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# Social Capital and Health. Exploring Associations between Bonding, Bridging, Vertical Social Capital and Life Expectancy, Adult, and Infant Mortality in 43 Countries, while Controlling for Absolute and Relative Incomes

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## Abstract

In recent years the concept of social capital has become particularly popular in epidemiologic literature for its hypothesized effects on health inequalities observable at national levels. This project evolves around the theory of social capital, particularly the interaction of its bonding, bridging and vertical forms and dimensions for health outcomes. It also incorporates a competing viewpoint arguing that social capital is a weak predictor of health outcomes, while the bulk of the effect on health should stem from material and structural causes behind absolute and relative deprivation. Using the most recent wave of the World Values Survey the study explores associations between state-level endowments of social capital and population health, also controlling for levels of absolute and relative income. Results indicate weak, inconsistent associations between social capital and health outcomes, captured by life expectancy, adult, and infant mortality in a sample of 43 countries. Instead, alternative *neomaterial* indicators preserve their significance across the full spectrum of models and specifications. Results challenge the popular belief that social capital is of considerable importance to health and indicate that economic determinants continue to be of primary significance, rather than the sense of community or trust.


Keywords: Social capital; health; neomaterial theory; World Values Survey.

# Table of Contents

# Introduction

The magnitude of current variations in health outcomes measured by life expectancy across diverse regions is simply astonishing. It ranges from 82 years in industrial countries to 49 in Sub-Saharan Africa. Developed world is experiencing the highest life expectancies ever observed. If mortality rates at all ages in these countries remain at current levels, more than half of the babies born over the first decade of the 21st century will live to celebrate their 80th birthdays. Contrary to dynamics in developed countries, life expectancy in developing regions is not only lower, but also more volatile. For instance, the longest and the shortest life spans across Sub-Saharan Africa are almost 40 years apart (Bongaarts & Bulatao, 2000). Not only are such striking differences observable at cross-country comparisons – single-country analyses repeatedly reveal significant discrepancies in health outcomes at district or even community levels.

A multiple of academic sources is flooded with attempts of interpreting such striking health inequalities. One of the most vigorous debates has emerged between the so-called "social capital" authors and the "*neomaterialists*" regarding the importance of socioeconomic determinants for health outcomes. The proponents of the former view base their theories on the notion of social capital, which Coleman (1990) defines as the degree of trustworthiness of the social structure, depth of civic associations, prevalence of norms and sanctions, and the availability of information channels that facilitate the actions of members within that social structure. According to some authors socially isolated individuals are at increased risk of poor health because of their limited access to instrumental aid, information, and emotional support (Kawachi et al., 1999; Berkman et al., 2000). Within the broader social context, higher degrees of interpersonal trust and positive reciprocity can be responsible for increasing the likelihood of adopting healthy norms of conduct and exerting social control over deviant health-related behavior.

In addition to establishing direct causal relationships between social capital and health outcomes, there have been attempts in literature to use the term as a pathway between income inequality and mortality. Wilkinson (1994) has argued that perceived low position in social hierarchy produces negative emotions such as shame and distrust, which are translated into poor health through psycho-neuro-endocrine mechanisms as well as through stress-induced behaviors such as alcohol abuse or smoking. Kawachi and others (1997) found empirical support for such claim and concluded that disinvestment in social capital is one of the pathways through which growing income inequality exerts its effects on population-level mortality.

Although the term has received wide recognition and has been applied in research on health outcomes on numerous occasions, a number of scholars remain skeptical about employing social capital in health literature. Some claim that Wilkinson is mistaken in his claim that social cohesion rather than political change is the major determinant of population health. According to Muntaner and Lynch (1999), focusing on subjective perceptions and psychosocial responses, while ignoring structural sources of inequality like class relations and economic policies, prevents Wilkinson's theory from explaining how income inequalities are generated and account for both relative and absolute deprivation.

Another major issue lies in applying social capital theory to public health interventions. Its proponents tend to assign the guilt for deficient levels of social capital on individuals lacking it, this way creating a "blame the victim" scenario, which could manifest in undesirable policy prescriptions. In fact, that's precisely the reason why social capital has become so popular among policy-makers: it is a fine excuse when low-quality interventions yield little results – they simply cannot succeed because the so-called unfavorable conditions are embedded in the social fiber itself. Instead, the critics of the concept suggest that recognizing economic and political processes as the causes of income inequality and subsequent divergence in health outcomes clearly indicates the areas of required strategic investments; investments into neomaterial conditions via more equitable distribution of public and private resources (Lynch & Kaplan, 1997).

Although social-capital opponents' arguments seem quite convincing and grounded, it nevertheless remains a concept worthy of further investigation and analysis. The problem with previous research has been its inability to come up with a unified conceptual framework and measurements at different levels of analysis (Macinko &Starfield, 2001). This paper intends to contribute to current stock of literature by applying a concise yet still an inclusive conceptual framework of social capital and health to the macro-level analysis. The aim of the study is to determine whether cross-country variations in levels of social capital can be associated with country-level differences in life expectancy and mortality; or it's just the *neomaterial* determinants that shape national health outcomes.

The paper presents an ecological analysis of life expectancy and mortality rates in 43 countries with social capital and *neomaterial* indicators as explanatory variables. Trust is selected as the primary proxy for social capital. Various types of trust indicators are presented, signaling an attempt to differentiate between the dimensions and forms of social capital occasionally outlined in academic literature (Putnam, 1995). The two dimensions are horizontal and vertical social capital. The former reflects ties that exist among individuals or groups of equals or near-equals, while the latter stems from hierarchical or unequal relations due to differences in power or resource bases. Horizontal social capital itself is divided into *bonding*, reinforcing exclusive identities and homogeneous groups, and *bridging*, emphasizing social ties between heterogeneous establishments and diverse social segments. *Neomaterial* indicators, included as the counterparts to social capital variables, are aimed at capturing structural causes behind relative and absolute deprivation and are proxied by GNI/capita and Gini coefficients.

This introductory chapter is followed by the Background section which discusses previous research on social capital and health inequalities, provides more insights into the social capital theory and, outlines major hypotheses. Data and Methods sections are devoted to introducing the source of statistical information, sample of analysis, methodological approach, and variables. Chapter five reports statistical results and discusses their implications. Chapter six evaluates major findings, discusses limitations and contributions of the given project, and suggests on future research areas.

# Theory

The following section presents background analysis for the study. It starts by outlining the theory of social capital and health inequalities. The focus is first placed on the definitions of social capital provided by numerous authors. Next, a broader framework of the social capital theory is presented that connects bonding, bridging and vertical social capital with health outcomes. The chapter then progresses to the review of previous empirical literature on the associations between the endowments of social capital and health inequalities. Criticisms of the concept's usage in epidemiologic studies are also provided there. Chapter concludes by indicating limitations of current literature on the subject and illuminates unfilled gaps in literature. Primary hypothesis behind this particular study is presented in the end.

*Defining Social Capital*

Although over the recent years, the concept of social capital has become one of the most popular exports from sociological theory into numerous academic disciplines, there is still little consensus on its intellectual roots and origins. Different authors with diverse backgrounds attribute its emergence to different sources. For instance, Portes (1998) suggests that the idea was implicit in such concepts as Marx's "atomized class-in-itself" and Durkheim's "emphasis on group life as an antidote to anomie and self-destruction" (p.2). Portes (1998) claims that building on these notions, Pierre Bourdieu was the first to actually systematically and explicitly analyze the notion of social capital in the present sense by defining it as "the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance or recognition" (Bourdieu, 1986, quoted in Islam et al., 2006, p.4).

Woolcock (1998), on the other hand, traces the origins of the idea all the way back to Marshall and Hicks, two major proponents of economic sciences. Although using the actual words "social capital", the phenomenon they were describing wasn't anywhere near its today's meaning, but instead was meant to "distinguish between temporary and permanent stocks of physical capital" (Woolcock, 1998, p.159). Intellectual roots of the concept according to Woolcock, go back to David Hume, Edmund Burke, and Adam Smith, all of whom discussed the presence (or absence, for that matter) of "economic norms of cooperation" and debated the necessity of moral and "natural protecting principles" resident in society for the proper functioning of the market mechanism (Macincko & Starfield, 2001, p. 388-389). Woolcock (1998) suggests, that "Durkheimian, Weberian, and Marxist traditions within classical sociology were all heavily influenced by the economic debates and issues of that period, and much of what we now refer to as 'social capital' lay at heart of these concerns" (p.160). He praises Hanifan (1920) for using the term in the astonishingly prescient way as "those tangible assets… namely good will, fellowship, sympathy, and social intercourse among individuals who make up a social unit" (quoted in Macinko & Starfield, 2001, p.389) and refers to a journalist Jane Jacobs for the first use of the term 'social capital' in its contemporary sense in 1961.

Refering to Durlauf and Fafchamps (2004), Islam et al. (2006), suggest that the concept was first introduced into modern social science research by economist Glen Loury (1977), who defined social capital as "naturally occurring social relationships among persons which promote or assist the acquisition of skills and traits valued in the marketplace… an asset which may be as

significant as financial bequests in accounting for the maintenance of inequality of our society" (Loury, 1977, quoted in Islam et al., 2006, p.4; also in Macinko & Starfield, 2001, p.390).
Although it is not easy to identify the precise architects behind the term, it is more than clear that after Loury and Bourdieu the concept of social capital was refined by Coleman (1990) and Putnam et al. (1993) to the degree that led to adopting its premises in research no longer limited by the boundaries of sociologic disciplines.

*Theoretical Refinement – Coleman*

James Coleman, a sociologist, primarily interested in micro-level determinants of social action, in his Foundations of Social Theory (1990), attempted to reconcile the two conflicting sociological traditions (one claiming that an actor is governed by social norms and obligations and the other one suggesting that an actor is wholly self-interested, pursuing the maximizing utility path) with his introduction of social capital, which according to him "is defined by its function. It is not a single entity but a variety of different entities, with two elements in common: they all consist of some aspect of social structures, and they facilitate certain actions of actors who are within the structure. Like other forms of capital, social capital is productive, making possible the achievement of certain ends that in its absence would not be possible. Unlike other forms of capital, social capital inheres in the structure of the relations between actors and among actors. It is not lodged either in the actors themselves or in physical implements of production" (1988, p.S98; 1990, p. 302). He claims that introducing social capital imports economists' principle of rational action for use in the analysis of social systems, without discarding social organization in the process

Coleman provides the attributes of the social relations that can constitute useful productive resources for individuals (social capital). He characterizes social structures by a multiple of outstanding obligations among individual actors that developed as a result of previous interactions among them and can be called in by the holders of these "bonds". Under such social organization, the degree of social capital depends on such elements as trustworthiness of the social environment, meaning obligations will be repaid, and the extent of obligations held: individuals in social structures with high levels of obligations outstanding at any time have more social capital on which they can draw (one could call this reciprocity). Basically, the overall usefulness of the tangible resources of that social structure is amplified by their availability to others when needed. Ease of access to important information that inheres in social relations is also an important role of social capital, according to Coleman, as well as the prevalence of firm norms and sanctions. For almost 20 years since such attributes of social capital have been outlined by Coleman, most of the research on the subject still defines the concept by the degree of trustworthiness of the social structure, norms of reciprocity, ease of access to information and pervasiveness of norms and sanctions, therefore indicating the vital contribution of James Coleman to the stock of knowledge on social capital.

*Theoretical Refinement – Putnam*

Robert Putnam is the second author whose extensive work on social capital illuminated the concept from the new angle and resulted in its adoption in diverse domains. In 1993, Putnam and colleagues concluded, after a 20-year study of decentralization and economic development in Italy, that social relations were the main explanation for differing levels of political and economic success among Italy's various regions (Mackinko and Starfield, 2001, p.391). Regions

with better performing governments also tended to score exceptionally high on measures of civic engagement, like voters' turnout or social club participation. Soaring levels of civic commitment according to Putnam result into greater trust, enforceable norms, and dense networks of association among citizens (social capital attributes). He continues that precisely this social capital is the driving force behind the improvements in governance and economic prosperity of Tuscany and Emilia-Romanga regions. Moreover, the findings by Putnam signify that regions with little civic engagement, like Calabria or Sicily, also have deficient social capital, and thus are characterized by prospering lawlessness, poorer governance and weaker economic performance (Putnam, 1993).

Putnam defines social capital as those "features of social organization, such as trust, norms, and networks that can improve the efficiency of society by facilitating coordinated actions" (1993, p.167). Later (1995), he proposes two distinct forms of social capital: localized (bonding) social capital and bridging social capital. More on these types will follow in the section presenting a broader model of the different forms of social capital and its relation to health inequalities. Elaborating on Putnam's explanation Szreter and Woolcock (2004) suggest that he leans towards a relatively restricted definition of social capital as the nature and extent of networks and associated norms of reciprocity. As such, social capital enables individuals to gain access to resources – ideas, information, money, services, favors – and to have accurate expectations regarding the behavior of others by virtue of their participation in relationships that are themselves the product of networks of association (Szreter and Woolcock , 2004, p.654-655). Therefore, Putnam places social capital at a relational level – it is the property of individuals, but only by virtue of their membership in a group. Putnam departs from Coleman's view that by definition social capital can only yield positive outcomes and suggests that the purposes to which a given resource can be put should be analytically distinct from how it is defined. The implications of such reasoning will become even more apparent when the criticisms of social capital are examined.

*Social Capital – Synthesis of Definitions*

Building up on Coleman and Putnam, as well as on other prominent scholars in the field (Portes, Woolcock, etc), Durlauf and Fafchamps (2004) identify three major ideas behind the concept which are concise yet representative of the phenomenon it intends to capture:

a) Social capital generates positive externalities for the members of the group
b) These externalities are achieved thanks to shared trust, norms, and values and their effects on expectations and behavior
c) Shared trust, norms, and values arise from informal forms of organizations based on social networks and association (p.5).

This concludes the section tracing the origins of the concept and revisiting the works of its most prominent theoreticians. The following part integrates social capital into epidemiological domain and presents the theoretical model of forms of social capital and health inequalities.

*Social Capital and Health – Income Inequality Link*

Before the actual model of social capital and health is provided, it is imperative to discuss the work of Richard Wilkinson, an epidemiologist who, according to Mackinko and Starfield (2001),

pioneered with the thesis that social capital is related to health inequalities. Investigating the effects of socioeconomic status on health inequalities, Wilkinson (1994) noticed that health outcomes appear to be positively correlated not only with absolute levels of income, but in some cases, even more strongly with the *distribution* of income; as if the latter becomes more important after a certain threshold level of absolute income is attained (see Figure 1) . This is particularly true of most affluent post-epidemiologic transition societies, where lethal diseases associated with sanitation, infection, and absolute poverty have become rare, that the degree of socioeconomic inequality has an exceptionally strong influence over the differentially evolving epidemiology (Szreter & Woolcock, 2004, p.652). Similar findings were presented by Waldmann (1992) who concluded that within a number of both developed and developing countries, a greater share of income going to the rich in each country was associated with a higher infant mortality rate in that country (Macinko and Starfield, 2001, p. 400).

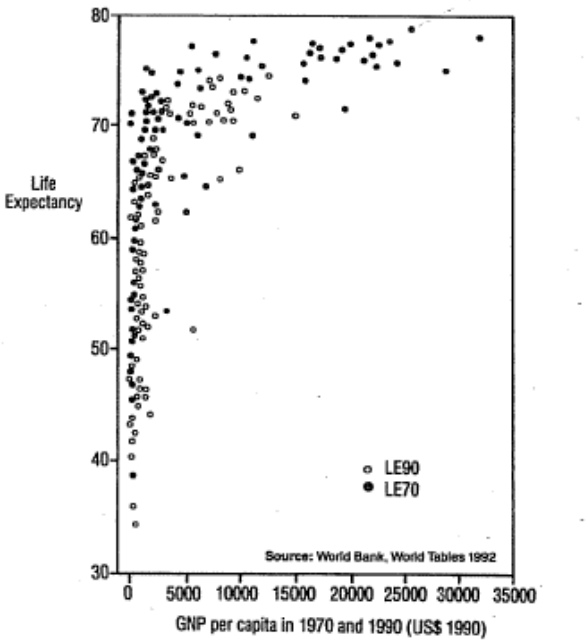


Figure 1: Life expectancy at birth (male and female) in relation to GNP/Capita, 1970 and 1990. Adapted from Wilkinson, 1995, p 62.

Having noticed the strength of the inequality link to health, Wilkinson suggested that cognitive processes of social comparison (how people feel about their circumstances and about themselves) should be involved in the picture (1994, p.70). He claims that perceptions of inequality are translated into such psychosocial responses as anxiety, stress, declining collective support, distrust and suspicion. Basically, high perceived inequality leads to the fading of social capital in the setting. Given high levels of anxiety and lack of ability to find comfort and support within the social structure, health inevitably deteriorates. In Wilkinson's model social capital becomes a pathway through which increasing inequality exerts its effects on weakening health through a multiple of psychosocial responses (see Figure 2 for details). He believes the concept of social capital is helpful in this model as it clearly indicates the source of the biological, evolutionary-programmed health effect, which flows from the relative social cohesiveness (or lack thereof) of a local or national community (Szreter & Woolcock, 2004, p.653).

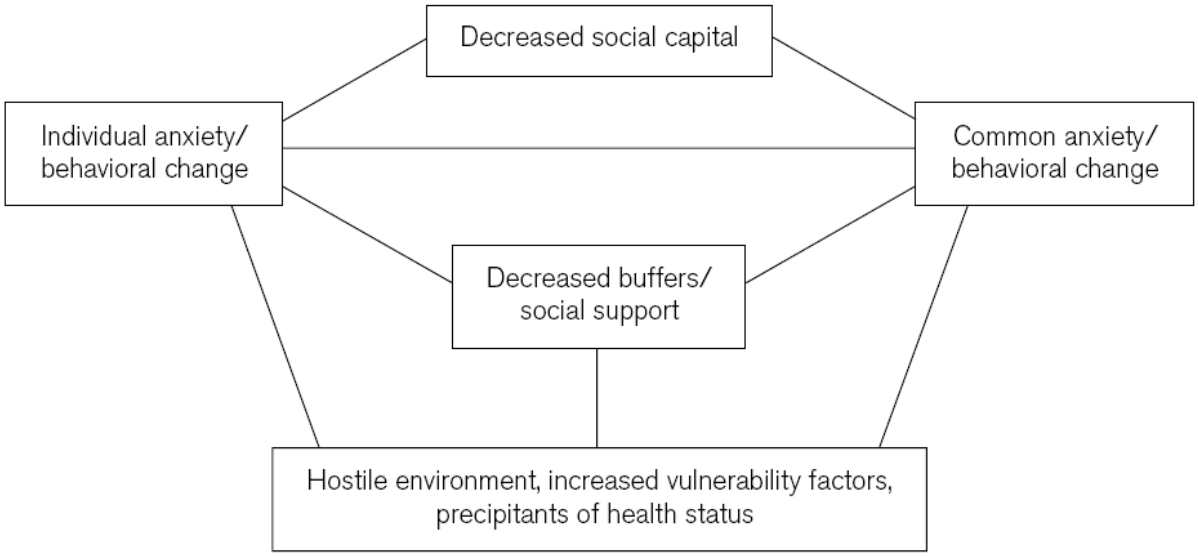


Figure 2: Social Capital and Psychosocial Processes. Adapted from Cullen and Whiteford, 2001.

*Social Capital and Health – Social Support Link*

At the same time as Wilkinson was propagating his theory of social capital as an explanatory pathway in the relationship between income inequality and health status, there has been simultaneous work going on linking health and social capital in a somewhat different manner. Szreter & Woolcock (2004) refer to this school of thought as the "social support" camp, which connects some of the social capital elements (norms of reciprocity being the most common one) to health outcomes through varying degrees of social support, attachment, influence and access to resources that is available to the members of the particular society (Berkman et al., 2000). Scholars like Berkman (2000), Cooper (1999), and Gorski (2000), see social capital as an integral part of the setting supplying informal networks of support to its members and thus boosting their health. It has been suggested that availability of social support improves child development (Keating, 2000), reduces depression susceptibility (Bullers, 2000), leads to less stress (Steptoe & Feldman, 2001), and increases capacity to respond to environmental stress (Wakefield, et al., 2001). Although both camps (Wilkinson's inequality and social support school) agree that more or less the same variables determine health outcomes, they differ with respect to which mechanisms set these social capital variables in motion. For Wilkinson, it's the perception of inequality and relative deprivation that leads to fading social capital. For scholars like Berkman, it is precisely the degree of civic society attained, the nature of one's social relations in itself.

*Overarching Theory of Social Capital and Health*

The need for an inclusive, generalized theory of social capital and health that could reconcile the two camps and acknowledge their viewpoints as valid is more than apparent. The following section attempts presenting such theory. It is mostly based on Szreter and Wolcock (2003), Cullen and Whiteford (2001) and Islam et al. (2006). All three accounts emphasize the interplay between bonding, bridging and vertical social capital and insist that the balance between the three is the key for leveling of health inequalities (see Figure 3).

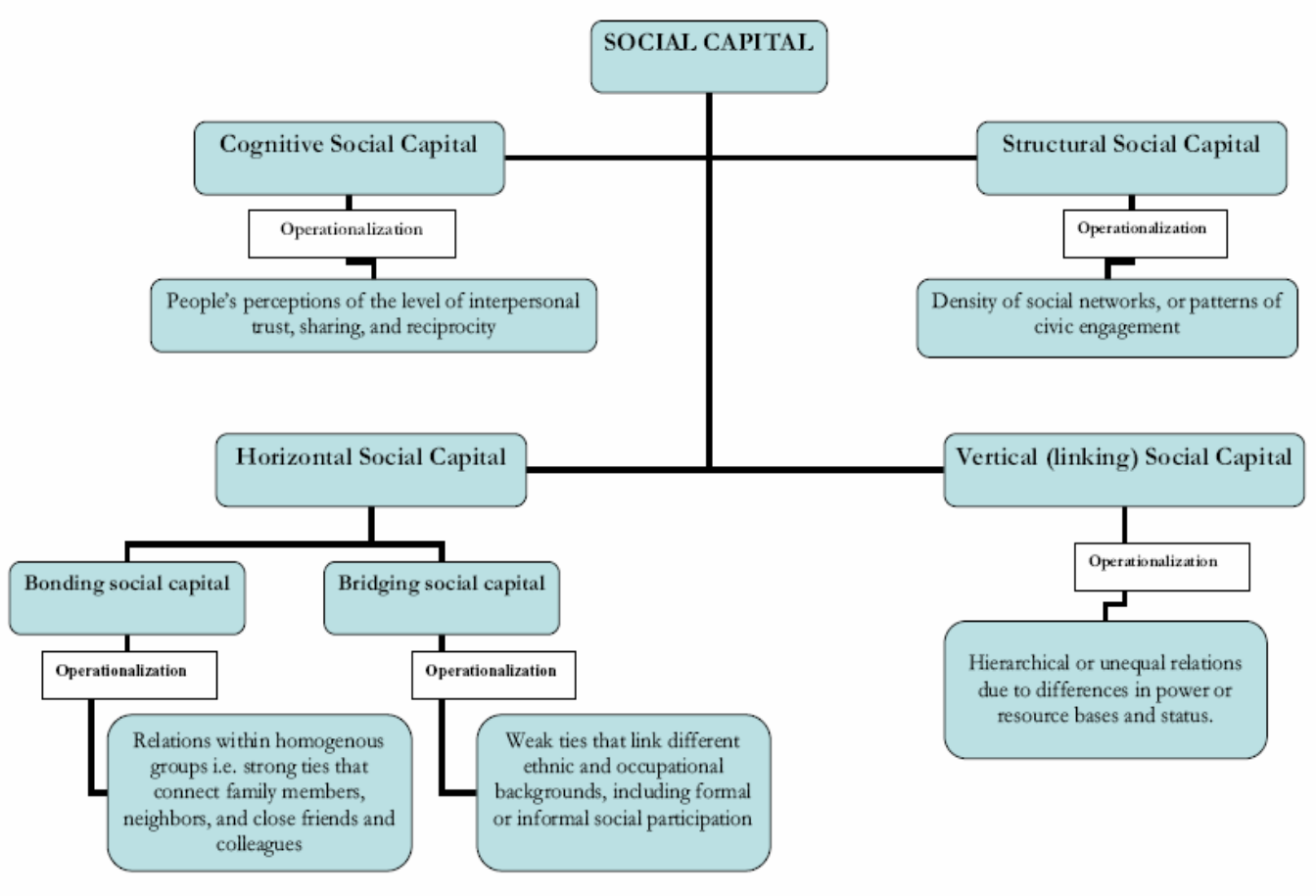


Figure 3: Forms and dimensions of social capital. Adapted from Islam et al., 2006, p.5.

The theory of social capital should start with determining precisely where it resides: whether it's strictly a property of individuals or it is the characteristic of groups and social relations. Recall Putnam and his idea that social capital is a property of individuals, only by virtue of their membership in a group; or Coleman's suggestion that social capital isn't lodged in the actors themselves, but instead inheres in the structure of the relations between actors and among actors. Developing this, Szreter and Woolcock (2003) claim that social capital is not a property of individuals *per se*, it is, however, a property of their relations with each other, occupying the abstract socio-cultural space of relationships between individuals (p. 655). Its manifestations, however, can be very much individualistic, but will nevertheless remain within a broader realm of association with others. Cullen and Whiteford (2001) recognize the very same claim and distinguish between the two components of social capital: cognitive and structural (see Figure 3).

Cognitive components refer to individual expressions; they are derived "from mental processes and resulting ideas, reinforced by culture and ideology, specifically norms, values, attitudes, and beliefs that contribute to cooperative behavior" (Uphoff, 2000, quoted in Cullen and Whiteford, 2001, p. 9). The structural components of social capital, on the other hand, refer to externally observable patterns of social organization, such as density of social networks, or patterns of civic association or even more macro-level rules, institutional arrangements, and precedents (Islam et al., 2006; Cullen and Whiteford, 2001).

With respect to health, cognitive components of social capital work on individual level by impacting behavioral norms, sanctioning potentially risky and deviant health-related behavior, providing mutual aid and support, and informal means of informational exchange. Structural components of social capital, on the other hand, connect to health on macro level through overarching health policies, mechanisms for their implementation, and the institutional implementing actors and on meso level through the effectiveness and efficacy of various networks in service delivery and diffusion mechanisms for health-related information (Cullen and Whiteford, 2001, p. 9).

Developing the theory further, leads to distinguishing between two dimensions of social capital: horizontal and vertical (or linking). According to Cullen and Whiteford (2001), horizontal social capital reflects ties that exist among individuals or groups of equals or near-equals, while vertical social capital stems from hierarchical or unequal relations due to differences in power or resource bases. Horizontal aspects of social capital can either *bond* or *bridge* groups, while vertical aspects link groups with power, access, and resource differentials (p.9). *Bonding* type of horizontal social capital covers relations within homogeneous groups, i.e. strong ties that connect family members, neighbors and close friends and colleagues. By contrast, *bridging* horizontal social capital is heterogeneous by definition, referring to the weak ties that link those of different ethnic and occupational backgrounds (Islam et al., 2006). Linking or vertical social capital refers to the nature and extent of vertical ties between groups of people who have open channels to access, resources, and power with those who do not. Relations between government and communities are encompassed within linking social capital (Cullen and Whiteford, 2001, p. 9).

With respect to health, *bonding* social capital is an important tool for information transmission, establishing and maintaining health norms, sanctioning deviant health behavior, providing mutual aid, and protecting the vulnerable (Islam et al., 2006 and Cullen & Whiteford, 2001). *Bridging* social capital is important for the success of civil society: it instigates opportunities for participation in heterogeneous groups of people from diverse social classes and opens channels to voice concern in favor of those who may have very little chance to reach more formal avenues in order to affect societal change, e.g. change in public welfare-oriented policies (Islam et al., p. 6). While bonding dimension of social capital very well connects to the paradigms of the "social support" school, with its significant emphasis on social connectedness and networks of mutuality and dependence, bridging social capital stands more in favor of Wilkinson's inequality hypothesis, as it enables access to material resources for disadvantaged groups by connecting them with more advantaged ones, thus reducing negative psychosocial processes among the former. Islam et al. (2006) suggest that virtually no studies have been done to examine the effects of bridging social capital on population health; therefore, this study fills this quite substantial gap in literature. Finally, linking social capital is applicable to both camps: state policies are capable of leading to income and wealth disparities, therefore instigating psychosocial dynamics among the disadvantaged according to Wilkinson's model. Similarly, the choice of government's action and approaches can either hinder the development of civil society, characterized by strong support networks, or, on the contrary, enhance such developments, therefore relating to the "social support" camp.

*Social Capital and Health – Government Performance and Social Deprivation*

In their comprehensive analysis of the utility of social capital in epidemiologic research, Macinko and Starfield (2001) identify two more areas in which social capital has been linked to health inequalities, in addition to the already mentioned camps of "social support" and "Wilkinson's inequality-psychosocial response model". The two identified traditions 1) use social capital as a mediator of the performance of government health policies or reforms, or 2) apply it interchangeably and synonymously with social deprivation and social cohesion in the analysis of violence and crime (p.400). Interestingly, the presented above theory of social capital, its components and dimensions is capable of accommodating even these two quite dissimilar schools of thought.

With respect to the first one, vertical dimension of social capital suits the best. High-quality vertical linkages allow essential responses to health crises and managing risk by coordinating the effects of policy and civil society (Cullen & Whiteford, 2001). State's direct influence on the structure and delivery of medical service can either be assisted and facilitated in the environment of effective vertical linkages, or on the other hand, become ineffective and opposed on the societal levels, when individuals and groups do not perceive power-holders as genuinely trusted allies. Feedback from civil society and communities is crucial to keep the targeting of health policy and services on track; however constructive feedback and criticism can occur only in vertically-healthy social environment.

The second stream of research using social capital interchangeably with social cohesion and relative deprivation can be accounted for by the earlier-presented theory as well, precisely by balancing all of the components of social capital it identified. Social cohesion, or better to say the lack of such, is usually defined by the presence of income and wealth inequality, racial and ethnic tensions, disparities in political participation and weak civic engagement (Cullen & Whiteford, 2001). Now, what these areas essentially represent are the deficiencies of linking, bridging and bonding social capital correspondingly. Social cohesion can be indicated by strong levels of trust and norms of reciprocity that bond groups, the abundance of bridging that transgresses social divisions, and mechanisms of conflict management (responsive democracy, an independent judiciary, etc.) that enable just links to exist between unequal groups, including government and communities (Maxwell, 1996; Jenson, 1998, quoted in Cullen & Whiteford, 2001, p. 10). Therefore, social cohesion is attainable only through well-integrated horizontal (bonding and bridging) and vertical (linking) social capital (see Figure 4).

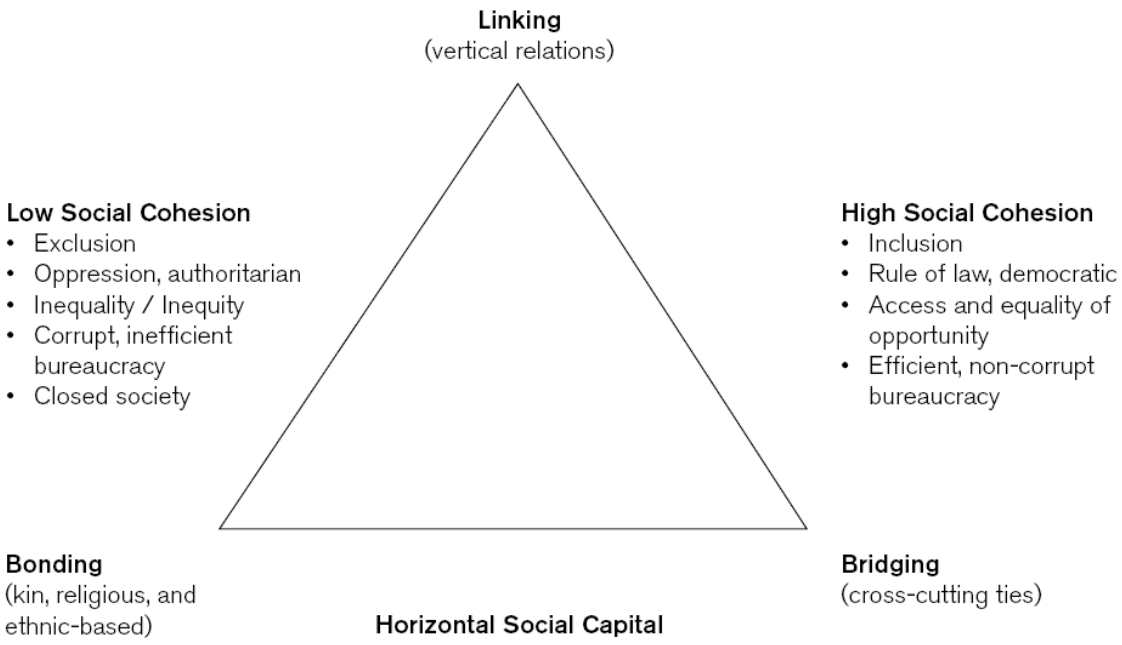


Figure 4: Social Cohesion: The Integration of Bonding, Bridging, and Linking Social Capital. Adapted from Cullen & Whiteford, 2001, p. 11.

This concludes the section outlining the theory of social capital and health. The model encompassing horizontal (bonding and bridging) as well as vertical (or linking) social capital manifested through structural and cognitive components is indeed a comprehensive one, capable of reconciling diverse theoretical traditions of research on social capital and health inequalities. It surely has its shortcomings, and those will be presented and acknowledged further in the paper. The section that does follow next presents a review of empirical research on social capital and health outcomes.

*Empirical Research on Social Capital and Health*

After Coleman's comprehensive theoretical refinement and Putnam's impressive findings in Italy, elevated by the World Bank's interest in the concept and Wilkinson's connection to health through relative income distribution, social capital has notoriously entered the field of epidemiology. Scheffler and Brown (2008) provide an impressive graph depicting the growth of literature on the subject in the fields of economics, public medicine and health economics over 1996-2005 (Figure 5). Although there is a change in the slope of increase in about the year 2000 and an eventual decline of economic writings connecting to social capital, the public medicine stock of literature on the subject continues its impressive growth at a rapid pace. The line EconLit-Health refers to the literature that links economics and health directly (the area of authors' focus) which according to Scheffler and Brown (2008) has only started to appear around 2006.The authors include it to suggest their unique contribution to the debate. Nevertheless, it is obvious that social capital and health is an intriguing subject, an area that is filled with multiple controversies with respect to units and levels of analyses, appropriate measurement techniques, and interpretation of results. The following outline of empirical findings presents the variety of articles, differing with respect to these characteristics.

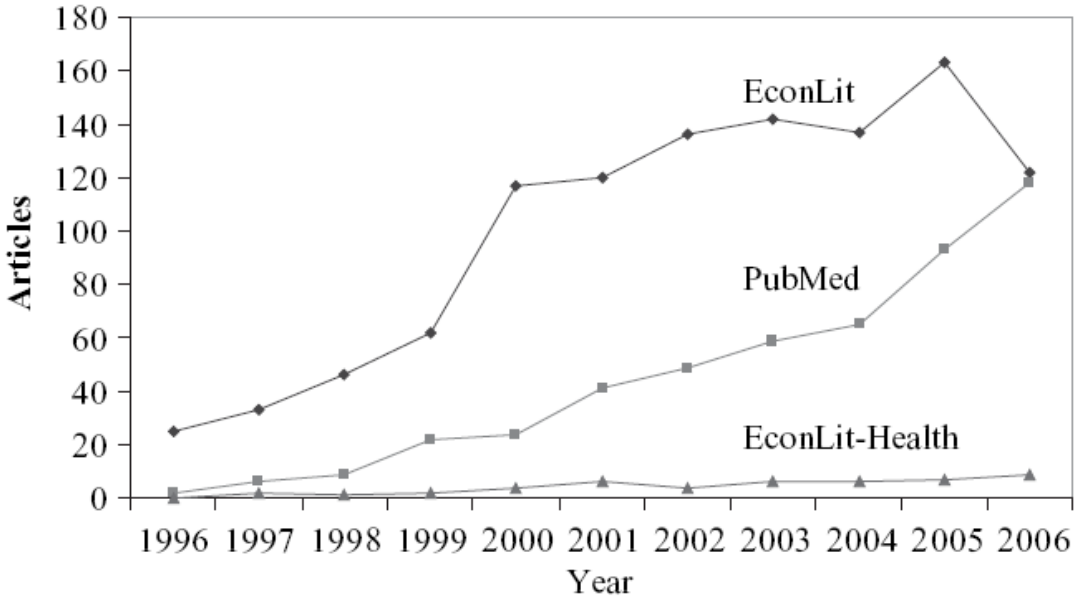


Figure 5: Papers published on social capital. Adapted from Scheffler and Brown, 2008, p. 324

Following Wilkinson's thesis that social capital is potentially related to health inequalities, Kawachi et al. (1997) were probably the first ones to explicitly employ social capital as an explanation for the effects of income inequality on health (Macinko and Starfield, 2001). Using the U.S. General Social Survey (GSS) they derived responses on social trust, perceived lack of fairness, perceived helpfulness of others and membership in groups. Individual responses were aggregated to the state level, thus making it a macro-level study. Each of the four variables was associated with income inequality and mortality at the 0.05 significance level. Their main finding is that the bulk of the income inequality effect contributes to disinvestment into social capital (path coefficient (p.c.) 0.73) while the latter exerts its negative influence on mortality (p.c. 0.64). The small direct path coefficient from income inequality to mortality (0.18) suggests that the former is an instrumental variable. That is, income inequality is directly and strongly related to the postulated causal factor (disinvestment in social capital), but when the causal effect is controlled for, there is little residual association between the instrumental variable and the outcome (mortality) (Kawachi et al., 1997, p.1495). However, the authors report path analysis for only one social capital indicator, perceived lack of fairness, leading to suspect the absence of statistically significant path relationships in other three cases.

Building on previous findings, Kawachi, Kennedy and Glass (1998) conducted a multilevel study next, in which they combined aggregated individual social capital responses (derived from GSS) with integral characteristics of group functioning (like number of voluntary organizations, number of political parties, crime levels, etc). The findings suggest that individuals living in states with low levels of trust had an increased adjusted odds ratio (1.4) of having lower self-reported health as opposed to someone living in states characterized by stronger trust. Similar findings were obtained with respect to low group membership and worse self-reported health (odds ratio 1.22) and low reciprocity and defected health (OR 1.48).

An interesting multilevel study was conducted by Veenstra et al. (2005) that attempted to predict self-rated health in 25 communities in British Columbia with both individual and community level measures of social capital, thus making it a multilevel analysis. Individual social capital stemmed from responses on perceived social and political trust and individual's participation in voluntary organizations. Contextual, or community-level social capital, was captured by measuring such community attributes as number of public spaces per capita (parks, sport-fields, cultural corners), number of voluntary organizations per capita, and average levels of community and political trust (aggregated individual scores). It was found that the primary predictors of self-rated health were age, political trust, and income, while community level indicators of social capital were not significantly associated with self-rated health.

A multiple of studies linking social capital and health were conducted beyond North America. For instance, Kennedy, Kawachi and Brainerd (1998) carried out a cross-sectional ecological analysis of the association between indicators of social capital and mortality rates across 40 regions of Russia. The measures of social capital included expected indicators of mistrust in government and civic engagement in politics, but were also supplemented with more general terms of quality of work relations or crime levels, tipping the social capital construct towards the wider term of social cohesion. Authors found associations between indicators of social capital and life expectancy as well as mortality. Their study provided an ambitious attempt to explain Russia's mortality crisis following the collapse of the Soviet Union.

Somewhat similar findings are presented by Skrabski et al. (2003) who analyzed Hungary. Using aggregated data on trust, reciprocity and assistance received from civil associations, authors confirm the relationships voiced earlier by Kawachi et al. in the U.S. and Russia regarding the effects of social capital on middle-age mortality and all cause mortality rates.

In Sweden, research on social capital and health started with a project carried out by Bolin, et al. (2003), who utilized a set of individual panel data from Statistics Sweden's Survey of Living Conditions (ULF) and reported that having a close friend outside the household had positive implications for self-rated health. A later, more elaborative study by Sundquist et al. based on the cross-sectional data from the 1990 and 1991 Swedish Annual Level-of-Living Survey found that individuals with low social participation had an increased risk of coronary heart diseases. Lindstrom (2004) made a significant contribution to the state of knowledge on social capital and health by constructing a social capital indicator based on cross-sectional data from Skane. The indicator absorbed individual measurements of social participation and perceived levels of trust and differentiated between four categories of communities with respect to their social capital endowments: high social participation/high trust (high social capital), high social participation /low trust (miniaturized society), low social participation/high trust (traditionalism), low social participation/low trust (low social capital). The findings indicate that the odds ratios of bad self-reported global health are the highest in the low-social capital category (low-social participation/low trust), but the miniaturization of community and low-social participation/high-trust categories also have significantly higher odds ratios than the high-social capital category (high-social participation/high trust) (Lindstrom, 2004, p. 595).

Literature on social capital and health is rich on cross-country studies, where individual level responses on relevant questions (trust, cooperation, and civic involvement) are aggregated to the

state level and are pulled together with similar aggregations from other counties for the purposes of comparing macro regions with diverse endowments social capital and health outcomes. The most widely used source of data for such projects is the World Values Survey (WVS), a worldwide investigation of socio-cultural and political change coordinated by Ronald F. Inglehart from the Center for Political Studies at the University of Michigan. Altogether this data source covers the period from 1981 to 2007 and accounts for 97 societies worldwide.

Using the 1995-1997 wave of the WVS, Smith and Polanyi (2003) found little evidence in support of the positive association between health levels and social capital. Proxied in their study by socially oriented behaviors and existence of socially-oriented norms, social capital did not reduce the likelihood of lower income groups reporting poor self-reported health as opposed to higher income groups. Similar conclusions were formulated by Lindstrom and Lindstrom (2006) after their ecological analysis of the 23 countries from the 1993 WVS. The study evaluated inequalities in social capital (proxied by generalized trust) and *neomaterial* indicators (proxied by relative and absolute income distribution) as possible determinants of health levels. Social capital captured by the percentage of respondents agreeing with the statement "most people can be trusted" showed no significant association life expectancy, adult mortality and infant mortality rates. Instead, both Gini coefficient and GNP/capita performed as robust determinants of health outcomes in various specifications, leading authors to doubt the suggested impact on health and instead support the notion that economic factors like absolute and relative distribution are of primary importance for health outcomes (Lindstrom and Lindstrom, 2006, p.679).

The final two paragraphs briefly summarize trends in empirical literature on social capital and health that were revealed as a result of review. Although a multiple of studies attempted to capture both cognitive (mostly trust and reciprocity) and structural (civic engagement and participation) components of social capital, in effect none of them presented indicators carefully grasping its horizontal (bridging and bonding) and vertical dimensions at the same time. Recall Islam's claim that virtually no studies have explicitly measured and tested the bridging form of social capital and its relation to health (2006, p.6). The way social capital is proxied across the literature is oftentimes confusing, and the lack of unified definition makes it difficult to compare studies, as in many cases social capital in some is very much distinct from social capital in others, while justifications for preferring one conceptualization over another are rarely provided.

With respect to findings, things look very promising for social capital research in North America, as most of the studies based on American data (mostly GSS) have found strong associations between improvements in health status and greater stocks of social capital, although Canadian results were a bit less convincing. European studies, including transition economies and Scandinavia, have found support for the social capital-health thesis. Cross-country analyses, mostly based on the World Values Survey data, on the other hand, have provided very little, if any evidence in support of social capital as a determinant of health. Such discrepancies in findings especially across diverse methodologies and analysis levels inspire one of the major criticisms of the concept's usage, mainly inconsistency in its operationalization and measurement. Wilkinson (1999) responds to such criticism by suggesting that, after all, social capital is a borrowed concept that hasn't been developed exclusively for health research. Kawachi and Berkman (2000) add that measures of social capital are still evolving and discrepancies in measurements should be anticipated and interpreted appropriately, although

with certain degree of caution. The following section discusses other criticisms of applying social capital in epidemiologic literature.

*Criticisms of Employing Social Capital in Epidemiologic Literature*

One of the major criticisms of the concept is that it has been stretched, modified, and extrapolated to cover so many types of relationships at so many levels of individual, group, institutional, and state analysis that the term lost all heuristic value (Macinko and Starfield, 2001, p.393). For more on this, one should consult Potes, 1998; Foley and Edwards, 1998; Woolcock, 1998, etc. Lochner et al. (1999), suggest that the concept is close to becoming "old wine in the new bottle", as it seems to tap into areas like sense of community, community relations, networks and empowerment, which have long before been identified as important determinants of physical and mental well-being by numerous community psychologists. Inconsistency in its definitional base complicates the situation even more, Glaeser et al. (2000), for instance, described it as 'the institutions, relationships, and norms that shape the quality and quantity of a society's social interactions (quoted in to Scheffler and Brown, 2008, p. 323), making it a vague and almost immeasurable concept. Walis et al. (1998), claim that the concept has gained its notorious fame not due to robust empirical justifications, but rather as a result of its potential to "mobilize diverse interests in a common dialogue and ultimately around a shared action agenda" (p.253, quoted in Macinko and Starfield, 2001, p.394).

The last point of the previous paragraph inspires another area of criticism, mainly how social capital came to be so popular in scientific circles and why this popularity had and continues to have a political and ideological aftertaste. Navarro's (2004) retrospective of historical dynamics in American and British social science research, including social medicine, over the last 45 years provides some very interesting arguments for further reflection. According to him, issues of class, race, and gender power relations, based on exploitation and domination were important areas of research prior to 1980's. As he tastefully puts it, "the name of the game was power and how that power was reproduced in ideological, political, cultural, social, and economic institutions" (Navarro, 2004, p. 673). However, around late 1970's and early 1980's a major political change occurred both in the U.S. and the UK which had significant consequences in the two societies, including their academic institutions. The change was the expansion of neoliberalism, or to use Anglo-Saxon terms, *Reaganism* and *Thatcherism*, and the dominance by neoliberal economic discourse of all the social sciences (Navarro, 2004, p. 673).

As a result, *capital* became the name of the game; that is precisely when scientific circles saw the popularization of concepts such as *human capital* and *social capital*. Given the heavy control of academia by federal funding, the newly-coined "capitals" quickly replaced traditional themes in literature. Social capital later gained particular endorsement among policy-makers, due to its unique ability to justify interventions which yielded little positive results. It inspired the conclusion that the social environment, which the policy had been applied to, was defective to start with; it lacked cohesiveness and trust; not the policy itself was flawed. This oftentimes led to the "blame the victim" scenario (Pearce, Davey-Smith, 2003), when societies rather than policy makers were held responsible for various negative social consequences (health, crime, wealth and income inequalities). The overall picture becomes very much politicized: ruling ideology dictates research avenues, the latter then supplies fancy "capital" concepts which are later successfully used to as buffers against unsuccessful interventions. The above is a very

controversial point. It does not necessarily represent the views of the author, but it is impossible to ignore it, as it is widely recognized in works of most prominent critics of social capital and its application in health literature (Lynch, Muntaner, Navarro, Davey-Smith, et al.).

A serious criticism is being put forward in connection to ignoring the negative consequences of social capital. According to Portes, although characterized by a variety of potentially favorable outcomes, social capital is capable of generating negative externalities that among others include: restrictions on individual freedom, exclusion of outsiders, excess claims on group members, and downward leveling norms (1998, p.15). Although theoretically, bridging social capital is intended to remedy exclusion of outsiders, it is frequently the case that excess of bonding over the deficiency of bridging social capital lead to such unfavorable consequences, which need to be addressed in theory and especially practice. Muntaner and Lynch (1999) have an interesting point themselves suggesting that some of the most unhealthy societies in this century have been highly cohesive – Nazi Germany, for example. As much as unified societies can serve a favorable ground for transmission of healthy norms and behaviors, they can be as much effective in disseminating unhealthy norms of conduct, like smoking, excessive alcohol consumption, or drug usage.

Other critics address the bases of Wilkinson's theory claiming that income inequality has little effects on population health. For instance Easton (1999) provides a case of New Zealand, which over the last 15 years experienced a steep decline in mortality rates accompanied with a substantial increase in income inequality. Others point out Putnam's inconsistency with respect to social capital's place in health policy who first in 1993 suggested that "we must be careful not to give governments credit (or blame) for matters beyond their control. In the language of policy analysis, we want to measure 'outputs' rather than 'outcomes' – health care rather than mortality rates… Health depends on factors like diet and lifestyle that are beyond the control of any democratic government" (Putnam, 1993, quoted in Davey Smith & Lynch, 2004, p.691). However, just in seven years he claimed that "of all the domains in which I have traced the consequences of social capital, in none is the importance of social connectedness so well established as in the case of health and well-being" (Putnam, 2000, quoted in Davey Smith & Lynch, 2004, p.691).

*The Debate with Neomaterialists*

The most vigorous criticism of social capital's application to medical research, however, has come from the so-called *neomaterial* authors. Upset by the historical dynamics in social science literature analyzed above, they are actively voicing concerns that increasing volume of research on social capital is diverting attention and resources from the true determinants of health and inequalities, mainly class and power relations. The dispute started with some authors questioning the accuracy of Wilkinson's suggestions that income inequality operates primarily through psychosocial mechanisms and cognitive processes of social comparison. Thus, Navarro (2004) criticizes Wilkinson for not exploring the structural causes behind inequality, like actors, purposes and interests of collective action in which class, race and gender continue to be crucial (p.674). Later, with refinements in social capital theory and its wider utilization in epidemiologic literature, mainly as a critical component in Wilkinson's mechanisms, the attention of the critics was channeled from subjective perceptions of inequality to the concept of social capital itself. Hence, their name, *neomaterialists:* older criticism from the *material* camp had to do with

interpreting the effects of inequality; a need to recognize its underlying material cases, while the new (*neo*) criticism targets social capital itself and its usage in epidemiology (including its link to inequality, its theoretical shortcomings or its policy implications). To bring up some examples, social capital is criticized for being pulled out of context of the broader social relationships (economic, political and cultural) which according to Muntaner and Lynch (1999) are absent from the inequality / social cohesion model. Also, failure by the social capital proponents to consider broader macroeconomic policies has been pointed out by Pearce and Davey Smith (2003), suggesting that even in rich countries the association between income inequalities and health can be explained by relative material deprivation in less affluent segments of the population (quoted in Lindstrom and Lindstrom, 2006, p.682). A multiple of empirical studies have confirmed *neomaterial* hypotheses by finding that access to material/economic resources as well as systematic disinvestments across a wide range of community infrastructure are the primary causes for fading health levels (Kaplan et al., 1996; Lynch & Kaplan, 1997; Davey Smith, 1996). Findings like these become especially eloquent when a multiple of empirical evidence has also pointed out a miniscule effect of social capital indicators as health predictors (Kelleher & Lynch, 2004).

A lot of work lies ahead before (if ever) the two camps are reconciled. Szreter and Woolcock (2003) skillfully put that "social capital is destined to become, like 'class', 'gender', and 'race', one of the 'essentially contested concepts' of the social sciences" (p. 654). Kawachi et al. (2004) add with a strong statement of their own: "for better of for worse (in terms of population health outcomes), social capital is here to stay" (p. 689). If so, it makes sense to recast the gaps in literature once again, as filling them might reduce the vigorous controversies associated with the concept today. Indistinct definitions, ambiguous measurement strategies, lack of literature integrating horizontal (both bonding and bridging) with vertical social capital in theoretical and empirical models, and, finally, unresolved quarrel with the *neomaterial* school are among primary things that need be accounted for in the forthcoming projects. This paper hopes to become a valuable contribution to the current stock of knowledge on the subject as it seeks to solve at least some of the identified above weaknesses.

*Hypothesis*

The major hypothesis that is going to be tested in the study stems from the theory of social capital and health and suggests that indicators of bonding, bridging and linking social capital, captured by different types of interpersonal trust and confidence in governance, are associated with population-level health outcomes. The hypothesis also absorbs the criticism coming from the *neomaterial* camp and presumes that the relationship between social capital and health persists even when structural causes behind absolute and relative deprivation (captured by GNI/capita and Gini coefficients) are also being controlled for. Therefore, in its clearer specification this study's assumption states that forms and dimensions of social capital as presented in the earlier theory are associated with country-level health outcomes, even when material determinants are also being controlled for in the empirical models.

# Data

The study presents a cross-sectional ecological analysis of health outcomes in 43 countries. Indicators capturing bonding, bridging and vertical dimensions of social capital, as well as *neomaterial* determinants are included as predictors in the models. More on the rationale behind the choice of variables and their transformations will follow in the Methods part. The 43 countries are chosen primarily for being listed in the 2005-2008 wave of the World Values Survey (WVS), the exclusive source of social capital information in this study. World Values Survey is a worldwide investigation of socio-cultural and political change coordinated by Ronald F. Inglehart from the Center for Political Studies at the University of Michigan. In collaboration with the European Values Study, the WVS carried out representative national surveys in 97 societies containing almost 90 percent of the world's population, that were conducted in five waves from 1981 to 2007 (WVS, 2009).

*World Values Survey (2005-2008 Wave)*

Altogether, the 2005-2008 wave of the World Values Survey includes 52 countries. The reason for selecting 43 of them is dictated by the availability of supplementary data on health outcomes and *neomaterial* indicators like GNI/capita and Gini coefficients for the time periods matching those when social capital scores were obtained. Sources of non-social capital data include the World Health Organization (2009) for life expectancy, adult and infant mortality rates; CIA Factbook (2009) and UNDP (2007) for Gini coefficients; and the World Bank (2008) for GNI/capita. Although reduced, the sample of 43 countries identified for this analysis does not seem to represent any obvious selection bias, as it preserves heterogeneity with respect to stages of economic development, geographic locations and cultural diversity of the selected regions.

As stated earlier, the project follows the methodology of an ecological study, meaning the unit of analysis is a group of individuals who are clustered together according to geo-demographic, socioeconomic or other criteria (ex. state/municipality/neighborhood as unit of analysis (Schneider et al., 2004; quoted in Islam et al., 2006, p.18). In ecological studies health status, social capital and *neomaterial* controls should all be examined at the aggregate level. All of the non-social capital data used here is in fact aggregated to the country-level and originally describes generalized populations. Original social capital scores, on the other hand, have been collected at individual level by the World Values Survey. In order for this project to meet the criteria of an ecological study, individual-level social capital responses need to be aggregated to the macro-level to be later matched with rest of the generalized country-level scores.

Aggregations like this can become dangerously misleading, especially when the source of original micro-level data undersamples or oversamples certain segments of the population, this way resulting in a sample that is unrepresentative of the entire region in question. Luckily, the World Values Survey adopts a stratified multi-stage random sampling technique and has as many as 1,500 respondents per each survey in each country. As a result, all of the country samples offered in the WVS are designed to be representative of their *entire* adult populations, as claimed in the World Values Survey data documentation (WVS, 2009).

Although some of the authors previously adopting the WVS data in their own analyses of social capital had used country weights to generate even more precise national estimates (Lynch et al.,

2001), there are a number of those who relied exclusively on unadjusted mean or proportion values of the WVS scores in their aggregations. For instance, Lindstrom and Lindstrom (2006) derived country-level social capital as an unadjusted population proportion agreeing with the statement "most people can be trusted" as opposed to those suggesting that "you can't be too careful in dealing with people". Similarly, Kennelly et al. (2003) in their analysis of social capital and health used raw arithmetic averages of the number of voluntary organizations to which adult citizens belonged and did unpaid work as one of the social capital indicators. Just like Lindstrom and Lindstrom (2006), they also employed unadjusted proportion of the population agreeing with "most people can be trusted" as another component of their social capital construct. Given the time constraints as well as some theoretical considerations against weighting, this study refrains from using weights and follows the steps of Lindstrom and Lindstrom (2006) and Kennelly et al. (2003) in aggregating individual social capital responses from the WVS and transforming them into country-level estimates, namely unadjusted proportion techniques. More details on aggregation with respect to specific variables used in this study's empirical models will follow in the Methods section.

Although issues with validity of aggregations derived from the WVS shouldn't be much of a setback, there are potential areas of concern with respect to actual response patterns to WVS' questionnaires in specific regions, especially when vertical social capital is considered. For instance, values on confidence in government, this study's proxy for vertical social capital (more on variable details in the upcoming chapter), seem to be exceptionally high in regions known for undemocratic, authoritarian regimes, like China or Vietnam (more than 95% of respondents there state they have complete confidence in their governments). The conclusion one inevitably draws after reviewing such scores is respondents' reluctance towards criticizing or expressing discontent with the actions of those in power. One should bear this potential limitation which is not uncommon across the majority of surveys (including the WVS), where response bias and misclassification issues can be quite recurring. Although questionable in some areas, the World Values Survey nevertheless remains an authoritative source of data on a multiple of socio-cultural indicators; it has been utilized in diverse studies from a variety of academic disciplines which underscores its reliability and trustworthiness.

*Non-WVS Sources*

Sources of supplementary non-social capital data include global non-governmental agencies with long traditions of collecting and analyzing socioeconomic, demographic, and health-related information. The choice of agencies as sources for the indicators is determined by matching the nature of the indicator with the agency's area of expertise. Thus, health-related indicators are borrowed from the WHO, while indicators of economic development from the World Bank, and the UNDP. CIA Factbook became of great assistance when up-to-date Gini coefficients were missing from UNDP reports. Surely, there is some degree of criticism applicable regarding individual indicators, for instance whether GNI/capita is a reliable measure of material well-being, or life expectancy a robust indicator of health, which will be examined further on when individual variables are discussed. With respect to source criticism that should be examined here, very little can be said about doubting the reliability of the World Bank estimates or the WHO figures. The following chapter takes a more detailed look at the variables used in this project, empirical design, and statistical tools used for testing the hypotheses.

# Methods

*Design*

As stated earlier, the study follows the methodology of a cross-sectional ecological study. Since the principles of ecological studies have been presented in the Data section, it makes sense to discuss the premises of a cross-sectional study now. Cross-sectional analysis presents a subset of research methods that involve investigating the relationship between a set of variables at a specific point in time. Often labeled as "hypothesis-generating" studies, they serve as a useful tool for the preliminary analysis that follows the aim of establishing a testable hypothesis that could be rechecked in more complex projects. Known for their "snapshot" nature, cross-sectional studies are often contrasted with longitudinal projects, which involve a series of measurements over a period of time (Petrie et al., 2002). Cross-sectional methods are widely preferred for being relatively straightforward, quick, and fairly inexpensive to carry out. The downside of conducting such studies in epidemiologic research lies in their inability to provide evidence of temporal relationship between the risk factors and health outcomes (be it disease incidence, self-reported health, or mortality), since data on risk and outcomes are collected simultaneously (Petrie et al., 2002). Nevertheless, it seems like an applicable methodology for *this* study, in light of author's primary intent to compare diverse macro-regions, rather than carry out a single-unit analysis.

*Sample*

The sample presents a reduced version of the 2005-2008 WVS' sample and contains data from 43 countries around the world. Including regions from all five continents and representing extremely diverse cultural aspirations and economic conditions makes this sample quite heterogeneous indeed. According to the World Bank's 2007 classification based on GNI/capita (Atlas method) the sample can be broken down the following way: high-income (16 countries), upper-middle income (12), lower-middle income (9), and low income (6). The sample can be also classified using La-Porta's (1999) findings on legal origins and cultural (religious) orientation. It is therefore comprised of 8 states with socialist legal traditions (institutions designed by the state to maintain its power and extract resources without much regard for protecting economic interests or liberties of the population); 17 countries with French civil law traditions (law as an instrument of the state in expanding its power, though in a more constrained way than socialist law); 12 locations with English common law heritage (law represents an intent to limit the power of the sovereign); and finally, 4 countries of German and 2 of Scandinavian civil law traditions (close to English common law, but especially known for their interventionist stance of the law). With respect to religious affiliation, which La-Porta (1999) also uses as a proxy for cultural variations, the sample includes 13 predominantly Catholic countries; 6 are Protestant; 7 – Muslim; 5 are Orthodox, and 12 represent other religious denominations (Anglican, Hindu, atheist, etc). Table 1 presents all countries included in the sample, as well as matches them with scores on social capital, *neomaterial*, and health indicators. After reviewing the table, one will probably have questions regarding how social capital scores were operationalized. More details on this follows in the next sub-section which explicitly discusses the variables.

Table 1: Prevalence of GNI/capita, life expectancy, adult and infant mortality, relative income distribution (Gini coefficient) and social capital indicators in 43 countries of the study

| Location | GNI per Capita | Life Expectancy | Adult Mortality | IMR | Gini Coefficient | Bonding Social Capital | Bridging Social Capital | Vertical (Linking) Social Capital | Generalized Trust |
|---|---|---|---|---|---|---|---|---|---|
| Argentina | 11670 | 75 | 124 | 14 | 0.49 | 36 | 13 | 36 | 17 |
| Australia | 32740 | 82 | 65 | 5 | 0.31 | 42 | 6 | 40 | 48 |
| Brazil | 8700 | 72 | 176 | 19 | 0.57 | 14 | 6 | 46 | 9 |
| Bulgaria | 10270 | 73 | 157 | 10 | 0.32 | 28 | 5 | 34 | 22 |
| Burkina Faso | 1120 | 47 | 427 | 122 | 0.4 | 20 | 14 | 49 | 15 |
| Chile | 11160 | 78 | 91 | 8 | 0.55 | 15 | 4 | 48 | 12 |
| China | 5370 | 73 | 116 | 20 | 0.47 | 21 | 2 | 93 | 52 |
| Colombia | 11560 | 74 | 131 | 17 | 0.54 | 17 | 4 | 51 | 14 |
| Cyprus | 25060 | 80 | 58 | 3 | 0.29 | 29 | 3 | 58 | 13 |
| Ethiopia | 780 | 56 | 326 | 77 | 0.3 | 20 | 12 | 26 | 24 |
| Finland | 30580 | 79 | 96 | 3 | 0.26 | 44 | 12 | 64 | 59 |
| France | 32240 | 81 | 91 | 4 | 0.28 | 68 | 29 | 29 | 19 |
| Germany | 32680 | 80 | 81 | 4 | 0.28 | 24 | 2 | 24 | 34 |
| Ghana | 1330 | 57 | 331 | 76 | 0.39 | 19 | 12 | 71 | 8 |
| India | 2460 | 63 | 241 | 57 | 0.37 | 29 | 13 | 55 | 23 |
| Indonesia | 3310 | 68 | 212 | 26 | 0.36 | 22 | 2 | 56 | 43 |
| Italy | 27630 | 81 | 64 | 3 | 0.33 | 7 | 0.7 | 26 | 29 |
| Jordan | 5160 | 71 | 152 | 21 | 0.39 | 31 | 4 | 87 | 31 |
| Malaysia | 12160 | 72 | 155 | 10 | 0.46 | 16 | 2 | 75 | 9 |
| Mali | 1040 | 46 | 427 | 119 | 0.4 | 35 | 24 | 71 | 17 |
| Mexico | 11190 | 74 | 122 | 29 | 0.51 | 26 | 4 | 45 | 16 |
| Morocco | 3990 | 72 | 119 | 34 | 0.4 | 37 | 1 | 55 | 13 |
| Netherlands | 37940 | 80 | 70 | 4 | 0.31 | 28 | 3 | 27 | 45 |
| New Zealand | 22090 | 80 | 75 | 5 | 0.36 | 58 | 24 | 41 | 51 |
| Peru | 7240 | 73 | 136 | 21 | 0.52 | 10 | 2 | 12 | 6 |
| Poland | 13030 | 75 | 145 | 6 | 0.36 | 11 | 2 | 18 | 19 |
| South Korea | 21240 | 79 | 84 | 5 | 0.35 | 15 | 3 | 46 | 30 |
| Romania | 9070 | 73 | 157 | 14 | 0.31 | 6 | 2 | 27 | 20 |
| Russia | 12740 | 66 | 300 | 10 | 0.42 | 21 | 2 | 45 | 27 |
| Serbia | 9320 | 73 | 141 | 7 | 0.3 | 30 | 4 | 26 | 15 |
| Slovenia | 22250 | 78 | 104 | 3 | 0.24 | 21 | 5 | 24 | 18 |
| South Africa | 9560 | 51 | 564 | 56 | 0.65 | 25 | 12 | 67 | 17 |
| Spain | 30820 | 81 | 75 | 4 | 0.32 | 41 | 7 | 45 | 20 |
| Sweden | 34310 | 81 | 64 | 3 | 0.23 | 49 | 16 | 42 | 68 |
| Switzerland | 43870 | 82 | 63 | 4 | 0.34 | 33 | 5 | 69 | 51 |
| Thailand | 7880 | 72 | 210 | 7 | 0.42 | 17 | 5 | 39 | 42 |
| Trinidad | 16800 | 69 | 199 | 33 | 0.39 | 20 | 7 | 27 | 4 |
| Turkey | 12350 | 73 | 123 | 24 | 0.44 | 22 | 3 | 63 | 5 |
| Ukraine | 6110 | 67 | 264 | 20 | 0.31 | 17 | 5 | 31 | 28 |
| UK | 33650 | 79 | 80 | 5 | 0.34 | 52 | 11 | 34 | 30 |
| United States | 44070 | 78 | 109 | 7 | 0.45 | 32 | 7 | 39 | 40 |
| Vietnam | 2310 | 72 | 155 | 15 | 0.37 | 12 | 1 | 98 | 52 |
| Zambia | 1220 | 43 | 617 | 102 | 0.51 | 14 | 9 | 42 | 11 |

Sources: WHO (2009), World Bank (2008), CIA Factbook (2009), World Values Survey (2009).
Note: GNI/Capita, U.S. $; Life Expectancy, years; IMR, deaths per 1000 live births; Adult Mortality, deaths per 1000 population; Social Capital and Trust, %.

*Variables*

Bonding Social Capital (*trust_pers*)

Bonding social capital is captured by the WVS' item requesting respondents to evaluate trust in people they know personally. Recall that bonding social capital is a part of social capital's horizontal dimension and is responsible for reinforcing exclusive identities between homogeneous groups. Authors previously using the WVS' question on "most people can be trusted vs. you can't be too careful in dealing with people" as a proxy for social capital, criticized such construct for being too general and incapable of explicitly capturing the quality of relationship among friends and family (Kennelly et al., 2003). The item on "trust in people you know personally", on the other hand, restricts respondents to evaluating relationships which have been already "approved" in a way; acquaintance occurred either as a result of voluntary social interaction (at social events, for instance) or in response to being brought together in similar structural settings (work environment). In either case, identities that develop as a result are often homogenous and "bonding", as opposed to those that are evaluated in response to the question on "most people can be trusted". This homogeneity and attachment are precisely what bonding social capital is about.

When answering the WVS question on "trust in people you know personally", respondents in each country select one of the four alternatives: 1 – "trust completely", 2 – "trust somewhat", 3 – "not very much" and 4 – "not at all". A single-country score is therefore derived from the proportion of respondents agreeing with alternative 1 – "trust completely". Approach like this is consistent with previous studies in the field (Lindstrom and Lindstrom, 2006; Kennelly at al, 2003) that used proportions of sample exclusively agreeing with one particular statement as single-region scores. Given the coding scale of this question on trust, it was chosen to refrain from the widely accepted aggregation technique of selecting the best *two* alternatives for a generalized score (usually on a scale from "completely" to "a great deal"), since the gap in this question's case from "completely" to "somewhat" seems a bit more substantial for them to be taken together.

An aggregating alternative could be developing a social capital index for each country: assigning a weight to each response alternative and then multiplying the proportion of respondents agreeing with it by that alternative's weight. This way the entire response pattern is reflected in the aggregated country score. The downside of this approach is the arbitrary choice of weights per each response alternative. To ensure the findings are unaffected by the aggregation methods, analysis was conducted with indicators derived through three aggregation alternatives: (1) each country's proportion agreeing with statement one ("trust completely") as the exclusive country score; (2) cumulative proportion in each country agreeing with statements one *and* two ("trust completely" and "trust somewhat") as the country score; (3) indexing scores through assigning arbitrary weights to each response alternative (descending order from 1 for 0) and then multiplying the proportion of respondents agreeing with that alternative by its weight. Adding the obtained numbers and deriving a percentage value then provides a single-country score. Results from all three cases revealed only insignificant discrepancies. It was therefore chosen to stick with the method that was the least arbitrary and the most logical, namely, (1) each country's proportion agreeing with statement one ("trust completely") as the exclusive country score.

Bridging Social Capital (*trust_rel*)

Bridging social capital in this study is captured by the WVS' item requesting respondents to evaluate their trust in people of another religion. Recall that bridging social capital is a subset of horizontal social capital and reflects the quality of relationship that exists between heterogeneous establishments – weak ties that prevail among dissimilar ethnic or occupational backgrounds. The item on "trust in people of another religion" seems like an effective construct, as it manages to capture one of the main aspects behind bridging social capital, mainly the quality of relationship among distinct groups.

The item on "trust in people of another religion" is captured in a similar way in the WVS as the item on "trust in people you know personally": a scale from one to four: with 1 being complete trust; 2 – "trust somewhat", 3 – "not very much" and 4 – "no trust". Single-country score for bridging social capital is therefore derived similarly to that of bonding social capital': each country's proportion agreeing with statement one ("trust completely") as the exclusive country score.

Vertical (Linking) Social Capital (*conf_gvt*)

The vertical dimension of social capital is captured by the WVS' item requesting respondents to assess their confidence in the government. Vertical social capital is confined to ties and relationships that exist between groups endowed with unequal amounts of power or resources. Islam et al. (2003) suggest that the quality of linkages between governments and communities are the most common example of vertical social capital. However, one shouldn't forget the criticism put forward in the previous section regarding excessive levels of confidence in governments reported in areas known for undemocratic, often repressive regimes (China or Vietnam). Such obvious response bias could make this variable a bit unstable and less reliable than others. Nevertheless, it is a near-perfect proxy for vertical social capital and thus will stay in the model.

In the WVS, this item is captured in a manner slightly different from the other two indicators of bonding and bridging social capital. Respondents to the "confidence in government" question are selecting from such four alternatives: 1 – "complete confidence", 2 –"quite a lot of confidence", 3 – "not very much", 4 – "not at all". Given this new scale, it becomes unwise to continue using the aggregation strategy under which only the first alternative's proportion is considered. Therefore, this time, aggregating resembles classical cases when cumulative proportions agreeing with the two first options ("completely" and "quite a lot") are used as single-country scores. One could argue that the question on "confidence" calls for respondents' reflections and provides conclusions that are different from "trust-oriented" inquiries. Nevertheless, questions on confidence in institutions have been previously used as substitutes for institutional trust in articles on social capital (Paxton, 1999), which underscores their validity and utility for this project as well.

Generalized Trust (*trust_most*)

An indicator of generalized trust is also included in the model. It departs somewhat from the theory of social capital and health, with its forms and dimensions. The reason for including this construct is its wide utilization by previous studies in the field. Prior research adopting earlier waves of the WVS has found little support for the importance of generalized trust for population-

level health. The intent here is to check if such findings persist throughout the most recent wave of the WVS and determine whether the new approach to measuring social capital advocated in this study (through capturing its bonding, bridging, and vertical dimensions) could yield more conclusive results than the mainstream generalized trust indicator.

In the 2005-2008 wave of WVS generalized trust is captured by the already familiar question "Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people?" Two response alternatives are given: (1) "most people can be trusted, (2) "need to be very careful" (WVS, 2009). Similarly to previous studies dealing with this question, the aggregate country score is obtained as a proportion of total respondents agreeing with statement (1) "most people can be trusted".

Life Expectancy at Birth (*life_exp*)

According to the WHO (2009), Life expectancy at birth reflects the overall mortality level of a population. It summarizes the mortality pattern that prevails across all age groups - children and adolescents, adults and the elderly and is widely regarded as an indicator of a country's overall health. It is however far from being the flawless indicator. In places with high infant mortality rates, life expectancy at birth can become highly sensitive to premature newborn deaths. That is why an alternative indicator, life expectancy at age 5, is occasionally preferred to ordinary life expectancy at birth in such locations. It has also been criticized for placing too much emphasis on quantity of life, rather than on quality of life (Conference Board of Canada, 2009). Health-adjusted life-expectancy (HALE) can be a better indicator that accounts for such criticism as it presents the average number of years a person can expect to live in good health. Despite obvious shortcomings, life expectancy remains a reliable indicator of national health as it is repeatedly used in studies on macro-level health discrepancies. Life expectancy figures for this study were collected from the WHO statistical databases for the exact years as the World Values Surveys were carried out in corresponding countries (2005 through 2008).

Adult Mortality (*adult_mort*)

Adult mortality rate is in essence a probability that a 15 year-old will die before reaching their $60^{th}$ birthday. According to the WHO (2009), this is an important indicator for the comprehensive assessment of the mortality pattern in a population, especially with respect to its economically productive segments. Obtaining mortality rates for the exact time periods in which the WVS questionnaires were conducted in individual countries was a difficult task, since the WHO database only had this indicator listed through 2006 only. Therefore, the choice was made to stick with the 2006 values on adult mortality per 1000 population for all countries. This doesn't seem to be much of a problem since a bulk of WVS questionnaires across the sample were in fact carried out throughout the year 2006.

Infant Mortality (*IMR*)

Infant mortality rate represents a probability of a child born in a specific year or period dying before reaching the age of 1 if subject to age-specific mortality rates of that period. Calculated per 1000 live births, infant mortality rates are leading indicators of the level of child health and overall development in countries; the primary reason why they are also included among the objectives addressed in the Millennium Development Goals (WHO, 2009). Similarly as adult mortality rates, IMR's were collected for the year 2006, as more recent figures were missing from the WHO databases.

GNI per Capita (*gni*)

GNI per capita is an indicator of the average income of a country's citizens and is derived as the dollar value of a country's final income in a year divided by its total population. GNI per capita estimates used in this study are based on the World Bank's Purchasing Power Parity method since they take into account differences in the relative prices of goods and therefore provide a better overall measure of the real value of output produced by an economy compared to other economies (World Bank, 2009). There is a lot of criticism in the literature with respect to GNI per capita being a poor indicator of standards of living. In this study's case, it is rather used as a proxy for absolute income distribution alone, instead of being an overarching indicator of the quality of the life. Such usage of GNI/capita is inspired by the *neomaterial* view on the role of socioeconomic determinants for health outcomes that claims that material deprivation is the key to explaining health discrepancies. Therefore, this indicator tries to capture the very crude extent of material scarcity (or abundance for that matter). GNI/capita scores were collected from the World Bank's databases and entirely match the years of the WVS responses on social capital.

GINI Coefficient (*GINI*)

In contrast to GNI/capita that captures absolute material scarcity, Gini coefficient is designed to proxy for relative material deprivation – another *neomaterial* construct for health inequalities. The coefficient varies between 0, which reflects complete equality and 1, which indicates complete inequality (World Bank, 2009). Although the usage of Gini coefficient in the models is inspired by the *neomaterial* discourse, the indicator still falls a little bit short of capturing the very essence of *neomaterialists'* claims. Recall that they insist that structural causes *behind* income inequality (like class and political change) are central to health disparities. This construct assumes inequality as given, without digging towards the spectrum of causes behind it, which is a bit unfortunate. Upcoming studies interested in pinpointing the very essence of *neomaterial* effects should bear this limitation in mind and try to develop better indicators. This project, however, is more concerned with improving the definitional base of social capital and thus sticks with Gini index. Gini scores were collected from the UNDP Reports and CIA Factbook. In some cases the years for Gini coefficients match those of the WVS, while in others there are some discrepancies, yet there are none which are greater than three years apart.

*Statistical Analysis*

Empirical Model

The associations between social capital, *neomaterial* determinants and health outcomes will be analyzed through multivariate linear regression models. Such models assume linear associations between predictors and outcomes which have been explored prior to the analysis. Let's examine the theoretical model first:

Equation 1:

$$health\,outcome_i = \beta_0 + \beta_1 social\,capital_i + \beta_2 neomaterial\,construct_i + e_i$$

Expanding this theoretical depiction to include the actual variables will result in following equations below:

Equations 2 - 13:

$$life\_exp_i = \beta_0 + \beta_1 trust\_pers_i + \beta_2 gni_i + GINI_i + e_i$$

$$life\_exp_i = \beta_0 + \beta_1 trust\_rel_i + \beta_2 gni_i + GINI_i + e_i$$

$$life\_exp_i = \beta_0 + \beta_1 conf\_gvt_i + \beta_2 gni_i + GINI_i + e_i$$

$$life\_exp_i = \beta_0 + \beta_1 trust\_most_i + \beta_2 gni_i + GINI_i + e_i$$

$$adult\_mort_i = \beta_0 + \beta_1 trust\_pers_i + \beta_2 gni_i + GINI_i + e_i$$

$$adult\_mort_i = \beta_0 + \beta_1 trust\_rel_i + \beta_2 gni_i + GINI_i + e_i$$

$$adult\_mort_i = \beta_0 + \beta_1 conf\_gvt_i + \beta_2 gni_i + GINI_i + e_i$$

$$adult\_mort_i = \beta_0 + \beta_1 trust\_most_i + \beta_2 gni_i + GINI_i + e_i$$

$$IMR_i = \beta_0 + \beta_1 trust\_pers_i + \beta_2 gni_i + GINI_i + e_i$$

$$IMR_i = \beta_0 + \beta_1 trust\_rel_i + \beta_2 gni_i + GINI_i + e_i$$

$$IMR_i = \beta_0 + \beta_1 conf\_gvt_i + \beta_2 gni_i + GINI_i + e_i$$

$$IMR_i = \beta_0 + \beta_1 trust\_most_i + \beta_2 gni_i + GINI_i + e_i$$

Due to some strong cases of correlation between the four social capital constructs (Table 2), separate analyses are going to be conducted per each indicator, rather than throwing all of them into a single model and thus having to face multicolinearity issues.

Table 2: Correlation among the indicators of bonding, bridging, and vertical social capital

| Social Capital Variable | Correlation Coefficient | p-value, 95% |
|---|---|---|
| *trust_pers - trust_rel* | 0.6828 | 0.0000 |
| *trust_pers - conf_gvt* | 0.0101 | 0.9488 |
| *trust_pers - trust_most* | 0.3555 | 0.0193 |
| *trust_rel - conf_gvt* | -0.0170 | 0.9138 |
| *trust_rel - trust_most* | 0.0770 | 0.6235 |
| *conf_gvt - trust_most* | 0.2067 | 0.1836 |

Introducing Non-linear Effects of GNI/capita

Although the models above look quite straightforward and reasonable, their functional forms are a bit too simplistic, especially when cases of non-linear effects of some of the above indicators have been documented in literature. For instance, GNI/capita has been repeatedly shown by Wilkinson (1994) to have a non-linear effect on life expectancy, as its developments in lower divisions result in immediate improvements in life expectancy up to a certain threshold level,

beyond which the effects of absolute income on life expectancy become either neutral or even negative (consult Figure 1 for details). The situation holds true in case with the given sample as well:

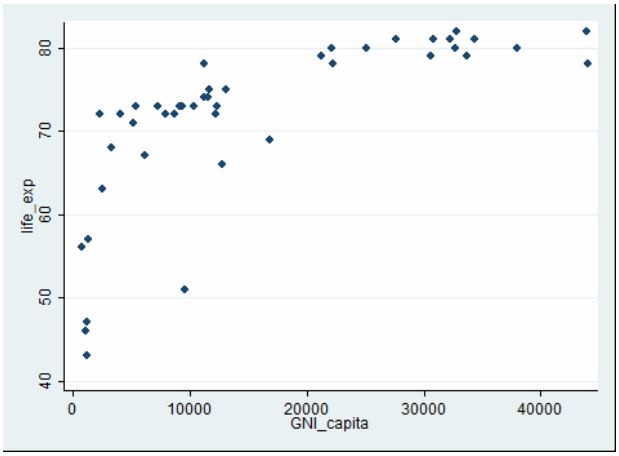


Figure 6: Life expectancy at birth in relation to GNI/capita in 43 countries (2005-2008)

The graphical depiction above indicates the need for introducing a variable which would account for non-linear effects of increasing GNI/capita for life expectancy. Squaring the variable *gni* will do just that. Therefore, a new variable emerges – *gni2,* which definitely improves the functional form of the empirical model.

Introducing Normality of GNI/capita's distribution

Squaring *gni* to account for non-linear effects isn't the only thing that can be done to improve the fit. In its original form, *gni* presents quite astonishing variations in values: from 780 to 44,070. Deriving the natural logarithm of the variable could solve some issues with such unhealthy variation in values and generate a less skewed distribution. That's why *gni* is going to be transformed into *ln_gni* (its natural logarithm).

Introducing Interaction Terms Based on White Test

Employing interaction terms is also a useful tool of improving the fit and discovering interesting or even unexpected combined effects of different independent variables. In order to decide on interaction terms, simple models (Equations 2 – 13) were estimated first. Then, a manual version of the White test was conducted after each of the models. Conducting a White test not only indicates the presence of heteroskedasticity, but also points out misspecification issues. All possible squarings and interactions were included in the testing, since the number of degrees of freedom available permitted doing so. The results revealed the need for including such variables in the improved models: interaction term of social capital constructs and Gini coefficient (*pers_GINI*; *rel_GINI*; *gvt_GINI*; *most_GINI*) and an interaction term of GNI/capita and Gini coefficient (*gni_GINI*).

However, when the two interactions were included in the already developed models, it became apparent that multicolinearity became an issue: regressions presented with unreasonably high *F*-statistics and $R^2$, while *t*-scores for most of the coefficients were insignificant. Moreover, coefficients presented with signs, contradicting any reasonable theory (for instance log of

GNI/capita appeared with a negative insignificant coefficient in the analysis of life expectancy). Using *variance inflator factor* to analyze the consequences of multicolinearity for overall model stability revealed quite unpleasant results. Both the *tolerance number* and the *condition number* were way beyond reasonable boundaries, indicating severe problems with collinearity and overall fit. Further analysis revealed that including base social capital indicators (*trust_pers*, *trust_rel*, *conf_gvt*, *trust_most*) in the same models with the interaction term of Gini coefficient and social capital construct (*pers_GINI*, *rel_GINI*, *conf_GINI*, *most_GINI*) was the source of the problem. As a result, this interaction term was excluded in the final models, making them look like this after all of the functional form adjustments described above:

Equations 14-25:

$$life\ expectancy_i = \beta_0 + \beta_1 trust\_pers_i + \beta_2 ln\_gni_i + \beta_3 GINI_i + \beta_4 gni2_i + \beta_5 gni\_GINI_i + e_i$$

$$life\ expectancy_i = \beta_0 + \beta_1 trust\_rel_i + \beta_2 ln\_gni_i + \beta_3 GINI_i + \beta_4 gni2_i + \beta_5 gni\_GINI_i + e_i$$

$$life\ expectancy_i = \beta_0 + \beta_1 conf\_gvt_i + \beta_2 ln\_gni_i + \beta_3 GINI_i + \beta_4 gni2_i + \beta_5 gni\_GINI_i + e_i$$

$$life\ expectancy_i = \beta_0 + \beta_1 trust\_most_i + \beta_2 ln\_gni_i + \beta_3 GINI_i + \beta_4 gni2_i + \beta_5 gni\_GINI_i + e_i$$

$$adult\ mortality_i = \beta_0 + \beta_1 trust\_pers_i + \beta_2 ln\_gni_i + \beta_3 GINI_i + \beta_4 gni2_i + \beta_5 gni\_GINI_i + e_i$$

$$adult\ mortality_i = \beta_0 + \beta_1 trust\_rel_i + \beta_2 ln\_gni_i + \beta_3 GINI_i + \beta_4 gni2_i + \beta_5 gni\_GINI_i + e_i$$

$$adult\ mortality_i = \beta_0 + \beta_1 conf\_gvt_i + \beta_2 ln\_gni_i + \beta_3 GINI_i + \beta_4 gni2_i + \beta_5 gni\_GINI_i + e_i$$

$$adult\ mortality_i = \beta_0 + \beta_1 trust\_most_i + \beta_2 ln\_gni_i + \beta_3 GINI_i + \beta_4 gni2_i + \beta_5 gni\_GINI_i + e_i$$

$$IMR_i = \beta_0 + \beta_1 trust\_pers_i + \beta_2 ln\_gni_i + \beta_3 GINI_i + \beta_4 gni2_i + \beta_5 gni\_GINI_i + e_i$$

$$IMR_i = \beta_0 + \beta_1 trust\_rel_i + \beta_2 ln\_gni_i + \beta_3 GINI_i + \beta_4 gni2_i + \beta_5 gni\_GINI_i + e_i$$

$$IMR_i = \beta_0 + \beta_1 conf\_gvt_i + \beta_2 ln\_gni_i + \beta_3 GINI_i + \beta_4 gni2_i + \beta_5 gni\_GINI_i + e_i$$

$$IMR_i = \beta_0 + \beta_1 trust\_most_i + \beta_2 ln\_gni_i + \beta_3 GINI_i + \beta_4 gni2_i + \beta_5 gni\_GINI_i + e_i$$

Statistical Tools

Each of the social capital indicators is examined for associations with life expectancy and mortality rates in separate multivariate linear regression models. *Neomaterial* constructs are also added into the models. Linear regression models are evaluated based on *R*-square ($R^2$) values, indicating the degree of variation in health outcomes explained by the set of selected predictors. Associations between individual variables and the outcomes are assessed through beta coefficients, mean elasticities, standard errors (SE) for beta coefficients, *t*-values (beta coefficient divided by the SE) and *p*-values associated with the *t*-scores. Models are then reduced in a number of ways and their *R*-squared values are re-evaluated in order to determine the contributions of individual variables to explaining overall variations in life expectancy and mortality. Statistical analysis is performed using STATA 10. Presentation of results follows next in Chapter 5.

# Results

The purpose of the study is to check whether indicators of bonding, bridging and vertical social capital are associated with macro-level health outcomes after *neomaterial* constructs, captured by absolute and relative income distribution, are also being controlled for. An indicator of generalized trust, inconsistent with the underlying theory is also evaluated, due to its wide prior utilization in similar studies. As a result, four sets of models are run, each examining the effects of specific social capital constructs on different health outcomes. The results of the testing are presented in Tables 4, 7, 10, and 13.

*Analyzing Bonding Social Capital*

The first set of models evaluated the contribution of bonding social capital construct (captured by the question on "trust in people you know personally") on life expectancy, adult and infant mortality. GNI/capita and Gini coefficients were also included in the models. Prior to running the regressions, correlations among the predictors were evaluated bivariately (Table 3). Expected strong correlations were revealed among the base variables and their derived squarings and interactions. Although potentially worrisome, such correlations were ignored, since the indicators involved later presented with quite dissimilar effects on outcome variables, leading to the conclusion that they weren't too closely connected. Interestingly, a rather strong correlation of nearly 0.38 was discovered between bonding social capital and GNI/capita, inspiring an idea that levels of social cohesion can very well be endogenous to material conditions in the country.

Table 3. Pairwise correlations of independent variables included in models presented in Table 4:

| Social Capital Variable | Correlation Coefficient | p-value, 95% |
|---|---|---|
| *trust_pers - ln_gni* | 0.3777 | 0.0125 |
| *trust_pers - GINI* | -0. 3552 | 0.0194 |
| *trust_pers – gni_GINI* | -0.1970 | 0.2055 |
| *trust_pers - gni2* | 0.3996 | 0.0079 |
| *GINI- ln_gni* | -0.2733 | 0.0761 |
| *gni_GINI - ln_gni* | 0.1865 | 0.2311 |
| *gni2 - ln_gni* | 0.9978 | 0.0000 |
| *gni_GINI - GINI* | 0.8908 | 0.0000 |
| *gni2 - GINI* | -0.3002 | 0.0505 |
| *gni2- gni_GINI* | 0.1573 | 0.3137 |

Table 4. Linear regression results. Bonding social capital and health outcomes (controlled for *neomaterial* indicators)

| Independent Variables | Dependent Variables | | |
|---|---|---|---|
| | Life Expectancy | Adult Mortality | IMR |
| Bonding Social Capital (*trust_pers*) | 0.0071779<br>(0.16) | -0.3583475<br>(-0.48) | 0.1261959<br>(1.17) |
| Log of GNI/capita (*ln_gni)* | 30.46358<br>(3.75) | -331.704<br>(-2.59) | -165.8457<br>(-5.53) |
| Gini Coefficient (*GINI)* | -200.9275<br>(-3.40) | 4006.213<br>(2.83) | 639.1486<br>(2.99) |
| Interaction of GNI/capita and Gini index (*gni_GINI*) | 18.66417<br>(3.20) | -382.5083<br>(-2.68) | -59.87327<br>(-2.69) |
| GNI/capita squared (*gni2*) | -1.718017<br>(-3.69) | 22.6302<br>(2.88) | 9.415814<br>(6.19) |
| Constant | -49. 59284<br>(-1.30) | 1094.073<br>(1.79) | 702.4604<br>(4.51) |
| *N* | 43 | 43 | 43 |
| $R^2$ | 0.81 | 0.66 | 0.87 |
| *F*-statistic | 48.15 | 57.40 | 27.22 |
| Breusch-Pagan test $\chi^2(1)$<br>*p*-value | 3.36<br>0.0667 | 4.84<br>0.0278 | 13.36<br>0.0003 |
| Ramsey RESET *F*(3, 34)<br>*p*-value | 4.62<br>0.0081 | 3.91<br>0.0169 | 7.13<br>0.0008 |
| White Test $\chi^2(5)$<br>*p*-value | 11.24<br>0.0468 | 12.66<br>0.0268 | 8.76<br>0.1192 |

*Note*: *t*-statistics reported in parentheses, based on (White/Huber) heteroskedasticity robust standard errors.

Results of the testing reveal that bonding social capital is a weak predictor of all three health outcomes examined. Not only does it present with very low *t*-scores, but also has a positive coefficient to it when infant mortality rates are inspected, implying that an increase in social capital is associated with a gain in infant mortality (although still insignificant). Contrary to bonding social capital, *neomaterial* proxies behave as robust determinants of all three health outcomes. Particularly strong associations are discovered between GNI/capita and health, while Gini coefficient also maintains its significance and expected coefficient sign across all models. Extremely high values on coefficients for Gini might become misleading. One should bear in mind that this variable only adopts values between 0 and 1. A negative significant coefficient for GNI/capita squared confirms non-linear effects of absolute income distribution on health. An interaction of absolute and relative income presents with a significant positive coefficient when

life expectancy is examined and negative, while still significant when mortality rates are looked at, which is consistent with initial expectations.

The *R*-squared for the model of life expectancy is 81%, suggesting that the selected set of independent variables explains 81% of variation in the outcome. When *neomaterial* indicators are removed from the model and it is re-run with only bonding social capital as a predictor, $R^2$ drops dramatically to 9%, suggesting the weak explanatory power of social capital which now presets as a significant determinant of life expectancy in this unreasonably reduced model. Most of the explanatory power stems from GNI/capita, which alone is responsible for 72% of variation in life expectancy. With respect to adult mortality, full model explains 66% of its variation. When *neomaterial* indicators are removed, the coefficient of determination plunges to 8%, presenting bonding social capital with a significant negative coefficient this time. Similarly to the case with life expectancy, GNI/capita is a major predictor of adult mortality, explaining 52% of variation in the dependent variable. Full model explains 87% of total variation in infant mortality rates. 68% of that is exclusively attributed to GNI/capita. Alone, bonding social capital claims only 3% of variation in IMR; contrary to the other two reduced models it is still insignificant at a 5% level.

Interpreting coefficients from the presented models is a challenging task. In order to facilitate it a little bit, elasticities for independent variables from the full models are reported. They are evaluated at the sample means of the independent variables and are reported for the predicted values of the dependent variables. Calculating elasticities at the "point of the means" is the most common way, since it is a representative point on the regression line (Adkins & Carter Hill, 2008).

Table 5. Elasticities of independent variables evaluated at sample means for the predicted values of outcome variables

| Independent Variables | Dependent Variables | | |
|---|---|---|---|
| | Predicted Life Expectancy (71.604651) | Predicted Adult Mortality (174.34884) | Predicted IMR (24.093023) |
| Bonding Social Capital (*trust_pers*) | 0.0026436<br>(0.16) | -0.0542038<br>(-0.47) | 0.1381333<br>(1.13) |
| Log of GNI/capita (*ln_gni)* | 3.919254<br>(3.78) | -17.52651<br>(-2.35) | -63.41275<br>(-5.65) |
| Gini Coefficient (*GINI)* | -1.083925<br>(-3.39) | 8.875978<br>(2.90) | 10.24735<br>(2.88) |
| Interaction of GNI/capita and Gini index (*gni_GINI*) | 0.9200701<br>(3.20) | -7.744177<br>(-2.69) | -8.771931<br>(-2.59) |
| GNI/capita squared (*gni2*) | -2.06545<br>(-3.73) | 11.17372<br>(2.62) | 33.64302<br>(6.13) |

*Note*: *z*-statistics are reported in parentheses

*Analyzing Bridging Social Capital*

Similar type of analysis is performed for bridging social capital and its potential associations with three types of health outcomes after also being controlled for *neomaterial* constructs. Prior to running linear regressions, correlations between independent variables are evaluated bivariately. Bridging social capital doesn't seem to be strongly or even partially correlated with any of the independent variables used in the second set of models. Recall that bonding social capital presented with quite strong (0.4) associations with *neomaterial* indicators, which is hardly the case with bridging. Other correlations have already been analyzed, since the model is identical to the one presented earlier, with the exception of bonding social capital being now replaced by bridging.

Table 6. Pairwise correlations of independent variables included in models presented in Table 7:

| Social Capital Variable | Correlation Coefficient | p-value, 95% |
|---|---|---|
| *trust_rel - ln_gni* | -0.1117 | 0.4757 |
| *trust_rel - GINI* | -0.1143 | 0.4653 |
| *trust_rel - gni_GINI* | -0.1832 | 0.2396 |
| *trust_rel - gni2* | -0.0822 | 0.6003 |
| *GINI - ln_gni* | -0.2733 | 0.0761 |
| *gni_GINI - ln_gni* | 0.1865 | 0.2311 |
| *gni2 - ln_gni* | 0.9978 | 0.0000 |
| *gni_GINI - GINI* | 0.8908 | 0.0000 |
| *gni2 - GINI* | -0.3002 | 0.0505 |
| *gni2- gni_GINI* | 0.1573 | 0.3137 |

Table 7. Linear regression results. Bridging social capital and health outcomes (controlled for *neomaterial* indicators)

| Independent Variables | Dependent Variables | | |
|---|---|---|---|
| | Life Expectancy | Adult Mortality | IMR |
| Bridging Social Capital (*trust_rel*) | -0.1592859<br>(-1.20) | 2.275332<br>(1.13) | 0.6495367<br>(1.90) |
| Log of GNI/capita (*ln_gni)* | 24.42083<br>(3.04) | -235.5677<br>(-2.19) | -147.1713<br>(-5.23) |
| Gini Coefficient (*GINI)* | -183.42083<br>(-2.67) | 3723.608<br>(2.25) | 591.8035<br>(3.12) |
| Interaction of GNI/capita and Gini index (*gni_GINI*) | 16.85716<br>(2.38) | -352.102<br>(-2.07) | -55.29653<br>(-2.76) |
| GNI/capita squared (*gni2*) | -1. 341493<br>(-2.88) | 16.54005<br>(2.01) | 8.312915<br>(5.94) |
| Constant | -25. 25707<br>(-0.65) | 708.7143<br>(1.10) | 626.1547<br>(4.22) |
| *N* | 43 | 43 | 43 |
| $R^2$ | 0.81 | 0.67 | 0.88 |
| *F*-statistic | 62.83 | 63.41 | 35.87 |
| Breusch-Pagan test $\chi^2(1)$ | 2.24 | 5.10 | 9.38 |
| *p*-value | 0.1343 | 0.0240 | 0.0022 |
| Ramsey RESET *F*(3, 34) | 6.91 | 5.22 | 6.26 |
| *p*-value | 0.0009 | 0.0045 | 0.0017 |
| White Test $\chi^2(5)$ | 12.43 | 13.52 | 6.66 |
| *p*-value | 0.0293 | 0.0189 | 0.2473 |

*Note*: *t*-statistics reported in parentheses, based on (White/Huber) heteroskedasticity robust standard errors.

Testing does not reveal significant associations between bridging social capital and health outcomes after being controlled for absolute and relative income distribution. The only exception is the model with infant mortality rates as dependent variable, where bridging social capital presents with a coefficient nearly approaching significance. However, the signs for bridging social capital's coefficients are unexpectedly negative in case with life expectancy and positive in case with adult and infant mortality, suggesting a detrimental effect of bridging social capital on health (although still insignificant at a 5% level). *Neomaterial* proxies appear with coefficients consistent with the previous set of models. Their *t*-values decrease slightly, compared with the first set, but the bottom line is still social capital's failure to present as a robust predictor of health outcomes after being controlled for absolute and relative incomes and the strength of the latter indicators as predictors of health outcomes.

Two of the specification tests aimed at discovering heteroskedasticity were first performed in models *without* robust standard errors. Both Breusch-Pagan (except the model with life expectancy) and White indicated the presence of heteroskedasticity. To fix it, option *robust* was added to the regression command in order to obtain heteroskedasticity-consistent standard errors. *T*-scores reported in parentheses are based on these robust SE's. Ramsey's RESET is approaching desirable values. Recall that conducting White test manually revealed the need for including additional interactions in the models, but when this was done, multicolinearity became unbearable. As a result, some interactions were dropped, spurring the critical values for RESET and suggesting that there are indeed some omitted variables in the models.

The *R*-squared for the model of life expectancy is 81%. When *neomaterial* indicators are removed from it and it is re-run with only bridging social capital as a predictor, $R^2$ drops to 7%; social capital persists as the insignificant determinant of life expectancy even in such unreasonably reduced model. Most of the explanatory power stems from GNI/capita, which alone is responsible for 72% of variation in life expectancy. With respect to adult mortality, the full model explains 67% of its variation. When *neomaterial* indicators are removed, the coefficient of determination plunges to 6% and bridging social capital still lacks significant associations with adult mortality, although being its sole predictor. Similarly to prior models, GNI/capita is a major predictor of adult mortality, explaining 52% of variation in the dependent variable. The full model explains 88% of total variation in infant mortality rates. 68% of it is exclusively attributed to GNI/capita. Alone, bridging social capital claims only 9% of variation in IMR and similarly to the other two reduced models is still insignificant at a 5% level.

Table 8. Elasticities of independent variables evaluated at sample means for the predicted values of outcome variables

| Independent Variables | Dependent Variables | | |
|---|---|---|---|
| | Predicted Life Expectancy (71.604651) | Predicted Adult Mortality (174.34884) | Predicted IMR (24.093023) |
| Bridging SocialCapital (*trust_rel*) | -0.0160217<br>(-1.20) | 0.0939936<br>(1.15) | 0.1941714<br>(1.92) |
| Log of GNI/capita (*ln_gni)* | 3.141831<br>(3.08) | -12.44688<br>(-2.19) | -56.27242<br>(-5.10) |
| Gini Coefficient (*GINI)* | -0.991291<br>(-2.67) | 8.24985<br>(2.29) | 9.488278<br>(2.96) |
| Interaction of GNI/capita and Gini index (*gni_GINI*) | 0.8309919<br>(2.38) | -7.128579<br>(-2.08) | -8.1014<br>(-2.64) |
| GNI/capita squared (*gni2*) | -1.612781<br>(-2.92) | 8.166689<br>(2.01) | 29.70232<br>(5.57) |

*Note*: *z*-statistics are reported in parentheses

*Analyzing Vertical Social Capital*

Associations between vertical social capital and health outcomes were investigated in ways similar to exploring bonding and bridging social capital. Bivariate correlations among independent variables were evaluated prior to including them into multivariate linear regression models. Contrary to bonding social capital which was positively correlated with GNI/capita, vertical social capital was negatively associated with absolute income distribution. The finding is somewhat expected, since richer societies have a tendency to be more critical of their governments. Another partial correlation was discovered between vertical social capital and GNI/capita squared. Other correlations involving vertical social capital were weak. The rest of the correlations have already been evaluated in the first description of the procedure, and will not be discussed here once again. Regression results are presented in Table 10 and follow next.

Table 9 Pairwise correlations of independent variables included in models presented in Table 10

| Social Capital Variable | Correlation Coefficient | p-value, 95% |
|---|---|---|
| *conf_gvt - ln_gni* | -0.3090 | 0.0438 |
| *conf_gvt - GINI* | 0.2588 | 0.0938 |
| *conf_gvt - gni_GINI* | 0.1129 | 0.4709 |
| *conf_gvt - gni2* | -0.3132 | 0.0409 |
| *GINI - ln_gni* | -0.2733 | 0.0761 |
| *gni_GINI - ln_gni* | 0.1865 | 0.2311 |
| *gni2 - ln_gni* | 0.9978 | 0.0000 |
| *gni_GINI - GINI* | 0.8908 | 0.0000 |
| *gni2 - GINI* | -0.3002 | 0.0505 |
| *gni2- gni_GINI* | 0.1573 | 0.3137 |

Table 10. Linear regressions results. Vertical social capital and health outcomes (controlled for *neomaterial* indicators)

| Independent Variables | Dependent Variables | | |
|---|---|---|---|
| | Life Expectancy | Adult Mortality | IMR |
| Vertical Social Capital (*conf_gvt*) | 0. 0493852<br>(1.18) | -0.9481083<br>(-1.44) | 0.1284745<br>(1.00) |
| Log of GNI/capita (*ln_gni)* | 29.83991<br>(3.55) | -311.2661<br>(-2.61) | -169.7833<br>(-5.08) |
| Gini Coefficient (*GINI)* | -212.899<br>(-3.57) | 4203.873<br>(3.42) | 691.4238<br>(2.48) |
| Interaction of GNI/capita and Gini index (*gni_GINI*) | 19.72668<br>(3.35) | -398.946<br>(-3.29) | -65.23894<br>(-2.25) |
| GNI/capita squared (*gni2*) | -1.689992<br>(-3.72) | 21.47863<br>(3.04) | 9.745922<br>(5.92) |
| Constant | -47.49497<br>(-1.15) | 1021.267<br>(1.81) | 718.3707<br>(3.95) |
| *N* | 43 | 43 | 43 |
| $R^2$ | 0.81 | 0.68 | 0.87 |
| *F*-statistic | 61.47 | 87.80 | 28.06 |
| Breusch-Pagan test $\chi^2(1)$ | 3.08 | 4.80 | 18.04 |
| *p*-value | 0.0794 | 0.0285 | 0.0000 |
| Ramsey RESET *F*(3, 34) | 3.77 | 2.43 | 5.61 |
| *p*-value | 0.0194 | 0.0817 | 0.0031 |
| White Test $\chi^2(5)$ | 13.22 | 13.59 | 13.72 |
| *p*-value | 0.0214 | 0.0185 | 0.0175 |

*Note*: *t*-statistics reported in parentheses, based on (White/Huber) heteroskedasticity robust standard errors.

Regression results reveal already familiar patterns: the indicator of social capital (vertical social capital this time) displays weak associations with all three health outcomes after *neomaterial* proxies are also being controlled for. Coefficient signs on vertical social capital follow the trend of bonding constructs: they are consistent with expectations when life expectancy and adult mortality are examined, but unexpectedly contradict expectations when IMR's are evaluated and suggest that increasing confidence in government spurs infant mortality rates (although without any significant effect). The rest of *neomaterial* indicators and their transformed variables present with significant and logical coefficients. The relationship seems to be particularly strong in the model with infant mortality rate as the dependent variable.

The *R*-squared for the full model of life expectancy is the familiar 81%, suggesting that the selected set of independent variables explains 81% of variation in the outcome. When

*neomaterial* indicators are removed from the model and it is re-run with only vertical social capital as the predictor, $R^2$ drops to stunning 5%, suggesting the weak explanatory power of social capital which continues as the insignificant determinant of life expectancy even in such unreasonably reduced model. Most of the explanatory power stems from GNI/capita, which alone is responsible for 72% of variation in life expectancy; Gini index alone claims about 14%. With respect to adult mortality, the full model explains 68% of its variation. When *neomaterial* indicators are removed, the coefficient of determination plunges to 2%, with vertical social capital still as an insignificant predictor of adult mortality. Similarly to the case with life expectancy, GNI/capita is a major predictor of adult mortality, explaining 52% of variation in the dependent variable. Another 15% is attributed to Gini coefficient. The full model explains 87% of total variation in infant mortality rates. 68% of it is exclusively attributed to GNI/capita. Alone, vertical social capital claims only 4% of variation in IMR and just like the two other reduced models is still insignificant at 5% level. Gini index is responsible for 8% of variation in infant mortality.

Table 11. Elasticities of independent variables evaluated at sample means for the predicted values of outcome variables

| Independent Variables | Dependent Variables | | |
|---|---|---|---|
| | Predicted Life Expectancy (71.604651) | Predicted Adult Mortality (174.34884) | Predicted IMR (24.093023) |
| Vertical SocialCapital (*conf_gvt*) | 0.0320948 (-1.18) | -0.2530565 (-1.44) | -0.2481442 (-0.99) |
| Log of GNI/capita (*ln_gni)* | 3.839016 (3.57) | -16.44661 (-2.40) | -64.91833 (-5.34) |
| Gini Coefficient (*GINI)* | -1.148507 (-3.56) | 9.313902 (3.54) | 11.08547 (2.43) |
| Interaction of GNI/capita and Gini index (*gni_GINI*) | 0.9724477 (3.36) | -8.076972 (-3.30) | -9.558045 (-2.20) |
| GNI/capita squared (*gni2*) | -2.031757 (-3.74) | 10.60513 (2.79) | 34.8225 (6.13) |

*Note*: *z*-statistics are reported in parentheses

*Analyzing Generalized Trust*

Analysis of associations between generalized trust and health outcomes concludes the section on Results. Recall that the indicator of generalized trust is not in-tune with the theory of bonding, bridging, and vertical social capital that is being explicitly tested in this study. Instead, it is more of a general proxy for social capital that received wide prior utilization in other academic studies in the field. The intent here is to re-evaluate prior findings employing this indicator using the most recent data, and observe whether the new approach to measuring social capital presented in this study could yield more conclusive results than the mainstream method.

Traditionally, analysis starts by evaluating bivariate correlations of independent variables included in the last set of models. Correlation matrix below resembles that of bonding social capital a lot (Table 3): social capital is correlated with both *neomaterial* proxies, inspiring a thought of partial endogeneity of social cohesion to economic conditions in the country. Correlation with Gini coefficient is of particular interest, as it reminds of Wilkinson's (1994) claims and later Kawachi's findings suggesting that income inequality leads to disinvestment in social capital, with the latter then exerting its negative influence over population health. Although correlation matrix is far from being a tool for a path-analysis, it still reveals the possibility of dynamics outlined by Wilkinson and later confirmed by Kawachi. The rest of the correlations are quite expected and have been discussed earlier on.

Table 12 Pairwise correlations of independent variables included in models listed in Table 13

| Social Capital Variable | Correlation Coefficient | p-value, 95% |
|---|---|---|
| *trust_most - ln_gni* | 0.3151 | 0.0396 |
| *trust_most - GINI* | -0.4270 | 0.0043 |
| *trust_most - gni_GINI* | -0.2934 | 0.0562 |
| *trust_most - gni2* | 0.3329 | 0.0291 |
| *GINI - ln_gni* | -0.2733 | 0.0761 |
| *gni_GINI - ln_gni* | 0.1865 | 0.2311 |
| *gni2 - ln_gni* | 0.9978 | 0.0000 |
| *gni_GINI - GINI* | 0.8908 | 0.0000 |
| *gni2 - GINI* | -0.3002 | 0.0505 |
| *gni2- gni_GINI* | 0.1573 | 0.3137 |

Table 13. Linear Regressions. Generalized trust and health outcomes (controlled for *neomaterial* indicators)

| Independent Variables | Dependent Variables | | |
|---|---|---|---|
| | Life Expectancy | Adult Mortality | IMR |
| Generalized Trust (*trust_most*) | 0.0782338<br>(1.76) | -0.7166525<br>(-0.96) | -0.3481563<br>(-2.65) |
| Log of GNI/capita (*ln_gni)* | 32.23168<br>(4.00) | -336.6706<br>(-2.58) | - 179.7834<br>(-5.97) |
| Gini Coefficient (*GINI)* | - 202.5682<br>(-3.50) | 3978.562<br>(2.85) | 669.5175<br>(2.67) |
| Interaction of GNI/capita and Gini index (*gni_GINI*) | 19.25204<br>(3.37) | -382.639<br>(-2.74) | -65.32929<br>(-2.49) |
| GNI/capita squared (*gni2*) | -1.843867<br>(-3.97) | 22.96905<br>(2.85) | 10.4158<br>(6.77) |
| Constant | -58.34772<br>(-1.56) | 1131.114<br>(1.84) | 764.7465<br>(4.74) |
| *N* | 43 | 43 | 43 |
| $R^2$ | 0.82 | 0.67 | 0.89 |
| *F*-statistic | 65.23 | 75.69 | 32.74 |
| Breusch-Pagan test $\chi^2(1)$<br>*p*-value | 2.51<br>0.1128 | 4.28<br>0.0386 | 17.32<br>0.0000 |
| Ramsey RESET *F*(3, 34)<br>*p*-value | 3.23<br>0.0344 | 3.68<br>0.0213 | 2.94<br>0.0471 |
| White Test $\chi^2(5)$<br>*p*-value | 12.15<br>0.0328 | 13.13<br>0.0222 | 14.59<br>0.0123 |

*Note*: *t*-statistics reported in parentheses, based on (White/Huber) heteroskedasticity robust standard errors.

Coefficients for generalized trust appear with reasonable signs in all three models, which hasn't been the case when alternative social constructs were evaluated earlier. This certainly plays to the advantage of generalized trust as an indicator. Moreover, unlike previous social capital proxies, generalized trust presents as a robust predictor of infant mortality rates and nearly approaches significance in case with life expectancy. Consistent with previous models, *neomaterial* indicators continue to exert strong effects over all three health outcomes with the effects being the most pronounced in the model with infant mortality rates as the dependent variable.

The *R*-squared for the full model of life expectancy is 82%. When *neomaterial* indicators are removed from the model and it is re-run only with generalized trust as the sole predictor, $R^2$ decreases to 14%. Although the drop isn't as impressive as in three other cases (below 10%), it

still points out obvious weakness of the social capital indicator. When used as the sole predictor of longevity, generalized trust presents with a positive coefficient significant at a 5% level. With respect to adult mortality, the full model explains 67% of its variation. When *neomaterial* indicators are removed, the coefficient of determination changes to 11%. Again, the magnitude of the drop is a bit less impressive than in the other three cases, yet still quite dramatic. The coefficient for generalized trust in the simple model becomes significant at 5% and presents with a negative sign suggesting a reverse relationship between generalized trust and adult mortality. The full model explains 89% of total variation in infant mortality rates. When *neomaterial* indicators are removed and a simple linear regression is estimated with generalized trust as the predictor, $R^2$ declines to 13%. As in the other two reduced models with generalized trust, obtained coefficient is significant at 5% and presents with an expected logical sign, implying a negative relationship between generalized trust and infant mortality. *Neomaterial* indicators preserve their strong associations with health outcomes already identified in previous models.

Table 14. Elasticities of independent variables evaluated at sample means for the predicted values of outcome variables

| Independent Variables | Dependent Variables | | |
|---|---|---|---|
| | Predicted Life Expectancy (71.604651) | Predicted Adult Mortality (174.34884) | Predicted IMR (24.093023) |
| Generalized Trust (*trust_most*) | 0.0286104 (1.76) | -0.1076365 (-0.94) | - 0.3784015 (-2.61) |
| Log of GNI/capita (*ln_gni)* | 4.146725 (4.03) | -17.78893 (-2.35) | -68.74198 (-6.33) |
| Gini Coefficient (*GINI)* | -1.092776 (-3.49) | 8.814715 (2.92) | 10.73425 (2.66) |
| Interaction of GNI/capita and Gini index (*gni_GINI*) | 0.9490498 (3.37) | -7.746823 (-2.74) | -9.571282 (-2.47) |
| GNI/capita squared (*gni2*) | -2.21675 (-4.00) | 11.34103 (2.60) | 37.216 (7.18) |

*Note*: *z*-statistics are reported in parentheses

To conclude, indicators of bonding, bridging, and vertical social capital appeared as weak determinants of health outcomes. Results on bridging social capital have been particularly disturbing, as they presented with coefficient signs contradicting the primary theory. Generalized trust, on the other hand, performed as a stronger construct, not only consistent with expectations across all three models, but also significant in the specification with IMR as the outcome, even after being controlled for *neomaterial* indicators. GNI/capita and Gini coefficient presented with significant coefficients across all sets of models. Explanatory power of absolute income was particularly strong, oftentimes exceeding half of the total variation in the outcome variables. The following chapter elaborates more on these findings and their implications as well as future research avenues.

# Discussion

The study presented the analysis of life expectancy, adult and infant mortality in 43 countries. Two theories with competing ideas regarding the importance of socioeconomic factors for health status were tested for associations with national health. The theory of social capital suggests that indicators of bonding, bridging and vertical social capital should perform as robust determinants of health outcomes, while the *neomaterial* camp asserts that the bulk of the effect should come from structural determinants behind absolute and relative deprivation. Results revealed weak explanatory power of social capital indicators for national health outcomes when *neomaterial* constructs had been also controlled for in the models. Traditional indicator of social capital (generalized trust) has been re-examined as well, in light of the up-to-date data available to the study. Results revealed a somewhat stronger association between the mainstream social capital proxy and health (which was in fact significant when infant mortality was examined). Nevertheless, *neomaterial* constructs were found to be the primary source of variation in all three health outcomes reviewed, thus confirming the *neomaterial* theory.

The most pronounced finding points out the importance of absolute incomes for population health. The result is consistent with previous literature in the field suggesting that overall economic well-being of a country is clearly an important factor in improving health status (Or, 2001). Even the proponents of psychosocial interpretations of health outcomes repeatedly reveal the significance of absolute incomes for health. For instance, Lochner et al. (2001) show strong effects of family income on mortality (by quartile, high to low family income results in relative risks of death of 1.00, 1.52, 2.14, and 2.69, correspondingly).

Another interesting finding reveals the existence of diminishing returns to scale in terms of health for richer countries, which seems to confirm Wilkinson's thesis (1994). Or (2001) has an interesting idea with respect to the pathways through which these diminishing returns might manifest in addition to the already established effect of inequality. In his work, the possible adverse side-effect of rapid economic growth is suggested by the finding of a significantly negative impact of air pollution on health. Although surely debatable, the idea definitely has some appeal and underlying rationale to it (Or, 2001, p. 28). A positive coefficient for the interaction of absolute and relative income distribution implies that health improvements do take place even when a rise in absolute incomes is accompanied with a widening of the gap between the rich and the poor, in part explaining the experience of New Zealand, which witnessed improvements in longevity even in the climate of widening inequality – absolute incomes must have been the primarily decisive factor.

The results for income inequality are consistently significant across the entire spectrum of models and specifications. However, interpreting this finding isn't easy at all, because diverse academic traditions have competing views regarding what it actually means. For Wilkinson and his followers income inequality inevitably entails cognitive processes of social comparison. Low position in the social hierarchy produces negative emotions such as shame and distrust, which are translated into poor health through psycho-neuro-endocrine mechanisms as well as through stress-induced behaviors such as smoking. These negative perceptions are simultaneously channeled into anti-social behaviors and decreased community participation (Pearce & Davey

Smith, 2003). So, income inequality affects health by affecting the way people feel about themselves and others, individual choices they make, and the way they behave as a community.

A competing camp argues that inequality shouldn't be treated as something exogenous; independent of the set of underlying factors like macro-level political and economic processes, class and gender struggles, disinvestment in infrastructure, education or environment. Interpretation of links between health and income inequality should therefore begin with the objective structural causes *behind* inequalities, and not just focus on subjective perceptions of that inequality (Lynch & Davey Smith, 2000, p.1202). An interesting point that the view makes is that an aggregate relationship between income inequality and health isn't always necessary. This relationship in essence depends on the degree to which inequality captures variation in its multiple underlying structural causes. For instance, Ross et al. (2000) have found in Canada that the aggregate-level association between income inequality and health may break down if inequality is less linked to investments in health-related public infrastructure. This can in fact explain the already familiar peculiar case of New Zealand where an increase in inequality was synchronized with improvements in longevity. Apparently inequality there wasn't linked to a significant extent with a wide variety of material conditions, capable of claiming considerable influences over health.

When using the two viewpoints on the role of income inequality for health outcomes to explain *this* study's findings it becomes evident that the first camp has fewer explanations to offer. Should subjective psychosocial responses be as powerful as Wilkinson and colleagues suggest, then the values on social capital (which are among the acclaimed consequences of inequality and the true determinants of health according to Wilkinson) would have been much more substantial and significant than was in fact found in here. Instead, it very much looks like inequality, as presented here, successfully captures a wide array of underlying material factors which are of significant importance to health in the sample of countries reviewed.

Although an appealing and highly contested concept, income inequality still explains little variation in health outcomes. Recall elasticities below 1 in models with life expectancy or *R*-squared values well below 10% in simple specifications where income inequality is the sole determinant of health. Having noticed such dynamics before, Pearce and Davey Smith (2003) criticized health researchers for overselling the effects of inequality and "seeing gold where it does not exist". An example the two authors bring up refers to the already discussed study by Lochner et al. (2001). Having obtained the relative risks of mortality for five groups categorized from low to high inequality as 1.00, 1.08, 1.10, 1.11, and 1.12, compared with relative risks for four groups categorized from high to low income as 1.00, 1.52, 2.14, 2.69, Lochner et al. (2001) still choose to focus on the miniature effects of inequality, which Pearce and Davey Smith (2003) claim can very well be the residual effects of other variables. So, a word of caution needs to be put forward. Although a lot of time can be spent interpreting etiological pathways to and from income inequality in relation to health, it isn't always "time well spent", because the magnitude of the effect is often less than one would probably desire. A better idea would probably be to take a look behind inequality, determine its structural causes and examine them for associations with health instead.

With respect to social capital, things are way less promising. Employing the model of bonding, bridging and vertical social capital advocated by Szreter and Woolcock (2003) and Islam et al. (2006) to explaining health inequalities across countries did not yield significant results. Not only was the effect insignificant, but the actual direction of the effect in certain specifications was simply erratic. What seems to be the case is that the likelihood of discovering a "desirable" association between social capital and health depends on the degree of correlation between social capital construct and absolute income. This explains findings on "generalized trust" (the social capital construct that is correlated with GNI/capita the most) which are in fact significant when IMR is examined. Also, this potentially casts doubt on numerous studies conducted in the U.S. that used social capital indicators as the sole predictors of mortality and health, without controlling for incomes or at least exploring correlations between incomes and social capital. Pearce and Davey Smith (2003) elaborate on the same observation suggesting that weak levels of networks and social involvement surely can be associated with ill health, but the association, rather than being causal, is due to other socioeconomic factors that influence both phenomena (be it absolute income, or the very same factors behind inequality that need to be explored further on).

A few words need to be said regarding this study's contributions to the stock of knowledge on socioeconomic determinants of health across countries. It made a brave attempt to develop a unique, previously unused set of indicators to grasp all three forms of social capital repeatedly outlined in literature. A study by Nogueira from early 2009 claims to employ indicators pinpointing three social capital dimensions as well, however its vertical (linking) indicator only intends to proxy for trust in government, while in this study it is being captured explicitly. Wilkinson's hypothesis regarding non-linear effects of absolute incomes for health has been also put to the test in this study which definitely plays to its gain. Also, exploring correlations between incomes and social capital, improving overall fit by employing interactions, and controlling for *neomaterial* effects prevented obtaining misleading results, with the effects of social capital on health being unreasonably inflated, which has been repeatedly put to criticism by Pearce and Davey Smith (2003). Finally, relying on the most recent wave of the WVS (2009) allows this study to be considered quite timely and up-to-date.

Obviously there are a number of limitations to this study. One of them is inherent in all projects following similar design and refers to the "ecological fallacy", a problem with deducting conclusions about individuals based on aggregated data collected for a group to which those individuals belong. A situation like this doesn't necessarily mean that discovered associations and inferences based on these associations are ultimately invalid. However, it does mean that the process of preparing the data from the World Values Survey used in here can potentially conceal certain variations in individual characteristics not otherwise visible at the aggregate level. Another thing that is in a way related to the "ecological fallacy" is the issue of weighting data and generating valid national estimates for aggregated scores. While some studies claim to have used weights in dealing with WVS data, others suggest using *unadjusted* proportions of respondents agreeing with a certain response alternative as a country score. This project refrains from using weights not only because of time constraints, but also because of some theoretical considerations encountered as a result of investigating the effects of weighting.

Another two limitations have to do with the way social capital is presented in the study. As seen from the background section, social capital is a multifaceted concept. Here, however, it is only restricted to trust. Although trust is arguably the most common manifestation of social capital, accounts of other proxies like perceived helpfulness of others or participation in voluntary organizations are not uncommon in literature. Another thing has to do with the choice of questions intended to capture the forms and dimensions of social capital. It has been stated that this study stands out for its usage of unique items capturing bonding, bridging, and vertical social capital. However, there is an obvious downside of using previously untested constructs. Unfortunately, it becomes especially evident when bridging social capital is considered: coefficient signs on the indicator behave extremely erratically, pointing out potential weakness of the construct. Finally, one shouldn't forget that no inferences about causality should be made based on the analysis presented in the study, since the design employed gives clues about associations only. Stemming from this is the caution regarding reverse causality, especially when generalized trust is significantly associated with some health outcomes. It can very well be the case that improved health causes greater prevalence of trust, but not the other way around. This study, unfortunately, cannot provide a definitive answer to this question, as it only points out associations between independent and outcome variables.

This study has also illuminated a variety of areas that need to be developed deeper in future research in order to advance the knowledge on the role of socioeconomic determinants for health outcomes. Firstly, indicators of bonding, bridging, and vertical social capital need to be re-evaluated at the individual level, so that the ecological fallacy is no longer the issue. Moreover, statistical tools that could not only reveal associations, but also demonstrate the actual causal paths through which inequality or social capital exert their influences over health should be used. Differentiating between levels of economic development can be an interesting thing to do as well, since it allows an even better testing of Wilkinson's hypothesis that suggests that absolute income is of little importance to health in economically advanced societies, while it is extremely decisive in less affluent locations. With respect to *neomaterial* theory, indicators going beyond income inequality, grasping its underlying structural and material causes, need to be developed in order to be entirely consistent with the theory.

To summarize, the study presented ecological analysis of health outcomes measured by life expectancy, adult mortality and infant mortality rates in 43 countries. The theory of social capital and health has been put to the test, and associations between three health outcomes and three forms and dimensions of social capital were explored. *Neomaterial* theory, with its skeptical views on the role of social capital for health has also been integrated in the analysis, and empirical models were controlled for constructs capturing forces behind absolute and relative deprivation. Findings revealed only insignificant associations between social capital and health. The only remedy was the mainstream proxy of "generalized trust" (although inconsistent with the presented theory of social capital and health) that was associated with infant mortality rates. *Neomaterial* constructs, on the other hand, behaved as robust determinants of health outcomes across the full spectrum of models and specifications, with the effects for absolute incomes being the most pronounced. It seems that the volume of material resources available and the ability to access these resources continue to be the primary determinants of population health, rather than the sense of community or trust.

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