in this study.

Independent Variable – Infant Mortality Rate

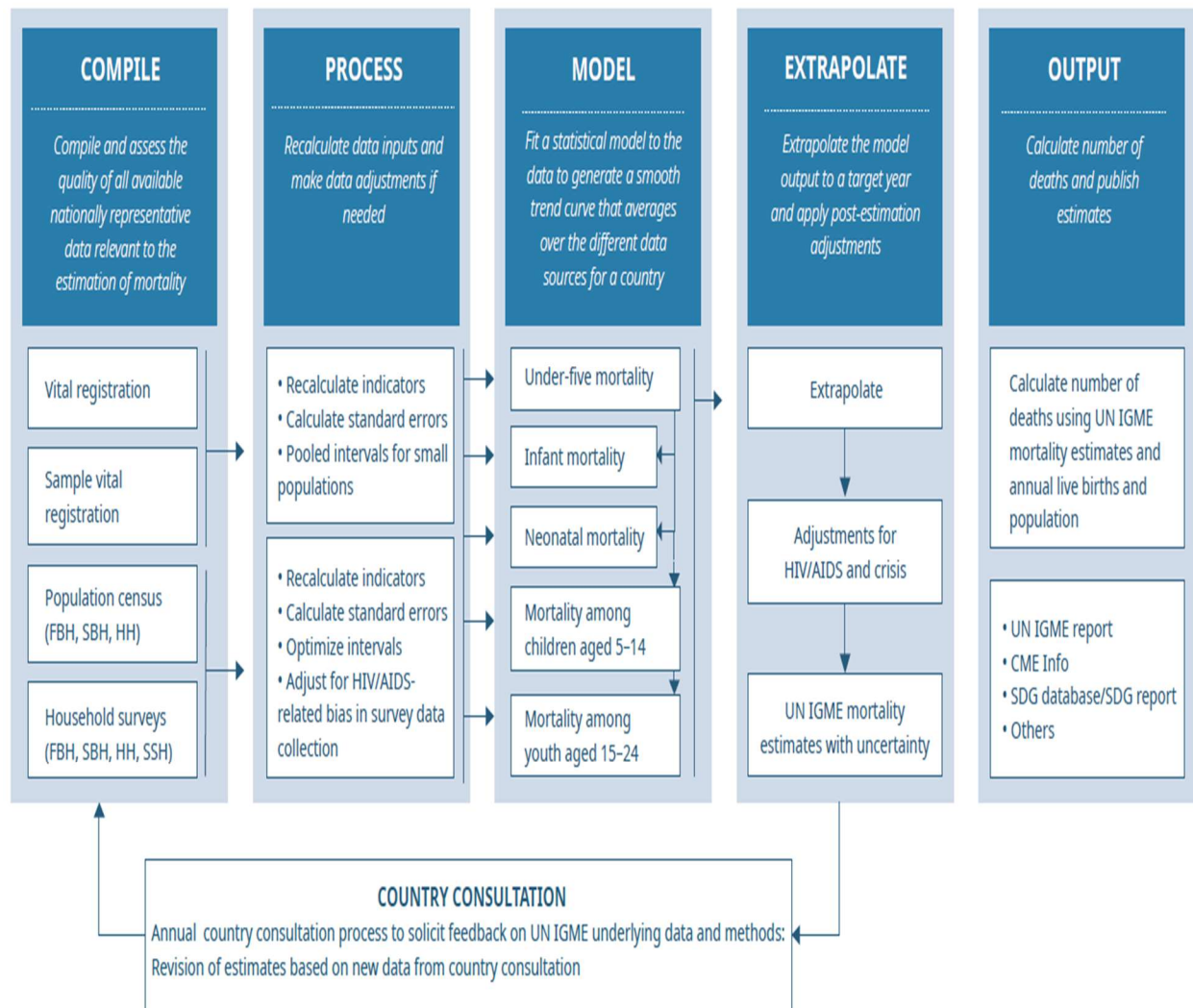
The key independent variable used in this study is the infant mortality rate, which is defined in Table 4.1. This data was obtained from the United Nations Inter-agency Group for Child Mortality Estimation (UN-IGME), which was formed in 2004 and is led by the United Nations Children’s Fund (UNICEF) with other members being the World Health Organization (WHO), the World Bank Group (WB), and the United Nations Department of Economic and Social Affairs (UNDESA).

Table 4.1. Key independent variable with definition

<i>United Nations Inter-agency Group for Child Mortality Estimation (UN-IGME), 2026</i>	
Infant Mortality Rate	The number of infants dying before reaching 1 year of age per 1,000 live births in a given year.

The estimates of the infant mortality rates are calculated using the process described below, which is detailed in full in UNICEF-WHO-WB-UNDESA (2025). Figure 4.2 summarizes the group’s standardized workflow. The process to create reliable estimates of the rates of infant mortality in each nation in each year begins with the collection of civil-registration data from the nations where it is available, which at present is roughly 60 nations. In these nations, data on the number of infant births and deaths for the entire population are recorded on a continuous basis, which yields timely and accurate estimates.

Figure 4.2. Workflow used to create infant mortality rate data



UNICEF-WHO-WB-UNDESA, 2025

Difficulties arise when attempting to create estimates for the other, mostly developing countries, who do not have systems that fully record such information. In those nations, data is collected largely from UNICEF Multiple Indicator Cluster Surveys (MICS) and U.S. Agency for International Development (USAID) Demographic and Health Surveys (DHS), although other nationally representative survey data are said to be sometimes included. These surveys ask

women to detail information about their children and any deaths. This information is delivered in one of two forms:

***Full birth history (FBH)**, whereby women are asked for the date of birth of each of their children, whether the child is still alive, and if not, the child's age at death; and*

***Summary birth history (SBH)**, whereby women are asked only about the number of children ever born to them and the number who have died (or equivalently, the number still alive).*

UNICEF-WHO-WB-UNDESA, 2025

DHS and MICS surveys primarily report FBH data.

Once data has been collected for each nation, the UN-IGME runs checks to determine the quality of the data and makes necessary adjustments using standard methods. Then, using estimates for previous years, the group addresses bias from the many different data sources across nations by the use of the Bayesian B-splines bias-adjusted model. This model fits a smoothed trend curve to the reported data, both past and present, and then extrapolates to create estimates for the desired period, which represents the infant mortality rate in a nation during one calendar year. This ensures that the final estimates that are published for each year, for example 2022, are representative of the infant mortality rate in each nation in that calendar year.

Control Variables

Other control variables were introduced into the regression model for several reasons. First, adding control variables helps reduce omitted variable bias when those variables have a relationship with the dependent variable but are also somewhat correlated with in the key independent variable of interest (Wooldridge, 2016). Their introduction also can reduce the

possibility that the research will yield a spurious relationship between the key independent variable and the dependent variable by appropriately capturing the impact of the confounding variable (Welkowitz et al., 2011). It also increases the ability to infer causality by testing other possible explanations for the changes in the dependent variable (Wooldridge, 2016). Thus, control variables were selected that have been shown to have a relationship with societal happiness and whose absence may have biased the coefficient on the main independent variable on interest, the infant mortality rate in a nation.

Gross Domestic Product

One of the control variables in this study is gross domestic product (GDP), which was created as detailed in Table 4.2. GDP is the standard measure of the total economic value that is added during the production of goods and services in a country in a given calendar year (OECD, 2026). While GDP and infant mortality rates have historically been highly correlated, research has shown that the relationship has changed with the health levels of some countries improving substantially in recent years without a corresponding change in average wealth (FRED, 2025).

GDP was included in this study as research has demonstrated that there is a relationship between GDP and happiness. For example, Stevenson and Wolfers (2013) found that increases in GDP per capita are correlated with increases in happiness. Kula et al. (2010) showed that GDP per capita is more correlated with happiness than all other indices except the corruption perception index, and Araki (2022) found that the link between one's salary and happiness is stronger than other factors like safety or education. In a similar vein, Tella et al. (2003) found strong correlations between changes in current and lagged GDP per capita and societal happiness. Deaton (2008) found that each time GDP more than doubled, there was a

corresponding increase in societal happiness, and Oishi et al. (2022) demonstrated that the correlation has strengthened in the United States and Europe over the last 50 years.

The finding of a link between GDP and happiness though is not universal. Research has also shown that despite China’s GDP growing more than fourfold over the past two decades, citizens’ life satisfaction has not increased in tandem and may have declined due to social problems such as rising unemployment, the collapse of social security systems (Easterlin, 2013), and the disappearance of valued aspects of their lives (O’Donnell, 2013). Another study of more than 50 nations found no correlation between economic growth and happiness (Easterlin, 2014) with other researchers drawing similar conclusions (Kapoor & Debroy, 2019; Shrotryia & Singh, 2020).

Table 4.2. Gross domestic product (GDP) variable with definition

<i>World Bank, 2025a</i>	
GDP per capita (constant 2015 US\$)	Calculated by taking the total income earned in each country each year through activities that produce goods and services and dividing that number by the number of people living in each country in each year. To control for the influence of price changes due to inflation/deflation over time, this variable has been converted to constant prices, using the value of the United States dollar in the year 2015. The values are reported in thousands of U.S. dollars.

Given the importance of this variable, this study controls for the impact of GDP using GDP per capita which helps eliminate any bias tied to differential population sizes across nations. It also helps prevent the impact of demographic trends (e.g. changes in fertility rates or migration patterns) from being improperly attributed to GDP. These data are collected by the World Bank Group (WB) from national accounts data that are compiled in line with the international standards that are detailed in the statistical System of National Accounts framework

(UN, 2009). This variable is reported by the World Bank in constant 2015 year U.S. dollars. Using constant dollars is beneficial as the impact of inflation has been taken into account, resulting in changes in monetary levels better representing the actual purchasing power in the calendar year.

Unemployment Rate

Another important variable that was included is the unemployment rate, which is defined in Table 4.3. As to the relationship between unemployment and infant mortality, research has yielded conflicting results. For example, Maruthappu et al. (2017) found that unemployment is tied with a deterioration in infant mortality rates during cyclical economic downturns, especially in the least developed nations, but other researchers have found no significant relationship between the variables (Al-Saqry et al., 2025; Joyce & Mocan, 1991; Shin, 2019). Research, however, has consistently shown that having a job improves happiness levels (Stankunas et al., 2006; Waters & Moore, 2002) while unemployment engenders lower levels of happiness and well-being than other negative life events like divorce (Clark & Oswald, 1994). Thus, given this support in the research literature that demonstrates its relationship with happiness, it is believed necessary to control for the impact of the unemployment rate on societal happiness.

Table 4.3. Unemployment rate variable with definition

<i>International Labour Organization (ILO), 2026a</i>	
Unemployment rate	Percentage of the total labor force (adults 15 years of age or older) that does not have a job but is able to work and actively trying to secure work.

The data on the unemployment rate in each nation are collected by the International Labor Organization (ILO) using the definition for unemployment that was agreed to at the 19th International Conference of Labour Statisticians and published as part of their “internationally comparable labour statistics” (ILO, 2026a). The ILO’s estimates are developed through the following approach (ILO, 2026a; ILO, 2026b). First of all, the ILO defines an unemployed person to be one who did not work, but was able to work, and was actively searching for work. The unemployment rate then is this total number divided by the number of people in the labor force, which is defined as the number of adults ages 15 years or older. The ILO works with the governments of most nations to have this information collected in standardized ways through national labor force surveys. For a few (mostly developing) nations, other types of collection instruments are used, and this requires the ILO to engage in additional steps, such as cross validation and linear interpolation, to ensure the validity of the data and minimize the errors of their estimates. The final published estimates reflect the annual average for the year in which the information was collected. That means that the ILO’s data for the 2022 calendar year, for example, is labeled as 2022 estimates.

Government Effectiveness

Research has also suggested that where human rights are respected, societies are happier (Kenny, 1999). In particular, where the governments exercise power effectively with low levels of corruption, societies are generally happier (Anderson, 2016; Kula et al., 2010; Sulemana, 2015). Thus, a variable was introduced to control for its impact. This variable, government effectiveness, is created by the World Bank Group’s Development Economics Policy Indicators

Group (DECIG), as part of its Worldwide Governance Indicators (WGI), and its definition is presented in Table 4.4.

Table 4.4. Government effectiveness variable with definition

<i>World Bank, 2025a</i>	
Government effectiveness	Measures "perceptions of the quality of public services, the civil service, policy formulation and implementation, and the credibility of a government's decisions" including "the extent to which public power is exercised for private gain, including both petty and grand forms of corruption". It also captures the degree to which the state favors "elites and private interests".

The methods the DECIG uses to create this variable are detailed in World Bank (2025b). A quick summary is presented below. Data are first collected from household and company surveys and expert assessments and then reviewed to ensure that the data meet the necessary standards for methodological rigor and comparability. The government effectiveness estimates are then produced from this data using an Unobserved Components Model (UCM), which combines imperfect information about the quality of governance from various sources into a single indicator with confidence intervals that express the uncertainty surrounding the estimates. The estimate for each nation is then expressed relative to the global average score for the year, with all scores falling within 2.5 standard deviations either above or below the mean score.

Dependency Ratios

Another variable of interest is the age-dependency ratio. This variable, defined in Table 4.5, helps highlight how many dependents each worker must support on average. Many nations in East Asia are seeing significant increases in elderly dependents while many nations in Africa

as seeing large increases in the number of child dependents. Both represent burdens on the working-age population that have been shown to impact people’s views on their well-being and happiness (Abbas et al., 2024; Skirbekk et al.,2022; Wachs et al., 2020).

Table 4.5. Age-dependency ratio variable with definition

<i>United Nations Department of Economic and Social Affairs (UNDESA), 2026</i>	
Age-dependency ratio	Ratio of dependents (people under the age of 15 years or over the age of 64 years) to working-age population (people aged 15-64 years). E.g. 15 = 15 dependents per 100 workers.

This variable is created by the United Nations Department of Economic and Social Affairs (UNDESA). The numerator is sum of the number of people less than 15 years of age and the number of people 65 years of age or older. The denominator is the number of people of working age, which is defined as those who are at least 15 years of age but are younger than 65 years of age. These data are collected using the methods detailed in UNDSEA (2024) that are briefly covered here. The data are obtained from many governmental and non-governmental organizations, such as the OECD, WHO, World Bank, Max Planck Institute for Demographic Research, and Eurostat, and then the estimation methods used in collecting the data are checked and differences reconciled. Then, the cohort-component method for projecting population (CCMPP) is employed to take the available data and create estimates of population by age range in ways that ensure that the demographic equation is balanced. This process continues in an iterative manner to ensure optimal consistency from each benchmark year to the next. This process yields the estimates that are published as best representing the age-dependency ratios in each nation in each calendar year.

Summary Statistics

For the variables that were selected for use in this study, the summary statistics are presented in Table 4.7. Across all the variables, there is significant variation. This heterogeneity should enable the impact of each variable to be tested and identified. Importantly, for the infant mortality rate, the values range from 1.7 to 30.1, suggesting a large differential across nations in the number of infants that die each year.

Table 4.6. Summary statistics

Variables	Mean	Std. Dev.	Min	25%	Median	75%	Max	N
Societal happiness	5.43	1.12	1.36	4.55	5.68	6.33	7.74	111
Infant mortality rate	20.05	18.25	1.71	5.87	12.86	30.14	73.94	111
GDP per capita	11.38	16.68	0.38	1.66	4.79	12.68	97.79	111
Unemployment rate	6.88	5.67	0.23	3.15	5.04	9.16	33.27	111
Government efficiency	-0.25	0.9	-1.68	-0.91	-0.45	0.1	2.25	111
Age-dependency ratio	59.48	15.05	28.14	49.95	56.2	69.38	99.51	111

Model

This study uses a cross-sectional, multivariate-regression model to assess the impact of the key variable, infant mortality, on societal happiness. The generalized form of the model is shown in Eq. 1.

$$\text{Societal Happiness}_i = \alpha + \beta_0 * X_i + \beta_1 * C_i + \varepsilon_i \quad (1)$$

The left-hand side of the equation is the reported societal happiness score for each nation *i*. Societal happiness is assumed to be a function of the mortality rate of children under one year of age (X_i), a host of control variables (C_i), and an error term (ε_i). When reporting the change in the dependent variable, the regression coefficients for each variable in this model will be adjusted to eliminate bias using the standard approach of exponentiating each coefficient x using the formula detailed in Eq. 2.

$$e^x - 1 * 100 \quad (2)$$

Before running the cross-sectional, multivariate-regression model, it was necessary to determine whether any of the variables that were selected exhibited collinearity to a degree that might bias the model. To assess this, the variance inflation factor was calculated using R software (R Core Team, 2026) and the Companion to Applied Regression (*car*) package (Fox & Weisberg, 2019). Results (Table 4.8) showed no potential issues, as the calculated values were all below the threshold. This is important as this suggests that the control variables are not impacting societal happiness in the same way that infant mortality does. That is, these other variables seemingly do not directly measure the unhappiness that results from the death of an infant, which is expected. More importantly, it appears that they do not serve as proxies for the general condition of deprivation, which the infant mortality rate is believed to capture. Given these findings, it is believed that results from a cross-sectional, multivariate-regression model that uses these variables is unlikely to yield biased results.

Table 4.7. Test of multicollinearity using Variance Inflation Factor statistical test

Variable	VIF
Infant mortality rate	3.44
GDP per capita	2.89
Unemployment rate	1.78
Government efficiency	3.08
Age-dependency ratio	2.49

Note: In interpreting variance inflation factor (VIF) results, scores greater than five suggest the presence of problematic issues with collinearity that may result in biased estimates.

Use of Non-linear Formulations

In this study, as part of the process of ensuring the fit of the regression model, the control variables were tested using various formulations to assess whether the relationship between each control variable and societal happiness is best modeled as a linear relationship. For many of the control variables, a linear relationship was found to be present as the residuals were randomly scattered around the zero line with no evidence of a curved pattern. This is true for government effectiveness, which when modeled as having a linear relationship with societal happiness exhibits a largely flat, linear pattern (Figure 8.1). Similar patterns were found for both the unemployment rate and age dependency ratio. When the relationship of each with societal happiness was tested as being linear, the residual plots were mostly flat with values clustered around zero (Figures 8.2 & 8.3). Thus, for these three control variables then, the model will take the form shown in Eq. 3.

$$\text{Societal Happiness}_i = \alpha + \beta_0 * \text{Government Effectiveness}_i + \beta_1 * \text{Unemployment Rate}_i + \beta_2 * \text{Age Dependency Ratio}_i + \varepsilon_i \quad (3)$$

The next step that was undertaken was finding the appropriate approach to modeling the relationship between GDP per capita and societal happiness. This proved more difficult. The

research literature frequently introduces GDP as a quadratic variable as the effects of GDP on happiness are typically non-linear. For example, Morgan et al. (2015) found that above a certain income threshold GDP increases do not improve happiness levels, but among lower income nations increases in GDP have a much more substantial impact on happiness (Morgan et al., 2015). This work is supported by research that finds that, while countries with a higher GDP are generally happier than poor nations (Stevenson and Wolfers, 2013), any income gains above \$10,000 per person have little impact on societal happiness (Frey, 2001). These findings reflect the well-known economic idea that there are decreasing returns to income.

When the relationship between GDP per capita and societal happiness was tested using a linear model and employing the data in this study, the model showed significant curvature in the residuals plot (Figure 8.4). Next, the relationship was tested using a quadratic formulation. Surprisingly, while the residuals plot showed some flattening, it still demonstrated significant curvature (Figure 8.5). Then, GDP per capita was introduced as a third-order polynomial. Results showed more flattening but still not an elimination of the curved pattern of the plot (Figure 8.6). Given the fact that even higher-order polynomials did not fully remove the underlying curvature skew, yet another model was tested. This one employed a natural logarithmic transformation. Results using this model (Figure 8.7) showed the greatest control of the errors in the residuals, suggesting that this model fit the data quite well. As a result, the natural logarithmic transformation of GDP per capita will be used in this study. This evolves the model into the form shown in Eq. 4.

$$\text{Societal Happiness}_i = \alpha + \beta_0 * \text{Natural Logarithm of GDP per Capita}_i + \beta_1 * \text{Government Effectiveness}_i + \beta_2 * \text{Unemployment Rate}_i + \beta_3 * \text{Age Dependency Ratio}_i + \varepsilon_i \quad (4)$$

Lastly, the most appropriate form to model the infant mortality rate was investigated. Residual plots were first created using a model that assumed a linear relationship between the infant mortality rate and societal happiness. The residual plot results, however, showed a significant curve (Figure 8.8), suggesting that a different model was needed. To test this assumption, the model was next formulated using a quadratic term. These results showed a dramatic improvement in the model fit, with the curvature in the residuals plot almost completely disappearing (Figure 8.9). Thus, this study will model the relationship between the infant mortality rate and societal happiness as a second-order polynomial, thereby transforming the model into the form shown in Eq. 5.

$$\text{Societal Happiness}_i = \alpha + \beta_0 * \text{Infant Mortality Rate}_i + \beta_1 * \text{Infant Mortality Rate}_i^2 + \beta_2 * \text{Natural Logarithm of GDP per Capita} + \beta_3 * \text{Government Effectiveness}_i + \beta_4 * \text{Unemployment Rate}_i + \beta_5 * \text{Age Dependency Ratio}_i + \varepsilon_i \quad (5)$$

R Software

To assess the relationship between the infant mortality rate and societal happiness, analyses were performed using R Statistical Software (v4.5.3; R Core Team 2026). Post-regression standardized coefficients were created using the *lm.beta* package (Behrendt, 2025) while tests to ensure model robustness required other packages. For example, the variance inflation factor for each variable was calculated using the *car* package (Fox & Weisberg, 2019), with a final check of the correlation of the variables to be used in the model determined shown in Table 5.1. Results again showed only moderate correlations, at levels that are generally seen as acceptable.

Table 4.8. Test of multicollinearity using Variance Inflation Factor statistical test

Variable	VIF
Infant mortality rate	3.64
Natural logarithm of GDP per capita	4.98
Unemployment rate	1.19
Government efficiency	3.45
Age-dependency ratio	2.54

Note: In interpreting variance inflation factor (VIF) results, scores greater than five suggest the presence of problematic issues with collinearity that may result in biased estimates.

Chapter 5 - Results

Societal Happiness and Infant Mortality Globally

To identify the impact of the infant mortality rate variable on societal happiness in the most recent year for which data are available, 2023, a cross-sectional regression was run that controlled for the impact of additional variables that are thought to be salient. The F-test for this model shows that the independent variables, as a group, have a significant impact on the dependent variable ($p < .01$), and the adjusted R-squared value suggests that this model explains roughly 62.5 percent of the variation in the dependent variable (Table 5.1).

Table 5.1. Cross-sectional Ordinary Least Squares (OLS) regression results for impact of key variables on societal happiness.

	Coefficients	Standardized Coefficients	Standard Error	t-value	Pr(> t)	Significance Level
Infant mortality rate	-0.027	-0.438	0.019	-1.447	0.151	
Infant mortality rate squared	0.0002	0.234	0.0002	0.936	0.352	
Natural logarithm of per-capita GDP	0.484	0.570	0.128	3.775	0.000	***
Unemployment rate	-0.038	-0.190	0.013	-2.941	0.004	***
Age dependency ratio	-0.003	-0.039	0.007	-0.411	0.682	
Government efficiency	-0.030	-0.023	0.139	-0.212	0.833	
Intercept	5.464	NA	0.566	9.645	4.19E-16	***
Adjusted R ²	0.625					
F	31.5					
p	< 0.01					

*** $p < 0.01$ // ** $p < 0.05$ // * $p < 0.1$

As to the impact of the main variable of interest, the infant mortality rate, in both the regression results (Table 5.1) and the F-test of joint significance of the second-order polynomial variables (Table 5.2), the infant mortality rate is revealed to not have a significant impact on societal happiness. As for the other variables, increases in GDP per capita are shown to

significantly impact ($p < .01$) societal happiness, although as was expected, increases in GDP per capita are shown to be more impactful for nations that are relatively poor. Nations at the 25th percentile of the distribution in this study had a per-capita GDP of \$1,666, and results suggest that a \$1,000 increase in per-capita GDP to \$2,666 would increase the happiness level of these societies by 0.712 points¹. However, for nations at the 75th percentile of the distribution (per-capita GDP: \$12,860), a \$1,000 increase in per-capita GDP would not be as impactful, increasing societal happiness by just 0.521 points. Thus, the relationship is shown to be decreasing in impact with income. The unemployment rate also appears to have a significant ($p < .01$) relationship with societal happiness. When the unemployment rate is higher, societies are found, on average, to be less happy. Results suggest that each 1-percentage-point increase in the unemployment rate is linked with a 0.038 point reduction in societal happiness. As for the other control variables, government effectiveness and the age dependency ratio, neither is shown to have a significant impact on societal happiness.

Table 5.2. F-test results on the joint significance of the infant mortality rate second-order polynomial variables on societal happiness.

F	1.666
p	0.194

Next, a test of the relationship between the infant mortality rate and societal happiness was conducted with the per-capita GDP variable removed from the regression. This model's F-test (Table 5.3) showed that the remaining independent variables, as a group, exert a significant

¹ This value is calculated using the following approach. The 25 percentile GDP per capita value in thousands is \$1.66 (Table 4.7). Applying the coefficient for the natural logarithm of GDP per capita (0.484) from Table 5.1, the formula, $\text{Ln}(\$1,666 * 0.484)$, equals 0.247. Repeating this for a 1-unit increase in GDP per capita to \$2,666 results in a value of 0.959. Differencing these values rounds to the stated increase in societal happiness of 0.712 points.

impact on the dependent variable ($p < .01$). However, the power to explain the variation in the dependent variable decreases from 64.5 percent in the model used in Table 5.1 to 56.9 percent in this model (Table 5.3), a decrease in overall explanatory power of 7.6 percentage points. This suggests that the removal of the per-capita GDP is unsound.

Table 5.3. Cross-sectional Ordinary Least Squares (OLS) regression results for impact of key variables on societal happiness.

	Coefficients	Standardized Coefficients	Standard Error	t-value	Pr(> t)	Significance Level
Infant mortality rate	-0.067	-1.103	0.016	-4.16	6.68E-05	***
Infant mortality rate squared	0.001	0.694	0.0002	2.97	0.004	***
Unemployment rate	-0.029	-0.146	0.013	-2.13	0.036	**
Age dependency ratio	-0.008	-0.107	0.007	-1.09	0.278	
Government efficiency	0.300	0.238	0.114	2.64	0.010	***
Intercept	7.022	NA	0.397	17.67	< 2e-16	***
Adjusted R ²	0.569					
F	29.7					
p	< 0.01					

*** $p < 0.01$ // ** $p < 0.05$ // * $p < 0.1$

As to the main variable of interest, the infant mortality rate, when per-capita GDP is removed, it is shown to have a quite significant ($p < .01$) impact on societal happiness (Tables 5.3 and 5.4). Nations at the 25th percentile of the distribution in this study had an infant mortality rate of 5.87 per 1,000 live births, and results suggest that an additional infant death per 1,000 live births decreases these nations' societal happiness scores by 0.279 points². For nations with a higher rate of infant mortality though, the results suggest that the impact on societal happiness is

² This value is calculated by taking the infant mortality rate at the 25th percentile of the distribution in this study (5.87 infant deaths per 1,000 live births (Table 4.7)) and applying the coefficients for the infant mortality rate (-0.027) and the infant mortality rate squared (0.0002) from Table 5.3. Mathematically, $(5.87 * -0.027) + (5.87 * 12.86 * 0.0002)$ equals -0.151. Repeating this for a 1-unit increase in the infant mortality rate to 6.87 results in a value of -0.430. Differencing these values yields the stated decrease in societal happiness of 0.279 points.

not as large. For nations at the 75th percentile of the distribution, whose infant mortality rate was 30.14 in 2023, an additional infant death per 1,000 live births is shown to decrease these nations' societal happiness scores by just 0.01 points. This result, however, may not truly reflect the impact of changes in the infant mortality rate. Rather, it may be that when per-capita GDP is not included in the model, then infant mortality becomes a proxy measure of GDP. That is, it is likely that per-capita GDP not the infant mortality rate is the driving force behind these statistically significant results.

Table 5.4. F-test results on the joint significance of the infant mortality rate second-order polynomial variables on societal happiness.

F	10.424
p	0.0001

Chapter 6 - Discussion

Conclusions

This study concludes that the null hypothesis, which states that nations with lower rates of infant mortality do not have higher levels of societal happiness, should not be rejected. That is, the infant mortality rate does not appear to significantly impact societal happiness (Table 5.1). As to why the relationship between societal happiness and the infant mortality rate was revealed in this study to not be significant, there are several possibilities.

It might be driven by the fact that there are relatively few people who are directly impacted by infant deaths. To see this, one merely needs to note that, even in the nation most heavily impacted by infant deaths, the rate of death is just 73.9 infants per 1,000 live births (Table 4.7). That means that, even where infant deaths are most prevalent, 92.6% of all births do not result in death, which shows that far more people in each nation are not directly impacted by infant deaths. Potentially this means that the pain of those directly impacted alone is not enough, no matter the magnitude of their pain, to significantly sway the societal happiness results, especially given that the societal happiness scores in this study were generated from a sampling design used to ensure representation across all members of each society.

It may also be that for most of the people in each nation, changes in the rate of infant deaths simply do not impact their level of happiness. Most people may be completely oblivious or immune to changes in the conditions of others. That is, it may be that the majority of people in each nation hold hedonistic perspectives, where happiness is derived only from actions that directly benefit the self. It might also be that the set-point view of happiness is correct, which holds that happiness levels do not change.

The set-point view, however, is undermined by the fact that other variables in this study are shown to have a significant impact on societal happiness, namely per-capita GDP and the unemployment rate. A \$1,000 increase in per-capita GDP for nations with a median level of per-capita GDP (\$4,790) is shown to significantly increase ($p < .01$) the societal happiness of citizens of those nations by 0.576 points. The significance and strength of the per-capita GDP variable may be driven by the fact that it directly impacts more members of a nation than infant mortality, as every family in a nation would seemingly require at least one income to survive. Thus, if people hold the self-centered orientation of the hedonistic theory, their happiness would be impacted by changes in personal or familial income (Haybron, 2008; Jacobsen, 2014; Veenhoven, 2003). Likewise, becoming rich is a desire of many people, and increases in income as demonstrated by changes in per-capita GDP would likely satisfy those desires and bring happiness through the mechanisms detailed in desire-satisfaction theory (Heathwood, 2019; Heathwood, 2022). Changes in income might even work through eudaimonia allowing people to think that they are making a difference in the world that is being recognized by changes in their own income or the income of others in their nation (Bartram, 2012; Carlisle & Hanlon, 2007; Kanasz, 2013; Schnittker, 2008; Thin, 2012). Thus, there are many theoretical happiness pathways that might be triggered by changes in per-capita GDP.

As for the unemployment rate, results suggest that each 1-percentage-point increase in the unemployment rate is linked with a 0.038 point reduction in societal happiness. This is another variable that has economy-wide implications. Changes of just a few percentage points are frequently portrayed as being the difference between a well-functioning economy and one that is in crisis. Given that essentially all members of society need at least one person in the family to have a job, all people in a society are likely quite attuned to changes in the

unemployment rate. Similar to GDP, the impact on happiness may be driven by the mechanisms of hedonistic theory, desire-satisfaction theory, eudaimonia, or even social-construction theory, where the created norm is that one should possess a stable job to be happy (Veenhoven, 2008). Unemployment rates may also impact happiness through the comparisons individuals frequently make with others, as detailed in social comparison theory (Festinger, 1954; Lewallen & Behm-Morawitz, 2016; Verduyn et al., 2020; Vogel et al., 2014). Individuals may conclude that they have achieved less when they compare their unemployed state against that of others who possess jobs. This may reduce their level of happiness. Similarly, the significance of the unemployment rate on happiness may reveal that what matters is not so much the total wealth of a society but the degree to which that wealth is, or is perceived to be, evenly distributed—an idea that sociologists have termed “relative deprivation” (Young, 2007). In other words, even if a nation’s GDP is strong, unemployment rates may result in perceptions of deprivation relative to others in society, triggering feelings of unfairness and dissatisfaction and precipitating negative emotions like anger and resentment (Bernstein & Crosby, 1980; Fullerton et al., 2020; Smith et al., 2012). Thus, similar to GDP, there seem to be numerous theoretical mechanisms through which changes in the unemployment rate may impact societal happiness.

Limitations and Future Research

The infant mortality rate has frequently been used by researchers as a proxy for the level of deprivation in a nation. This suggests that people believe that this variable best captures the condition of deprivation. However, if this variable is truly a solid measure of the level of deprivation in a nation, it is difficult to believe that changes in its level would not impact societal

happiness. How could it be that reducing a nation's shortage of basic needs like money, food, and health would not improve the happiness of the people of the nation? Yet, that is exactly what this study reveals. Unfortunately, this study cannot definitively explain exactly why changes in the number of infant deaths in a nation do not significantly impact societal happiness. There is thus a need for future research to determine the reasons why reduced infant mortality rates are not a strong predictor of changes in societal happiness as would be expected.

One possible reason is that theoretical perspectives, such as those articulated in set-point theory or hedonistic theory, best capture the mechanisms of happiness in most nations. If most people hold a hedonistic perspective, for example, they likely would only care about changes that affect them directly. Since infant mortality does not directly impact the majority of people in a nation, this could be why societal happiness levels in this study did not improve. In other words, even if some people in a nation possess a eudaimonic perspective to life, they may be too few in number to meaningfully impact the happiness levels of a nation, on aggregate, through their altruistic actions. This hypothesis though needs to be rigorously tested. Research should also attempt to quantify the relative share of people in each nation holding each of the various dispositions to happiness.

Another possible reason could be that deprivation does impact the level of happiness in a nation, but that the infant mortality rate is simply not as good a proxy of deprivation as widely believed. That is, there may be other, and potentially, better measures of deprivation, for example, per-capita GDP. This study reveals a significant relationship between per-capita GDP and societal happiness (Table 5.1). Moreover, when per-capita GDP is included in the regression model, the infant mortality rate becomes insignificant (Table 5.1). This suggests that per-capita GDP is also a proxy for the underlying latent variable of deprivation and a stronger one than the

infant mortality rate. If this is the case, it is also true that per-capita GDP and the infant mortality rate do not capture deprivation in the same way, as the variance inflation factor tests (Tables 4.8 and 4.9) did not indicate any problematic degree of correlation. This means that the data are not highly collinear. Future research should, therefore, test the long-held belief that the infant mortality rate is the best proxy for deprivation against alternative measures like per-capita GDP.

Per-capita GDP though does seem to have some limitations that might temper its utility. One of those is that per-capita GDP is a measure of the average level of wealth across a nation. This is problematic because a government action may increase the income only of those with already high incomes, and yet the result of this would be that per-capita GDP would increase, all other things being equal. The problem with this is that such an outcome would not address the issue of deprivation, but it would result in a change in the level of the proxy measure for deprivation. Another issue, from the ideas of relative deprivation theory, is that such an increase in the incomes of high earners would also likely decrease the happiness of many non-high-income earners by worsening the perceived inequity in the distribution of incomes. Thus, while there would be no absolute worsening of deprivation within the nation, the proxy measure would likely suggest that there was. Similarly, if a government action was taken that increased per-capita GDP for all and thus significantly reduced the overall level of deprivation in a nation, the mechanisms of relative deprivation theory would argue that this would not change the overall level of happiness within that nation. That is to say that if the condition of all was improved equally, there would be no impact on the emotional state of any individual, as relative relationships would be constant and thus valued as before. Improvements in the level of happiness would only occur if actions to reduce deprivation in a nation changed how individuals viewed their status relative to other members of that nation. Research should therefore attempt to

quantify whether any increase in quality of life will trigger changes in happiness if all to whom one may compare or be compared gain equally. It may be that when there are small shifts, the benchmarking patterns of relative deprivation theory are dominant but that they become less salient when changes are of a large magnitude.

As both the infant mortality rate and per-capita GDP appear to have weaknesses that limit their utility in research, it seems that future research into deprivation would benefit from the development of other tools to assess the impact of changes in deprivation. Suggested tools for researchers to consider and test include measures of the median income and the level of income concentration in a nation.

Another limitation of this study is the fact that the regression model was not able to control for all of the variables thought to impact societal happiness. In fact, the F test of the joint significance of the independent variables shows that they, as a group, explain roughly 62.5 percent of the variation in the dependent variable (Table 5.1). That means that more than a third of the variation was unexplained and captured by the error term. Reliable data for numerous factors did not exist for enough nations to allow their inclusion into the model. For example, crime is known to harm people, driving many into deep states of depression (Bowles et al., 2005). Yet, no variable has been collected and curated across a sufficient number of nations to allow its impact to be tested. Increasing education levels is another variable that has been linked with increased levels of happiness (Bednarik, 2024), but data existed only for a small number of countries. This was also the case for inequality measures such as wealth distribution within nations.

Yet another limitation of this study was that the statistical analysis involved a cross-sectional analysis that examined only one moment in time, the year 2023. Potentially, this year

was an outlier or influenced by events not controlled by this study. Future work in this realm should, therefore, consider alternative frameworks, such as a panel-model approach. This would allow the model to exploit not only the variation across nations but also the variation across time to better identify impacts and reduce the potential for omitted variable bias (Wooldridge, 2016).

Chapter 7 - References

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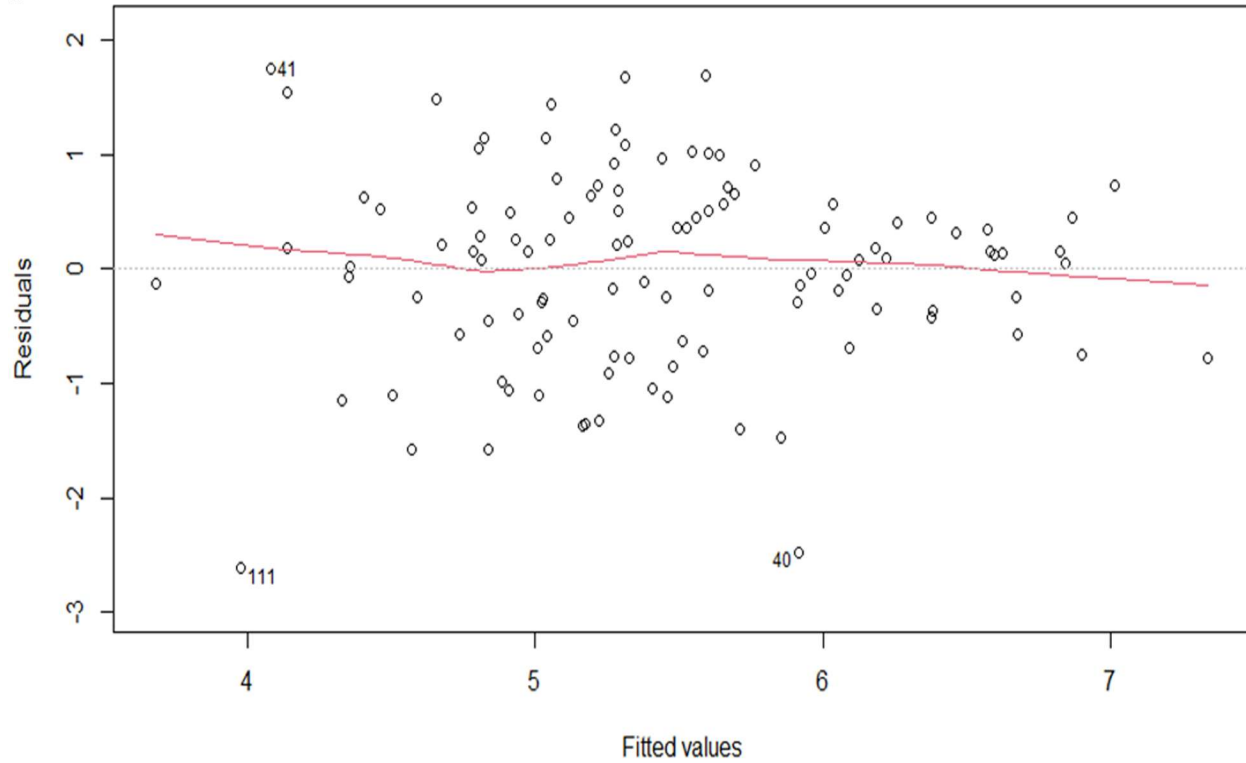
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Chapter 8 - Appendix

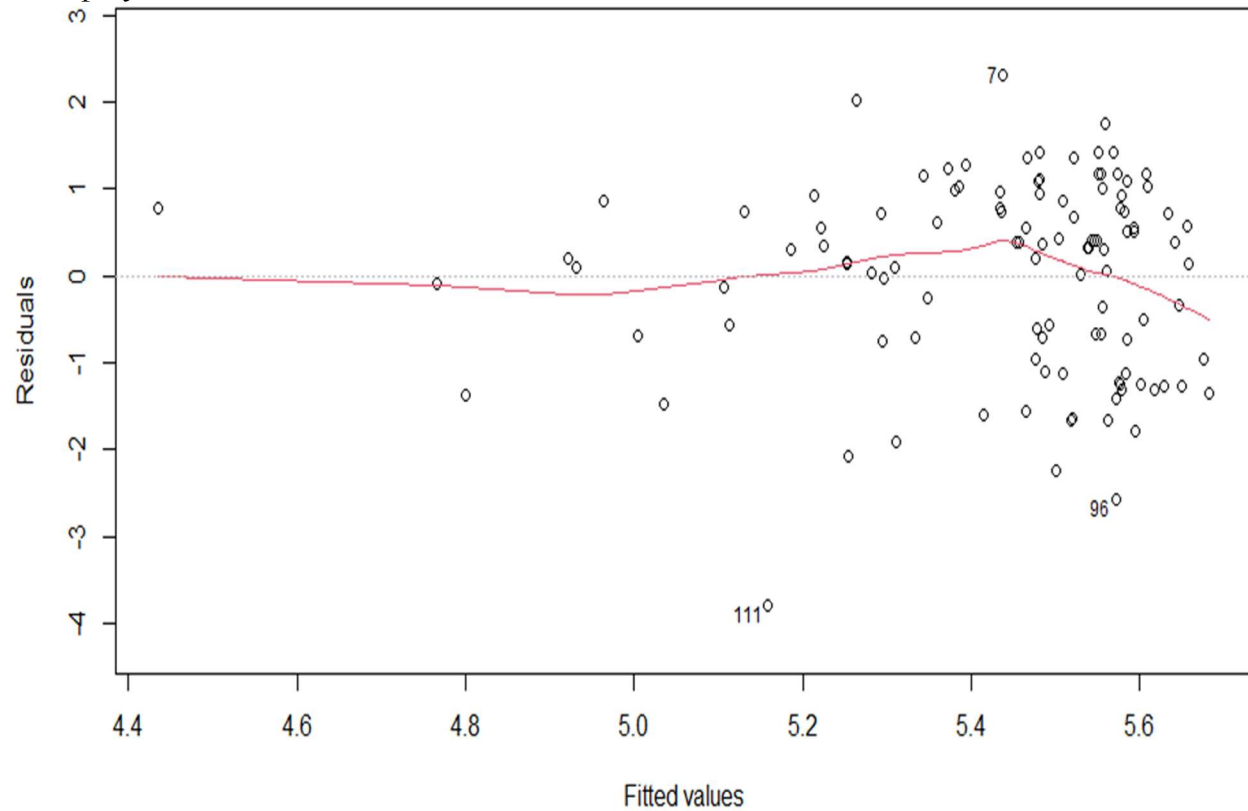
Relationship of Government Effectiveness with Societal Happiness

Figure 8.1. Plot of residuals relative to fitted values when regressing societal happiness on government effectiveness



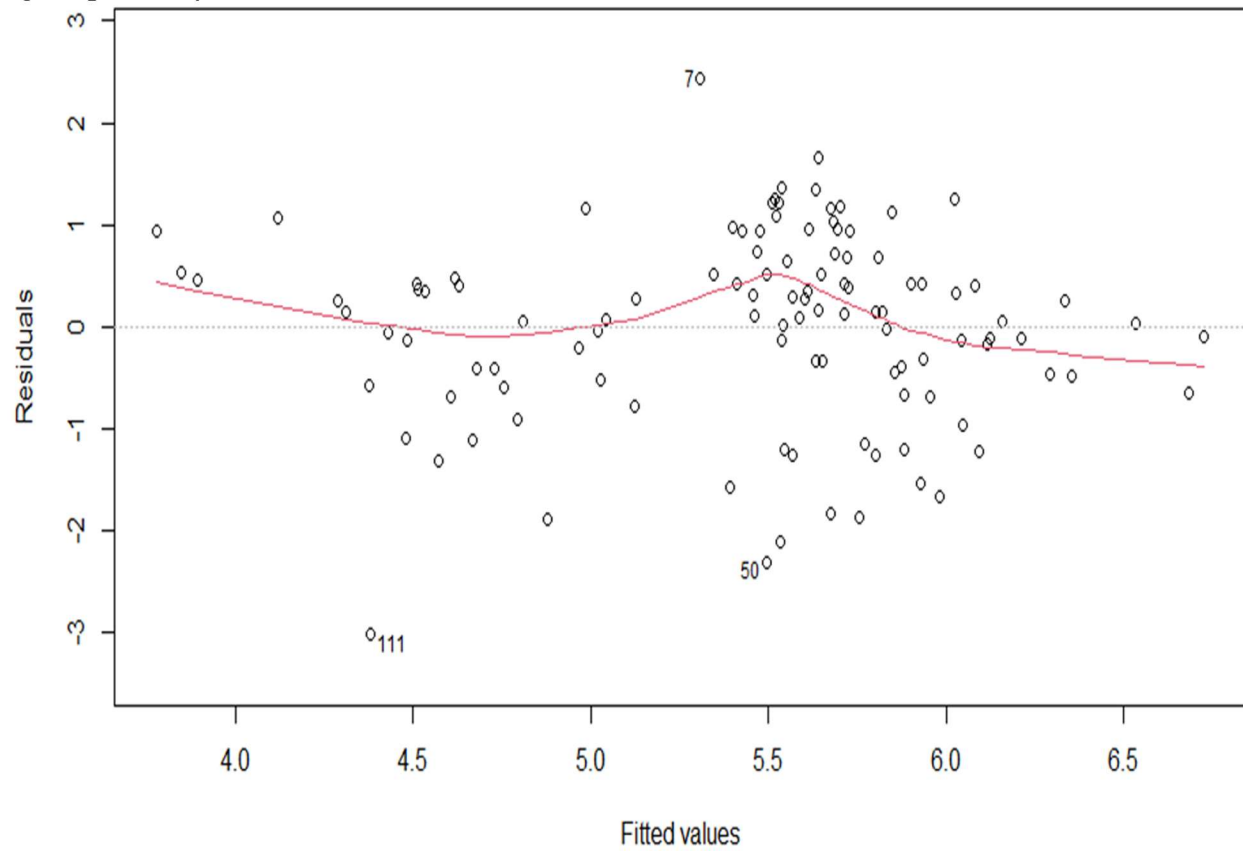
Relationship of the Unemployment Rate with Societal Happiness

Figure 8.2. Plot of residuals relative to fitted values when regressing societal happiness on the unemployment rate



Relationship of the Age Dependency Ratio with Societal Happiness

Figure 8.3. Plot of residuals relative to fitted values when regressing societal happiness on the age dependency ratio



Relationship of GDP per capita with Societal Happiness

Figure 8.4. Plot of residuals relative to fitted values when regressing societal happiness on GDP per capita

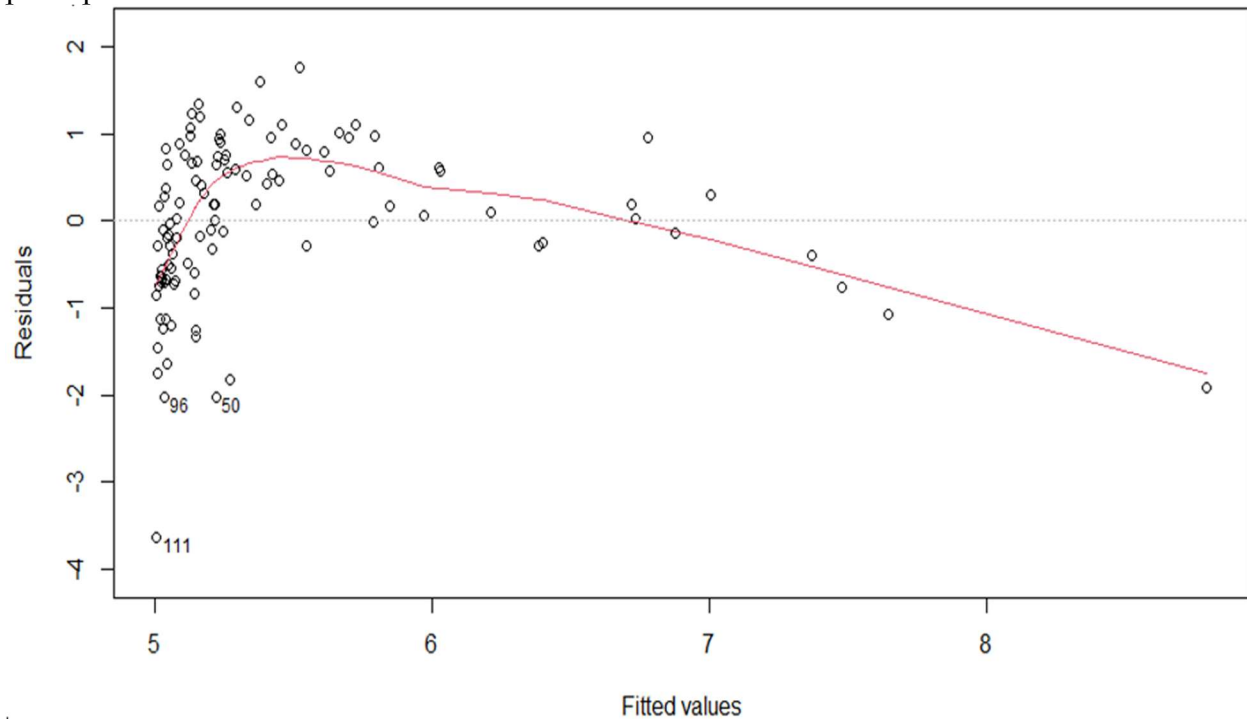


Figure 8.5. Plot of residuals relative to fitted values when regressing societal happiness on GDP per capita and GDP per capita squared

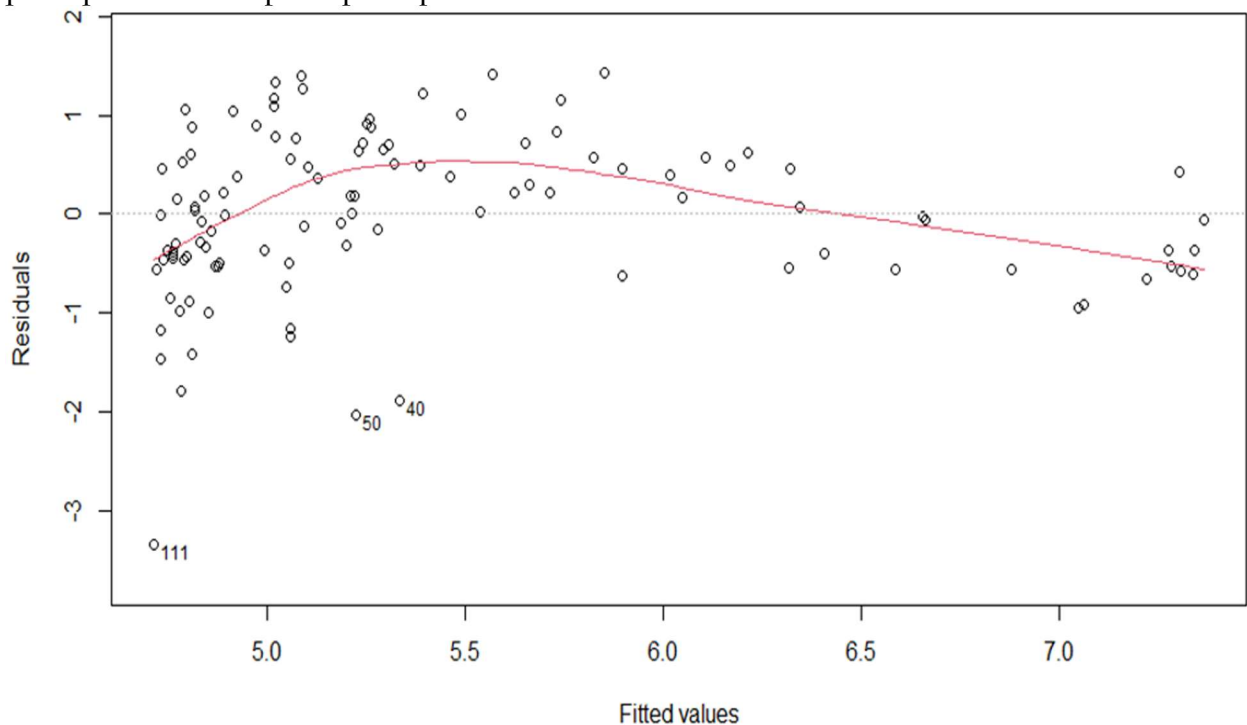


Figure 8.6. Plot of residuals relative to fitted values when regressing societal happiness on GDP per capita, GDP per capita squared, and GDP per capita cubed

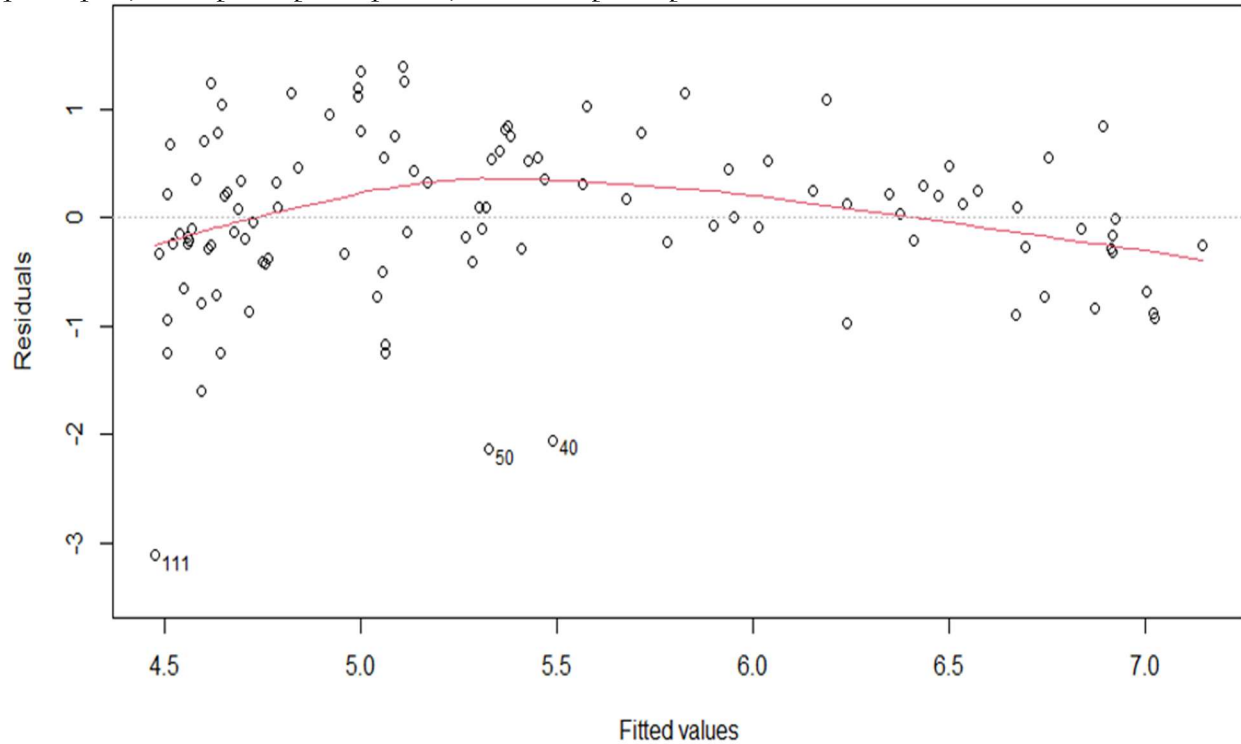
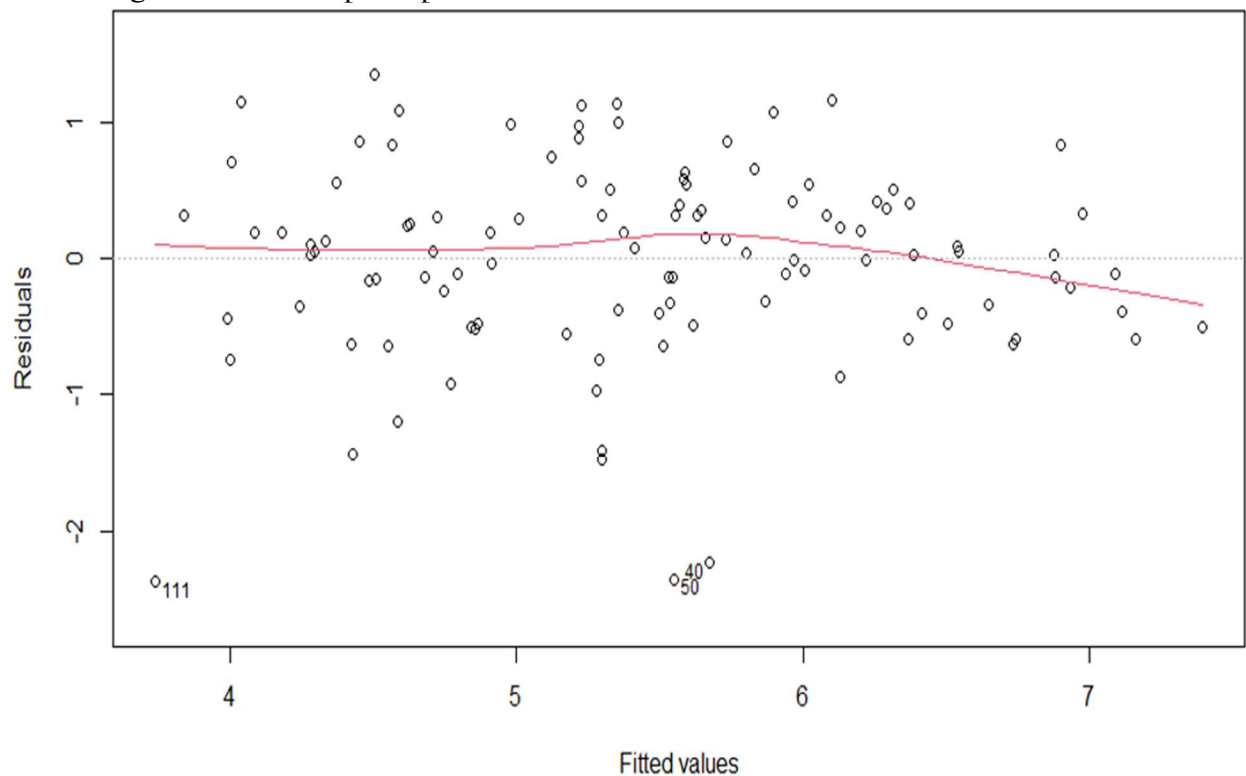


Figure 8.7. Plot of residuals relative to fitted values when regressing societal happiness on the natural logarithm of GDP per capita



Relationship of the Infant Mortality Rate with Societal Happiness

Figure 8.8. Plot of residuals relative to fitted values when regressing societal happiness on the infant mortality rate

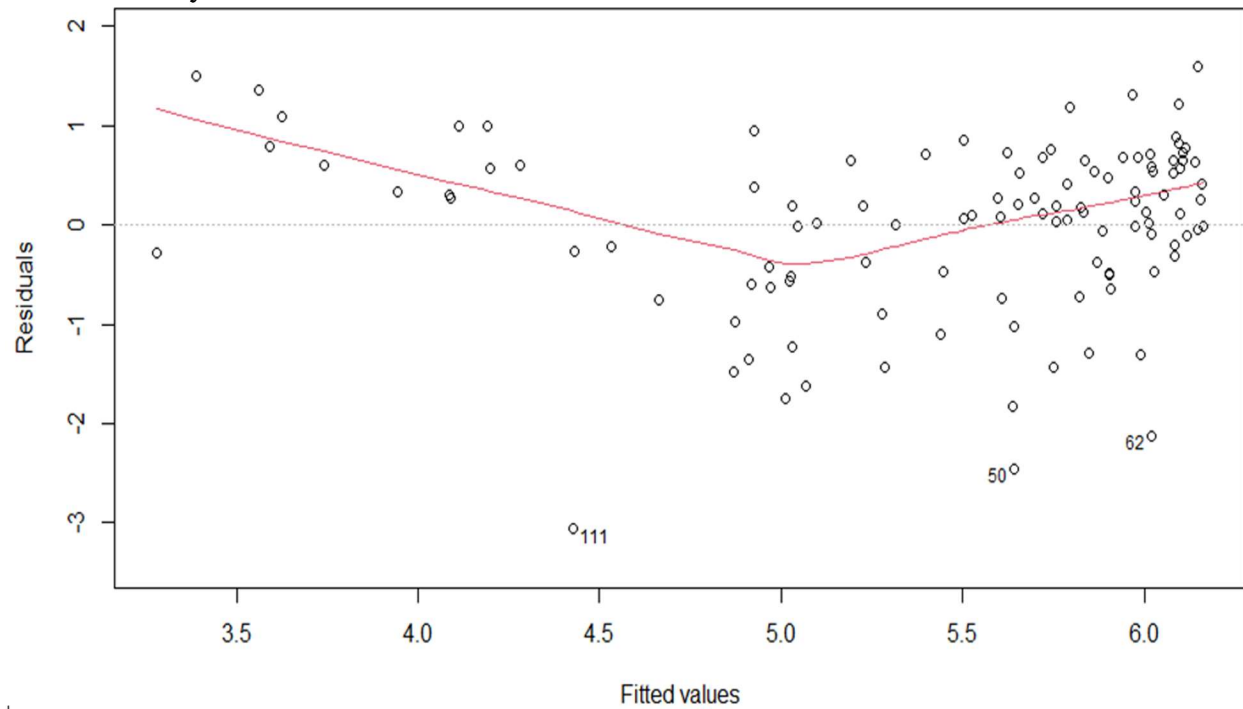


Figure 8.9. Plot of residuals relative to fitted values when regressing societal happiness on the infant mortality rate and the infant mortality rate squared

