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Who Pays Income Inequality's Health Tax?
Toward a Conditional Model of Economic Stratification and Population Health

A Dissertation submitted in partial satisfaction
of the requirements for the degree of

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Sociology

by

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ABSTRACT OF THE DISSERTATION

Who Pays Income Inequality's Health Tax?
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by

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Social epidemiologists contend that economic inequality is an important driver of population health. However, results from empirical research that examines the link between income inequality and population health are equivocal. In this dissertation, I revisit the income inequality-health debate. I develop a model that envisions income inequality as a key component of economic stratification that intersects with positional factors, like socioeconomic status, to influence population health. Drawing empirical evidence from both cross-national, comparative and within-U.S. data, I calculate multiple-imputation fixed effects, Prais-Winston, and hybrid panel estimators to examine who pays income inequality's health tax at the global, country, and individual level.

Findings from the three studies indicate that several factors, including economic development, political exclusion of non-elites, educational attainment, gender, and early-life poverty, interact with income inequality to produce health disparities. The results suggest that income inequality does not act as a sort of pollution from which no one can escape but as a feature of economic stratification reflective of unequal distribution of resources that has a differential impact on health for vulnerable and privileged groups at multiple levels of analysis.

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Introduction

Since Wilkinson's (1992) foundational study, the proposed harmful relationship between income inequality and health (hereafter, the income inequality-health hypothesis) has been subject to empirical scrutiny. Early studies established a negative link between income inequality and population health (James and Cossman 2006). However, as comprehensive data and sophisticated statistical methods became available, studies began to produce contradictory results (e.g., Beckfield 2004; Babones 2008; Torre and Myrskylä 2014). A review of 98 aggregate and multi-level studies finds little support for the income inequality-health hypothesis (Lynch, et al. 2004). Another meta-analysis suggests a modest adverse effect of income inequality on health, however, the results must be interpreted with caution due to the heterogeneity between the reviewed studies (Kondo, et al. 2009). A third meta-analysis illustrates that 83% of global-level studies support the income inequality-health hypothesis (Wilkinson and Pickett 2006). Despite recent claims of a causal relationship between income inequality and health (Pickett and Wilkinson 2015), the hypothesis is far from unequivocal. An exploration of the key debates surrounding it help to elucidate why the hypothesis remains subject to considerable debate.

Key Debates in the Income Inequality-Health Hypothesis

Geographic Level of Analysis

A global focus remains a salient method for examining the hypothesis as Wilkinson (1996) posits that inequality should play a larger role in influencing population health after societies undergo epidemiological transition. His theoretical perspective emphasizes psychosocial determinants of health, which may become more important after basic needs

are met. However, cross-national studies of the income inequality-health hypothesis yield conflicting evaluations with some offering no support (Avendano 2012), others providing qualified support (Pop, et al. 2013; Torre and Myrskylä 2014) and still others that evince stronger support (Herzer and Nunnencamp 2015). However, much of the cross-national work displays considerable variation in terms of methodologies, data sources, and control variables, such that it is not straightforward to compare study results (Torre and Myrskylä 2014). Furthermore, many studies are limited by inadequate data, small sample sizes, and selection and heterogeneity biases (see Mellor and Milyo 2001; Beckfield 2004; Babones 2008 for a discussion).

Support for the hypothesis appears much clearer within the United States (Deaton 2003; Ram 2005; Clarkwest 2008; Hill and Jorgenson 2018), although the geographic level of measurement for income inequality is an important methodological consideration (Chen and Crawford 2012). Deaton and Lubotsky (2003) contend that race is a confounding factor[1] in the inequality-health link in the United States and that no direct relationship exists. However, some research indicates that ethnic heterogeneity is not a significant confounder in the United States (Subramanian and Kawachi 2003a; Subramanian and Kawachi 2003b, 2004; Ram 2005; Ash and Robinson 2009).

Thus, geographic scale is an important consideration in any examinations of the hypothesis. Cross-national, comparative studies deliver the benefit of investigating the income inequality-health hypothesis across diverse societies. This type of research provides ammunition for claims of generalizability, as well as a focus on inequality as a society-level reflection of status hierarchy or differentiation (Wilkinson 1996; Wilkinson and

Pickett 2006; Pickett and Wilkinson 2015). By contrast, focusing on one nation or regions within a nation often allows for a more detailed examination, allowing for an examination of factors like ethnic heterogeneity and regional effects (Subramanian and Kawachi 2004; Pickett and Wilkinson 2015).

Mechanisms of Action

The key mechanisms through which income inequality are presumed to harm health are subject to debate. However, the primary intervening mechanisms include low social status (Wilkinson and Pickett 2009a; 2009b; Wilkinson 1999), underinvestment in public goods (Lynch and Kaplan 1997), and erosion of social cohesion and trust (Wilkinson 1997; Kawachi, et al. 1997). These narratives refer to one of two types of pathways: integrationist and neo-materialist pathways.

Social integration mechanisms focus on social comparisons that arise out of relative status positions. These comparisons, which are intensified by factors like conspicuous consumption, cause stress and anxiety which harms health (Wilkinson 1999; Wilkinson and Pickett 2009a; Wilkinson and Pickett 2017). Status differentiation becomes more important in unequal societies because less capability for social mobility exists (Wilkinson and Pickett 2017). These comparison processes erode trust and social cohesion due to the focus on individualism, which also influences population health in negative ways (Kawachi, et al. 1997; Kawachi, et al. 1999; Wilkinson and Pickett 2017).

In these pathways, the psychosocial experience of inequality in the form of depression, shame, and anxiety are the paramount factors that lead to poorer health behaviors, such as smoking or drinking (Lynch, et al. 2004). They are neo-Durkheimian in character because their ultimate focus is on social disintegration and its relationship to health (Muntaner and Lynch 1999).

Neo-materialist narratives minimize psychosocial pathways in favor of material ones. Income inequality is the result of historical, cultural, and political-economic processes that influence individuals' access to resources (e.g., access to technological innovation, medical care, etc.) and shape the availability of public goods that support health (e.g., health services, environmental regulation, welfare-states, etc.) (Lynch, et al. 2004; Singh, et al. 2016; Bor, Cohen, and Galea 2017). While neo-material theorists presume reciprocity between the psychosocial and material pathways (see Lynch and Kaplan 1997), material concerns, rather than the psychosocial experience of inequality, are most salient. Neo-materialists contend that psychosocial approaches downplay the structural causes of income inequality (Muntaner and Lynch 1999), while integrationists argue that distribution of material resources like public health expenditures play little or no mediating role in the relationship between income inequality and health (Pickett and Wilkinson 2015; Elgar 2010; Layte 2012).

Aggregate versus Individual-Level Studies

Wilkinson's (1992) original study utilizes population-level data. An important critique of the income inequality-health hypothesis is that any observed effect may actually be a "statistical artifact" of the relationship between absolute income and health. The

association between absolute income and population health has a concave shape, meaning that there are diminishing marginal returns to health with incremental gains in income. For example, if someone provided a $2,000 health expenditure to a person at the bottom of the income distribution, it will have larger consequences for their health than allocating $2,000 in health expenditure for an individual at the top of the income distribution. After a reaching a tipping point in the income distribution, absolute income ceases to garner meaningful advances to health. Thus, unequal societies appear to have worse health than equal societies due to this income polarization (Gravelle 1998; Subramanian and Kawachi 2004; Jen, Jones, and Johnston 2009a; 2009b). However, this narrative is contested, as some have demonstrated a harmful effect of inequality on health even after accounting for individual income (Kennedy, et al. 1998; Wolfson, et al. 1999; Blakely and Wilson 2006). As Deaton (2003: 118) states:

> The usage [of the term artifact] is designed to distinguish it from mechanisms in which income inequality has a direct effect on individual health, but it is unfortunate in suggesting that there is no real link between income inequality and health, and that redistributive policy cannot improve average population health. This is far from the case; if income causes health, and if there are diminishing returns, redistribution from rich to poor will improve average population health.

Perhaps more pressing than the artefactual narrative is that while recent ecological studies suggest the existence of an effect of inequality on *population* health (e.g., Torre and Myrskylä 2014; Herzer and Nunnencamp 2015; Curran and Mahutga 2018), ecological studies focus on only on average health outcomes. They provide an important view of income inequality's effect on societal-level health, but they are unable to examine the extent to which inequality influences health disparities by social position, resulting in

reduced, improved, or null effects on health *on average*. For example, it is unknown whether or not similar causal mechanisms generate both income inequality's negative effect on health and the socioeconomic gradient in health (see Beckfield, Olafsdottir, and Bakhtiari 2013; Truesdale and Jencks 2016 for a discussion). Ecological examinations will not yield insight into this question because it requires data about social position within a society. Wilkinson and Pickett (2008) posit that health disparities may be related to material living standards, while income inequality may reflect a psychosocially-mediated effect of social comparisons. Their findings show that mortality rates associated with county income are more strongly associated with income inequality and that state income inequality steepens certain mortality gradients. However, they examine this hypothesis utilizing county- and state-level income data, rather than drawing upon individual-level data to build a comprehensive health gradient. While their findings gesture towards tying together the income inequality-health hypothesis with that of the socioeconomic status-health gradient, they stop short of a full theoretical and empirical integration of these two frameworks.

Timing of Income Inequality Exposure

Income inequality's effect on population heath may not always reflect an instantaneous process (Subramanian and Kawachi 2004; Shi et al. 2004; Zheng 2012; c.f. Lillard et al. 2015). Past work suggests that income inequality may begin exerting influence on individual mortality risk starting five years after exposure, peaking at seven years, and diminishing after 12 years (Zheng 2012).

Other research demonstrates that early-life income inequality has implications for health across the life course (Lillard et al. 2015; Elgar, et al 2017). However, these studies are based on individual-level health outcomes, like mortality risk, self-rated health, psychological distress, and life satisfaction. In cases where population health is measured in the aggregate, such as life expectancy or age-specific mortality, lagged effects are less clear (Torre and Myrskylä 2014; Curran and Mahutga 2018).

Building on the Key Debates

In this dissertation, I build on these debates in the literature in four key ways. First, I illustrate that the mixed results from past cross-national, comparative studies may be driven by a failure to adequately consider economic development as a key moderator. That is, the effect of income inequality on health differs for low-, middle-, and high-income countries, which produces the wide range of results observed in previous work. Second, I subject the key mechanisms to empirical scrutiny by demonstrating that income inequality does not appear to have significant effects on health in higher income countries as predicted by Wilkinson (1996). Third, I integrate the income inequality-health literature with that of the socioeconomic status-health gradient by illustrating that income inequality influences the education-health gradient. Finally, I examine how the effect of early life income inequality (in the United States) on health over the life course varies for those who grew up in poverty versus those who did not, adding an important conditional effect to early life experiences of inequality. In the section that follows, I briefly describe my three empirical chapters, the primary findings from each study, and how each work extends the literature.

Empirical Chapters

Chapter 1: Income Inequality and Population Health: A Global Gradient?[2]

Cross-national empirical research on the link from income inequality to population health produces a range of conflicting conclusions. Income inequality sometimes improves, sometimes harms, and often has no effect on population health. We reconcile these mixed findings by proposing that economic development moderates the relationship between income inequality and health. We estimate fixed effects models with multiple measures of income inequality and population health to examine the degree to which the relationship between income inequality and population health varies with economic development. Consistent with our intervention, we find that development moderates the association between income inequality and two measures of population health, which closely track distinct channels through which inequality is thought to harm population health. Our findings produce two broad generalizations. First, we observe a *global gradient* in the relationship between income inequality and population health whereby the former has worse impacts on the latter in poor countries than in rich ones. Income inequality has a 139.7 to 374.3% more harmful effect on health in poorer than richer countries, a significantly harmful effect in 2.1 to 53.3 percent of countries and 6.6 to 67.6% of the world's population, but no significantly harmful effect in richer countries. Second, our results are consistent with income inequality playing either a *proximate* or *conditional* cause of lower population health, and with both psychological and neo-material mechanisms.

Thus, we suggest future research to identify specific material mechanisms operating at the macro-level, and whether or not these mechanisms interact with psychological processes at the level of individuals.

Chapter 2: Benefitting the Educated? Income Inequality and the Socioeconomic Status Health Gradient

Past research suggests that inequality may strengthen or weaken the effect of income on health, but it leaves unanswered key theoretical and empirical questions about the degree to which inequality shifts the socioeconomic status-health gradient. In this article, I propose that inequality may influence health disparities between resource rich and poor individuals, accounting for the mixed pattern of results in previous literature that examines the relationship between income inequality and individual-level health. I estimate two-way fixed effects linear probability models to examine the degree to which income inequality influences self-rated health disparities by income and education and whether or not economic development or political exclusion deepens the relationship between income inequality and socioeconomic status-health gradients. Consistent with my theorization, my results indicate that inequality strengthens the positive relationship between education and health, such that highly-educated individuals are significantly more likely to report good or excellent health in unequal contexts. Further, political exclusion of socioeconomic groups deepens inequality's moderating effect on the education-health relationship, consistent with a material narrative for the inequality-health hypothesis. My findings produce three broad generalizations. First, health appears to be influenced by both social position at the individual-level *and* income distribution at the country-level. Second,

consistent with previous research, inequality appears to have a *proximate* effect on health via steepening the SES-health gradient. Third, political exclusion of socioeconomic groups has important implications for inequality's effect on outcomes with social gradients, like health.

Chapter 3: Childhood Poverty Deepens the Harmful Effect of Early-Life Income Inequality on Health in Adulthood

Early-life adversity has important implications for health across the life course. Evidence suggests that inequality is related to deleterious outcomes in children and young adults. However, it is less clear the extent to which early-life inequality exposure affects health over the life course, or whether or not childhood socioeconomic disadvantage intensifies these effects. In this article, I expand upon the previous empirical work by examining the lagged and cumulative effects of early-life inequality utilizing data from the Panel Study of Income Dynamics. I also examine the conditional hypothesis that the harmful effect of early-life inequality on health varies by childhood socioeconomic circumstances. I estimate hybrid panel models of early-life income inequality and poverty on three measures of health. My results indicate that the effects of early-life inequality on self-rated health, psychological distress, and activities of daily living varies by childhood socioeconomic context. Early-life inequality has a deleterious effect on health later in life for individuals who characterize themselves as growing up in a poor household. By contrast, early-life inequality has a positive effect on health later in life for those who characterize themselves as either middle- or upper-class. The pattern of results does not suggest an overall pollution effect of early-life inequality on later life health. Instead, early-life inequality appears to

impact differentially those who grew up in poverty versus those who lived in middle- and upper-class households as child. Early-life inequality and poverty operate in tandem to shape later life health in a cumulative inequality process.

Notes

1. Specifically, Deaton and Lubotsky (2003) illustrate that the proportion of Black residents in U.S. states and Metropolitan Statistical Areas explains most of the income inequality-health association.

2. Dr. Matthew C. Mahutga was second author on this chapter.

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Chapter 1: Income Inequality and Population Health: A Global Gradient?

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Abstract

Cross-national empirical research on the link from income inequality to population health produces a range of conflicting conclusions. Income inequality sometimes improves, sometimes harms, and often has no effect on population health. We reconcile these mixed findings by proposing that economic development moderates the relationship between income inequality and health. We estimate fixed effects models with multiple measures of income inequality and population health to examine the degree to which the relationship between income inequality and population health varies with economic development. Consistent with our intervention, we find that development moderates the association between income inequality and two measures of population health, which closely track distinct channels through which inequality is thought to harm population health. Our findings produce two broad generalizations. First, we observe a *global gradient* in the relationship between income inequality and population health whereby the former has worse impacts on the latter in poor countries than in rich ones. Income inequality has a 139.7 to 374.3% more harmful effect on health in poorer than richer countries, a significantly harmful effect in 2.1 to 53.3 percent of countries and 6.6 to 67.6% of the world's population, but no significantly harmful effect in richer countries. Second, our results are consistent with income inequality playing either a *proximate* or *conditional*

cause of lower population health, and with both psychological and neo-material mechanisms. Thus, we suggest future research to identify specific material mechanisms operating at the macro-level, and whether or not these mechanisms interact with psychological processes at the level of individuals.

Keywords

cross-national, economic development, income inequality, population health

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Since Wilkinson's (1992) influential study about the deleterious effects of income inequality on health, researchers have continued to investigate the harmful health effects of inequality, with varied and contentious results. Some studies find such a relationship with deleterious health effects (e.g., Lynch and Kaplan 1997; Kawachi, et al. 1997; Ram 2006) while others do not (e.g., Mellor and Milyo 2001; Deaton 2003; Beckfield 2004). While many studies follow Wilkinson's focus on wealthy countries, others examine both developed and less developed countries with similarly mixed results (e.g., Gravelle, et al. 2002; Babones 2008; Pop, et al. 2013).

In this article, we advance the inequality-health debate by contending that income inequality has different health effects in rich and poor countries. We support this argument by testing for a moderating role of economic development. Based on previous literature, we identify two types of mechanisms linking income inequality to population health. Social integrationist theories posit that psychosocial factors, such as status comparisons, link inequality to poor health outcomes (e.g., Kawachi, et al. 1999; Layte 2012; Pickett and Wilkinson 2015). These theories imply that inequality should have more harmful effects in rich countries where status comparisons are more salient. By contrast, neo-materialist theories propose that material resources like health infrastructure account for inequality's negative relationship with health (e.g., Davey Smith 1996; Muntaner and Lynch 1999; Lynch, et al. 2004). Thus, neo-materialist perspectives suggest that inequality should have more harmful effects in poor countries where poor health infrastructure concentrates health care and healthy behavior among a small elite.

Introduction

An existing cross-national literature points to our intervention, but leaves unanswered the key empirical question about the role of economic development in the income inequality-health link (e.g., Mellor and Milyo 2001; Beckfield 2004; Pop, et al. 2013). Using a sample of countries covering fifty-three years (1960-2013) with wider income inequality coverage than the previous literature, we estimate fixed effects models with interaction terms between income inequality and economic development. In addition to the two standard health outcomes employed in previous literature (infant mortality and life expectancy at birth), we introduce two variables that address problems related to low variation in population health among rich countries, and more closely tap the psychosocial mechanisms proposed by Wilkinson and others, years lived with disability (YLD) per 100,000 due to non-communicable diseases and due to mental health disorders and substance abuse (1990-2013).

Our results suggest that economic development moderates the relationship between income inequality and two of the measures of health: life expectancy at birth and non-communicable disease YLD rate. At the lowest levels of economic development, income inequality has a significant deleterious impact on life expectancy. At the highest levels of economic development, we observe either a positive (life expectancy) or null (non-communicable disease YLD rate) association between inequality and health, but auxiliary analyses show that the former is untenable.

Because we employ alternative sources of Gini, alternative measurements of development and population health, and alternative econometrics, we observe variation in the size of this

global gradient across models. For example, comparing the estimated effect of income inequality at the lowest to the highest level of development, we observe a 139.7% to 374.3% more harmful effect on health at the lowest level of development. We observe a significant coefficient on income inequality indicating a harmful effect in 2.1% to 53.3% of countries and 6.6% to 67.6% of the world's population. In none of our analyses do we observe a harmful effect in more developed countries (e.g., countries with per capita GDP above the 54th percentile). While the pattern of these relationships suggests that material mechanisms may play an important role in the relationship between income inequality and health, our concluding discussion suggests the need for more research. We contend that research that differentiates between income inequality as a *proximate* or truly conditional cause for poor population health will further the literature. We also suggest research examining neo-material mediators and moderators operating at the macro-level and the role of psychosocial mechanisms in poorer countries, and we propose strategies to examine these more directly.

Background

A recent review of studies suggests a causal link between income inequality and health (Pickett and Wilkinson 2015). Several researchers have suggested intervening mechanisms, including low social status (Wilkinson and Pickett 2009a; 2009b; Wilkinson 1999), underinvestment in public goods (Lynch and Kaplan 1997), and erosion of social cohesion and trust (Wilkinson 1997; Kawachi, et al. 1997). These narratives fall into two primary categories: integrationist and neo-materialist.

Social integration mechanisms are rooted in comparisons that arise when people consider their relative status positions. Due to factors like conspicuous consumption, individuals readily discern their relative status and the subsequent comparisons result in stress and anxiety which harms health (Wilkinson 1999; Wilkinson and Pickett 2009a; Wilkinson and Pickett 2017). In more unequal societies, less capability for social mobility exists; therefore, status differentiation becomes more important (Wilkinson and Pickett 2017). Furthermore, these processes erode trust and social cohesion through the focus on individualism, which has important implications for population health (Kawachi, et al. 1997; Kawachi, et al. 1999; Wilkinson and Pickett 2017). These pathways focus on the psychosocial experience of inequality in the form of depression, shame, and anxiety, and how these experiences impact health behaviors, such as smoking or drinking (Lynch, et al. 2004). They have a neo-Durkheimian character in that their ultimate focus is on social disintegration and its relationship to health (Muntaner and Lynch 1999).

The second narrative minimizes the psychosocial pathways in favor of material ones, resulting in a neo-materialist theory of income inequality and health. In one variant, income inequality is the result of historical, cultural, and political-economic processes that influence individuals' access to resources (e.g., access to technological innovation, medical care, etc.) and shape the availability of public goods that support health (e.g., health services, environmental regulation, welfare-states, etc.) (Lynch, et al. 2004; Singh, et al. 2016; Bor, Cohen, and Galea 2017).

The consequences to underinvestment in medical services, education, cultural events, and environmental protections impact the poor disproportionately in countries with high income inequality, which worsens population health (Lynch and Kaplan 1997; Muntaner and Lynch 1999; Bhandari, Newton, and Bernabé 2015).

As we elaborate below, another variant holds that income inequality harms population health only when there is a significant deficit between median incomes and the average cost for effective health care. In this scenario, income inequality matters differently in poor than in rich countries because *relatively* poor individuals in rich countries earn incomes closer to the cost of effective health care than do *relatively* poor individuals in poor countries. Thus, income inequality is either a proximate cause of poor population health, or depends on the absolute incomes of the relatively poor in relation to the average costs of effective health care. While neo-material theorists presume that the psychosocial and material pathways are reciprocal (see Lynch and Kaplan 1997), material concerns, rather than the emotional experience of inequality, are paramount in these pathways. Neo-materialists critique psychosocial approaches as downplaying the structural causes of inequality (Muntaner and Lynch 1999), while integrationists argue that distribution of material resources such as public health expenditures play little or no mediating role in the relationship between income inequality and health (Pickett and Wilkinson 2015; Elgar 2010; Layte 2012).

While recent work makes strong causal claims regarding the health effects of inequality (see Pickett and Wilkinson 2015), the cross-national empirical track record of these effects is mixed in both research design and findings. One meta-analysis finds that 83% of international-level studies support the income inequality-health link (Wilkinson and Pickett 2006), while another concludes that there is little evidence of a direct effect (Lynch, et al. 2004). Previous cross-national work displays considerable variation in terms of methodologies, data sources, and control variables, such that comparing findings across these studies is not a straightforward exercise (Torre and Myrskylä 2014). Furthermore, many of these studies are limited by inadequate data, small sample sizes, and selection and heterogeneity biases (see Mellor and Milyo 2001; Beckfield 2004; Babones 2008 for a discussion).[1] More recent work takes steps to ameliorate these problems. Results from these studies are not conclusive. Some offer no support (Avedano 2012), others offer qualified support (Pop, et al. 2013; Torre and Myrskylä 2014) and still others suggest contrarian evidence (Herzer and Nunnencamp 2015).

A key to these mixed findings may lie in the fact that income inequality has different effects on health in countries at different levels of development. Economic resources play an important role in health outcomes (Pritchett and Summers 1996; Deaton 2003). If true, we would expect to observe no effect in studies that combine countries at various levels of economic development (e.g., Gravelle, et al. 2002; Beckfield 2004; Babones 2008). Depending on ***how*** the effect of inequality varies by development, we might expect to observe positive, negative, or null effects in studies that focus on countries at particular levels of development (e.g., Hajebi and Javad Razmi 2014; Torre and Myrskylä 2014;

Herzer and Nunnencamp 2015). Thus, a crucial part of the story may be that a country's economic resources, or lack thereof, impact the relationship between income inequality and health.

Development and the Inequality-Health Effect

We propose a partial explanation for varied findings in the literature—inequality may have different effects in poor and rich countries. Indeed, both integrationist and neo-materialist approaches suggest as much, but reach very different conclusions with respect to direction. Narratives that focus on social integration contend that the link between income inequality and health may be stronger in high-income countries. Here, social factors are presumed to become stronger determinants of health after countries undergo an epidemiological transition. When basic human needs are met, individuals are more likely attend to status comparisons that erode health (see Wilkinson 1996 for a discussion). Therefore, one might expect income inequality to have more harmful effects on population health in rich countries. Moreover, psychosocial mechanisms have implications for both non-communicable diseases and mental illnesses (Kawachi, et al. 1999; Pickett and Wilkinson 2010; 2015; Lago, et al. 2018). Thus, we might observe even larger relative differences in the effect of income inequality and population health between rich and poor countries when considering these types of health outcomes. That is, the integrationist approach suggests:

H_1: Income Inequality harms population health more in rich than in poor countries.

By contrast, neo-materialist perspectives suggest that income inequality may have a more serious effect on health in poorer countries. Poor residents of high-income countries may

experience less severe negative impacts of income inequality on health for several reasons. First, they enjoy larger provisions for public services and greater administrative capacity, on average, than do the poor in poor countries (Anand and Ravallion 1993; Elo 2009; Pop, et al. 2013). Poorer countries with high income inequality may invest less in public goods; however, unlike high-income countries with high income inequality, they lack the economic and administrative resources to maintain infrastructure for all. The majority of the burden of health care costs falls on the household in low- and middle-income countries, as public spending on health is often incomplete or absent (Mills 2014). In low- and middle-income countries, only the rich have access to resources that improve health because no safety nets exist for the poor.

Second, poor*er* individuals in poor countries possess far fewer economic resources than do poor*er* individuals in rich countries (Korzeniewicz and Moran 2009). Thus, even in the presence of minimal health infrastructure, poorer individuals in poor countries will have fewer surplus resources to spend on health care than their counterparts in rich countries. In this scenario, the relationship between income inequality and population health is a conditional one. Income inequality only harms population health when the incomes of the relatively poor are inadequate in relation to the average cost of effective health care. In short, neo-materialists suggest income inequality is related to disinvestment in public goods, the lack of democratic institutions, or the deficit between surplus incomes and effective health care among the poor rather than psychosocial factors. In each case, one would expect a more harmful impact of inequality on population health in poor than in rich

countries (e.g., Davey Smith 1996; Muntaner and Lynch 1999; Lynch, et al. 2004). That is, the neo-materialist perspective suggests that:

H_2: Income Inequality harms population health more in poor than in rich countries.

While little empirical work makes a strong case for a conditional effect of inequality on health, some results suggest as much. For example, some researchers divide countries into developmental groups and estimate regressions separately. These scholars then make descriptive comparisons of the association between income inequality and health across these developmental groups. But even these suggestive results are mixed. When only low- and middle-income countries are considered in the analysis, the results illustrate either a positive relationship (e.g., Pulok 2012) or a negative one (e.g., Hajebi and Javad Razmi 2014). Pop, et al. (2013) find conflicting results in a hybrid model where Gini enters as both a country-mean and a country-mean-deviated covariate. The former produces a significantly negative association between inequality and life expectancy in low- and middle-income countries, but no significant impact in high-income countries. The latter produces a significantly positive effect in poor countries, but no effect in middle and high-income countries.[2] Herzer and Nunnencamp (2015) find evidence of a positive association between income inequality and life expectancy in high-income countries and a negative association between income inequality and life expectancy for low-income countries.[3]

While the practice of dividing samples of countries into income thresholds can provide suggestive evidence for variation in the association between inequality and health across developmental strata, it has several limitations. First, the income group classifications

themselves vary, with some employing their own thresholds and others employing pre-determined (e.g., World Bank) thresholds. Some make a distinction between less-developed and more-developed (Ram 2006; Herzer and Nunnencamp 2015). Others divide the sample into three components—low-income, middle-income, or high-income (Pop, et al. 2013). Still others estimate regressions on samples of low- and middle-income countries (Pulok 2012; Hajebi and Javad Razmi 2014) or on samples of high-income countries (Beckfield 2004; Torre and Myrskylä 2014). Unsurprisingly, results vary considerably across these classificatory systems.

Second, this approach reduces the asymptotic power of any statistical tests. Whereas the typical cross-nationally comparative dataset may include up to 180 countries, this number shrinks considerably when dividing across two or three categories. Third, and perhaps most importantly, none of these studies focus extensively on *testing* the null hypothesis that inequality effects are invariant across levels of GDP per capita. *Qualitative* differences between coefficients across groups of countries in different income classifications may not be *significantly* different from zero.[4]

Our Analytical Strategy

Following recent programmatic statements in this literature (Pickett and Wilkinson 2015), we propose an alternative modeling strategy to test the moderation hypothesis: an interaction of GDP per capita with income inequality in the fixed-effects framework with minimal controls as originally employed by Beckfield (2004). Our approach is strategic for several reasons. First, this strategy allows for maximum variation for economic

development, which maximizes statistical power. Second, following Beckfield (2004) and advice from Pickett and Wilkinson (2015: 319-320), we include no time-varying controls outside of a linear time trend. When combined with our fixed-effects approach, this allows us to eliminate unmeasured time-invariant country characteristics without "controlling" for covariates on the causal path from inequality to health, a discussion to which we return in the concluding sections. Third, our approach involves time-varying measures of both Gini and population health (see Pickett and Wilkinson 2015: 320). Fourth, our approach does not require income thresholds and allows for a direct test of the null hypothesis that the association between income inequality and health operates in the same manner at all levels of development (i.e., the coefficient on the interaction term is zero).

We also address one other problem that may plague previous research: the low variability in life expectancy and infant mortality in rich countries (Avendano 2012; Pop, et al. 2013; Regidor, et al. 2012). This problem makes it quite difficult to evaluate the assertion that income inequality has different implications for population health in wealthier countries because any observed differences could be due as much to low variability on population health as to different inequality effects. To address this problem, we employ an additional measure of population health—years lived with disability (YLD) per 100,000. We utilize the non-communicable disease YLD, which includes all disability due to non-communicable diseases and the mental and substance abuse disorder YLD, which includes all disability owing to mental illness and substance abuse.

The non-communicable illness YLD measure captures illnesses for which there is greater variation among middle- and high-income countries. In these countries, life expectancy is higher and better infrastructure limits the transmission of communicable diseases (Anand and Ravallion 1993; Cutler, et al. 2006; Elo 2009). Previous work suggests a link between income inequality and greater prevalence, incidence, and risk of mental illness in high income countries owing to reduced social capital, status hierarchy, and feelings of shame (Ribeiro, et al. 2017; Pabayo, Kawachi, and Gilman 2014; Patel, et al. 2018). Thus, if psychosocial mechanisms are the primary pathways through which income inequality may impact health, we may observe a significant, positive relationship between mental and substance abuse disorder YLD and income inequality; particularly in high-income countries.

Data and Methods

Dependent Variables – Population Health

The dependent variables are life expectancy at birth, infant mortality, and years lived with two types of disability (YLD). The first two measures are commonly used in previous cross-national research about income inequality and health (Wilkinson 1992; Mellor and Milyo 2001; Beckfield 2004; Babones 2008). We obtained the life expectancy and infant mortality measures from the World Bank Development Indicators (World Bank 2016). Life expectancy at birth refers to the combined male and female life expectancy at the country-level. Infant mortality rate refers to the number of infants dying before reaching one year of age, per 1000 live births at the country-level. It is logged to ensure normality. The life expectancy variable covers a maximum of 170 countries and 53 years (1960-2013),

while the infant mortality variable covers a maximum of 169 countries and 53 years (1960-2013). These variables are drawn from population estimates or from country vital records. There are no self-reported health elements. We utilize linear interpolation to fill in missing values within countries between years. For the life expectancy at birth variable, interpolated data accounts for 1% of cases, while for the infant mortality variable, it accounts for .01% of cases.

We utilize YLD data from the Global Burden of Disease study (GBD 2015) to test the hypothesis that past a certain level of economic development, life expectancy may no longer adequately capture how income inequality harms health. Years lived with disability (YLDs) are a measurement of the burden of disease that accounts for the short- or long-term loss of health due to a disability. They are generated by multiplying prevalence (based on systematic reviews) by the disability weight (based on population-based surveys) for each sequela (GBD 2015). The YLD variables contain no self-reported elements. We utilize variables for the rate of YLDs per 100,000 for non-communicable diseases and mental and substance use disorders, which is a subcategory of non-communicable diseases. The YLD variables cover a maximum of 165 countries and 23 years (1990-2013). The Global Burden of Disease study generates data for each country at five year intervals (i.e., 1990, 1995, 2000, etc.). Thus, we perform linear interpolation to fill in missing values within countries between years. The data interpolation accounts for about half of the cases for both sets of YLD variables.

Independent Variable – Income Inequality

Limited numbers of observations and lack of comparability are major issues in cross-national research involving income inequality (Solt 2009). The Standardized World Income Inequality Database (SWIID) maximizes cross-national and temporal comparability by drawing on the largest possible sample of countries and years from several data sources, including the World Income Inequality Database (WIID) and the high-quality estimates from the Luxembourg Income Study (LIS). However, complete comparability is not possible as cross-national surveys vary in terms of units of observation, income definitions, and quality. The SWIID allows users to account for uncertainty in Gini estimates that arise from residual incomparability. We follow the recommendations of Solt (2009) and account for this variability by estimating multiple imputation (MI) models. This procedure incorporates uncertainty in the Gini estimates into the coefficients and standard errors (for details, see Rubin 1996 and Jenkins 2105).

To improve comparability and coverage, we use post-tax and transfer (or "net") income inequality data from the SWIID (Solt 2009). Because they are benchmarked with LIS data (see Solt 2009 for a detailed discussion), incomes are adjusted for household size to produce inequality in equivalent household incomes. The Gini variable covers 173 countries and 53 years (1960-2013).

Independent Variable – Economic Development

We measure economic development with gross domestic product per capita (GDP per capita) in current US dollars from the World Bank Development Indicators (World Bank

2016). The GDP per capita variable covers 166 countries and 53 years (1960-2013). To alleviate biases in estimated coefficients and standard errors owing to extreme skew, we log GDP per capita. We utilize linear interpolation to fill in about 1% of missing values within countries between years.

Table 1 reports descriptive statistics for each variable. Bivariate correlations between income inequality and the health variables are similar but slightly higher than those presented in previous cross-national works (e.g., Beckfield 2004; Babones 2008).[5]

Multivariate Fixed Effects Models

Heterogeneity bias is an important issue in cross-national income inequality and health research (Beckfield 2004). To remedy this problem, we use a fixed-effects estimator in both approaches. While the fixed-effects estimator does not address biases arising from omitted time-varying variables, it eliminates biases owing to unobserved time-invariant country-specific variation. In addition to correcting the standard errors for uncertainty in Gini with the MI regressions, we also correct for heteroscedasticity and arbitrary forms auto-correlation within clusters (Rogers 1993).

Conceptually, we estimate the following equation for each indicator of population health:

(1) $Y_{jt} = a_j + \beta x_{jt} + \beta \gamma_{jt} + \beta x_{jt} \gamma_{jt} + \beta year_{jt} + \varepsilon_{jt}$

In equation 1, Y refers to the health outcome (life expectancy, infant mortality, or years lived with disability per 100,000) for country j at time t. X and γ are income inequality and GDP per capita, respectively. The fourth term refers to the interaction of income inequality

and GDP per capita. a contains the country-specific intercepts that net out any unobserved time-invariant, country-specific effects. Year is a linear time trend and ε is the error-term. The strength of this approach is three-fold. First, it both eliminates unmeasured, time-invariant factors and maximizes statistical power. Second, it maximizes cross-national and temporal variation in GDP per capita. Third, it enables a direct test of the null hypothesis that inequality does not have different effects at different levels of development, which is the null-hypothesis that $\beta x_{jt}\gamma_{jt}$ is equal to zero.

The data creates unbalanced panels, where countries contribute different numbers of observations. The final sample for the life expectancy models includes 4243 observations, 163 countries, and 53 years. For the infant mortality models, the final sample has 4155 observations, 162 countries, and 53 years. For the years lived with disability (YLD) models, the final samples have 2894 observations, 162 countries, and 20 years.

Alternative Data and Econometrics

As with any cross-national analyses, the data described above have both advantages and disadvantages that impact our estimates of the association between income inequality and health. Thus, we also analyze alternative sources of data on income inequality, life expectancy, and GDP per capita. In addition, we employ varying lags of income inequality, and alternative econometric corrections for heteroskedastic and serially-correlated errors, and unobserved period effects.

Our multiple analyses allow us to report a range of estimates for the association between income inequality and health that, *in toto*, provides a more balanced assessment of the association to inform the literature than any single analysis (see Pickett and Wilkinson 2015).

Results

We estimate two fixed effects models per dependent variable: a basic model including Gini, GDP per capita, and year, and an interactive model that adds the product of Gini and GDP per capita. The results for the infant mortality and life expectancy models are presented in Table 2. While the direct effect of economic development is not the focus of this article, we note that the insignificant effect of GDP per capita on life expectancy in Table 2 is in keeping with previous research, and is consistent with our concerns about the low variability of life expectancy among richer countries (see Beckfield 2004; Cutler, et al. 2006). The first panel reports the results from the basic models for infant mortality and life expectancy. Consistent with previous research, income inequality does not have a significant association with infant mortality. Similarly, income inequality does not have a significant impact on life expectancy in Model 2. The interaction term appears in Models 3 and 4. Model 3 reveals a small increase in the effect of income inequality on infant mortality as development increases; however, it is non-significant.

As has been noted elsewhere, income inequality's effect may be more salient for life expectancy because it captures cumulative advantages or disadvantages over an entire life course. Some evidence suggests that early-life income inequality has health implications for people as they get older (Elgar, et al. 2017). This impact may be even more apparent in

the context of development, as early life poverty is associated with greater health disadvantages later in life (Politt, et al. 2005; Pavalko and Caputo 2013). Thus, the interaction between income inequality and economic development is positive and significant in the interactive model of life expectancy (Model 4). This finding provides some support the argument that economic development attenuates the association between income inequality and life expectancy (H1).

When countries undergo epidemiological transition, communicable illnesses decline and life expectancy increases; however, life expectancy gains slow among more developed/healthy countries. Therefore, the significant interaction term in Model 4 should be read with some caution. However, non-communicable illnesses do not follow this pattern, and in fact become a larger concern for population health among countries with greater life expectancy (GBD 2015). Figure 2 plots several measures of population health against economic development. A comparison of the scatter plot for life-expectancy (top left) to that for YLD due to communicable diseases (top right) bears this out. In both cases, there is much less variability in population health at higher levels of development. By contrast, non-communicable illnesses and mental health/substance abuse disorders increase with development (due largely to longer life spans and more sophisticated diagnostic mechanisms). More importantly, the variation in both non-communicable diseases and mental health and substance abuse disorders among high-income countries (top right of each graph) is similar in magnitude to that among lower income countries (bottom left of each graph).

To proceed, we calculate separate fixed-effects models for non-communicable disease YLD rate and mental and substance use disorders YLD rate. The basic and interactive models are presented in Table 3. In Model 1, income inequality has a significantly positive impact on the non-communicable disease YLD rate. In Model 2, inequality has no significant effect on the mental and substance use disorders YLD rate. In Model 3, and consistent with H1, economic development attenuates the relationship between income inequality and the non-communicable disease YLD rate. However, economic development plays no moderating role in the relationship between income inequality and mental and substance use disorders YLD. Thus, the significant interaction term in Model 4 of table 2 is not an artifact of low variability in life expectancy in rich countries. Economic development appears to attenuate the link from inequality to both life expectancy and the non-communicable disease YLD rate.

Alternative Source of Income Inequality Data

The models in Table 4 replace the SWIID Ginis with those from Deininger and Squire (1996) as implemented by Beckfield (2004). These models provide a unique window into the inequality-health link for two reasons. First, they allow us to assess whether or not we observe a moderating effect of economic development in the inequality-health link across two sources of Gini. The second reason is that the Deininger and Squire (1996) dataset covers a different period of time (1947-1996) and set of countries than do the SWIID data. This replication also *addresses* spatial (i.e., country) and temporal composition.

Table 4 reports the results in a manner identical to Tables 2 and 3. The results are substantively identical to those produced using Solt's (2009) SWIID data. Panel 1 does not support the income inequality-health link, as inequality is not associated with infant mortality or life expectancy. The interactive models indicate no significant interaction between inequality and economic development when infant mortality is the dependent variable. However, the there is a significant, positive interaction between inequality and economic development when life expectancy is the dependent variable.

Additional Concerns

We conduct five additional analyses. First, the World Bank's life expectancy estimates come from a variety of sources using a variety of methods. Beckfield (2004) generated a measure of life expectancy that includes a control variable for one important difference in measurement: those based on estimates versus complete life tables (234). Second, to maximize sample size above, we used a measure of GDP per capita that does not account for differences in prices between countries (Purchasing Power Parity, PPP). These "real" GDP data are available but on smaller samples. Third, we address the potential for heteroskedastic and serially-correlated errors with the clustered sandwich estimator from Rogers (1993), but these may be biased when panels are unbalanced or few in number, and potentially less efficient than alternative generalized least squares estimators (e.g., Hansen 2007; Nichols and Schaffer 2007). Fourth, our previous models control for time effects with a linear time trend, which does not fully control for unmeasured, case-invariant period-specific fixed effects.

Thus, Table 5 reports two replications. In Model 1, we replace the World Bank's measure of life expectancy with that of Beckfield (2004) and his control (suppressed). In both models, we address the second, third, and fourth issues by employing real (PPP adjusted) GDP per capita from the Penn World Tables (Feenstra, Inklaar, and Timmer 2013), estimating and correcting for a first-order auto regressive process with a Prais-Winston transformation, employing a heteroscedasticity consistent covariance matrix, and including the full set of T-1 time dummies. In each model, the interaction coefficient between inequality and GDP per capita is in the same direction as our previous models and statistically significant. The t-ratios are generally smaller in Table 5 than Tables 2-6, suggesting our previous estimates are overly conservative owing to the bias of clustered standard errors with unbalanced panels.

Finally, some literature suggests the impacts of inequality on health are cumulative and lagged (Zheng 2012; c.f. Lillard et al. 2015; Shi et al. 2004). One anonymous reviewer suggested that such lags should be shorter for infectious diseases that are more important in poor countries and longer for degenerative diseases more prevalent in rich countries. If our data evinces this varied lag process, we should expect (a) lagged effects to be larger than contemporaneous ones and (b) lagged effects to peak at shorter intervals with respect to life expectancy than the non-communicable YLD rate. Because the SWIID data allow for the widest possible temporal range, we re-estimated the models from Tables 2 and 3 above with 1-10 year lags (see Kim, et al. 2008) for both life expectancy and non-communicable YLD rate. The interaction terms that we obtain from these models are reported in Figure 2. We find a linear (though not exactly monotonic) decrease in the size

of the interaction term for each lag from years 1-10. The pattern is the same for both outcomes. Moreover, the overlapping confidence intervals suggest that none of these coefficients are significantly different from each other (see Torre and Myrskylä. 2014).[6]

Substantive Significance

The results suggest that the impact of income inequality on life expectancy and years lived with disability due to non-communicable diseases varies significantly with the level of development and has more harmful effects on poorer countries. To examine the substantive importance of this variation, we examine the marginal effects of inequality on life expectancy and years lived with disability (non-communicable diseases) as they vary by GDP per capita. Each panel shows the marginal effects across the analyses in Tables 2-5.

The first panels of Figures 3a and 3b illustrates the analysis from Model 4 of Table 2. The second panel comes from Model 4 of Table 4. The results in the third panel come from Model 1 of Table 5. The left y-axis of Figure 3a displays the percent of cases at each level of development, while that on Figure 3b illustrates the percent of the population. All panels suggest that variation in the effect of inequality across development is fairly large. At the low end, we estimate that inequality's impact on population health is as much as 139.7 percent more deleterious in poorer countries (Panel 3). At the high end, we estimate that inequality's impact on population health is as much as 220.67 percent more deleterious in poorer countries (panel 1).[7]

In all panels, the effect of inequality on health is significantly negative at lower levels of development. However, the share of country-cases for which we observe this effect varies

from small to moderate (2.1 to 38.6%). Countries in this range include Uganda, Sudan, India, Bangladesh, Ethiopia, Guatemala and China. These percentages rise considerably when we factor in population size, however, because most of the world's population lives in the developing world. We estimate that 6.6 to 66.2% of the world's population lived in countries that experienced a negative effect of inequality on health over the period. Panels 1 and 3 in each figure also show that we estimate a significantly *positive* impact of inequality in extremely rich countries, though the share of cases is similarly small. While this finding is consistent with those elsewhere (e.g., Herzer and Nunnencamp 2015), we are skeptical of this association because of the low variability in life-expectancy among richer countries and because the finding lacks a theoretical rationale.

Figure 4 presents the results for YLD (non-communicable disease). Panel 1 comes from Model 3 of Table 3; panel two comes from Model 2 of Table 5. Panels 3 and 4 are identical to 1 and 2 except they report the percent of the world's population on the first y-axis rather than country-cases. As with life expectancy, each panel shows that inequality's impact on population health is significantly deleterious at lower levels of development. Unlike our analysis of life expectancy, none of these figures imply that inequality *improves* population health in richer countries, as the confidence interval includes zero for the full range of positive coefficients we estimate. The share of cases (39.6 to 53.3%) and world population (53.4 to 67.6%) for which this association holds is much larger than for life expectancy, and therefore includes middle-income countries like Paraguay and Thailand. These analyses also suggest an even larger gradient in the impact of income inequality and health across rich and poor countries than do our analyses of life expectancy. At the low end,

inequality's impact on population health is as much as 246.2 percent more deleterious in poorer countries (panel 1). At the high end, the impact is as much as 374.3 percent more deleterious (panel 2).

Taken together, the results presented in Figure 2 and 3 tell a clear, if varied, substantive story. Inequality harms population health among countries at the lowest developmental strata. Countries in the middle experience either a harmful (years lived with disability) or null (life expectancy) health impact from inequality. At the highest end of the developmental strata, we observe either a *beneficial* impact (life expectancy) or no impact (years lived with disability) of income inequality on population health, though we are skeptical of the life expectancy results among richer countries for the reasons discussed above. In short, our results reveal a *global* gradient in the relationship between income inequality and population health, and the magnitude of this macro-gradient is relatively large (139.7 to 374.3% more deleterious in poor countries).

Discussion

Theories linking income inequality to poorer health are intuitive and provide varied causal mechanisms, yet the empirical literature is mixed. While some of this owes to differences in methodology, sample composition, data sources, etc., we suggest that a conditional effect of inequality is also a plausible, if partial, explanation. That is, development is a key moderator in the relationship between inequality and health. While a few pieces of empirical work gesture toward this finding, none of them test the hypothesis directly in a systematic fashion. Our results hold across various analytical procedures including the source of Gini, country and temporal coverage, the measurement of population health, and

econometric considerations. The relationship between income inequality and population health is best described by a global gradient. Income inequality worsens population health in poorer countries, but has no significant harmful effects in richer countries.

While it is beyond the scope of the present paper to parse out the precise mechanisms underlying the partial associations we observe, we do provide some conjecture to motivate future research. First and foremost, both the more deleterious impact of inequality in poor countries and the null results on YLD from mental disorders and substance abuse align with previous research emphasizing mechanisms drawn from neo-materialist perspectives. That is, our results highlight neo-material mechanisms underlying the relationship between income inequality and health.

We imagine three types of neo-material processes that may matter (and co-vary across time and space), but with different implications for our understanding of a *causal* link from inequality to health. One type involves less economic and administrative capacity to build robust systems of public health in poor countries. In poor countries with high inequality, health care, adequate sanitation, nutrition and health education are enjoyed by a small and rich proportion of the population, which produces poor average population health outcomes. Contrarily, relatively poor individuals living in high-income countries with high income inequality enjoy vastly superior health care, sanitation, nutrition and health education than their counterparts in poor countries.

While health gradients exist even in rich countries with high inequality (e.g., Beckfield, Olafsdottir, and Bakhtiari 2013), these public goods are less concentrated among the rich than they are in poor countries with high inequality (Anand and Ravallion 1993; Elo 2009; Pop, et al. 2013).

Another type involves less robust political institutions in less-developed inegalitarian countries. Evidence suggests that political institutions are tied to population health through mechanisms such as democracy and stability (Klomp and de Haan 2009) and welfare regimes (Muntaner, et al. 2011). Transition to a capitalist economy, neoliberal restructuring, and trade openness also appear to have implications for health (Kaufman and Segura-Ubiergo 2001; Beckfield and Krieger 2009).

Both of these imply that the neo-material perspective treats income inequality as a *proximate* cause for lower population health, as it is part of a wider constellation of processes that impact differential exposure to material factors that impact health. Income inequality may be more strongly correlated with inequality in access to health care in poor countries where health infrastructure is less developed. Similarly, income inequality may be more strongly correlated with spending on health-enhancing social services in poor countries for which there is a shallow history of democracy and political inclusion. As such, the deleterious association between income inequality and health in poor countries may be the result of confounding factors such as public goods infrastructure or political institutions (c.f. Pickett and Wilkinson 2015). Both explanations imply that changes to the domestic political and institutional context might improve health outcomes even if

inequality remains constant. Future work could consider the degree to which the relationship between income inequality and health is driven by its correlation with this larger constellation of processes directly. Scholars could also investigate the degree to which *income* inequality is a proximate cause of poor health when compared with other forms of inequality.

However, a third possible mechanism involves the *minimum resources necessary to obtain adequate health care*, which are more widely distributed in rich countries than in poor ones, even in the context of high income inequality. In this scenario, the average cost for minimally-adequate health care is at or below the median income in rich countries, but well above the median income in poor countries. The wider availability of health insurance (either public or private) in high-income countries may also contribute to this outcome. Health insurance spreads the real cost of healthcare across a pool of both healthy and sick individuals/households (Mills 2014). It also shifts a portion of the cost to the private or public sector. Both would move the average cost for minimally adequate health care even further below the median income in high-income countries.[8] If such a structural relationship between health care costs and median incomes holds across developmental hierarchies, then a fixed level of income inequality should produce greater health gradients in poor countries than in rich ones (see Beckfield, Olafsdottir and Bakhtiari 2013).

Our finding of more deleterious health effects in poor countries is inconsistent with the notion that psychosocial mechanisms should produce bigger effects in richer countries (e.g., Wilkinson 1996; Wilkinson and Pickett 2009a). Nevertheless, future work should

consider modes of analysis that could assess the degree to which psychosocial mechanisms operate in poorer countries. Some recent research suggests that psychosocial pathways are also important for health in less-developed countries (Walker, Kyomuhendo, Chase, and Choudhry 2013). Walker, et al. (2013) find that poor people in diverse developmental contexts experience a common pattern of "pretence, withdrawal, self-loathing, 'othering', despair, depression, thoughts of suicide and…reductions in self efficacy" (215).

Thus, our results may suggest that psychosocial factors interact with material ones to produce a negative effect of inequality on population health in poorer countries. That is, social comparisons and status positions underling the stress, shame, and anxiety-mediated health effects may be worse in poorer countries. In the absence of a robust healthcare or health insurance infrastructure, for example, individuals have fewer resources with which to mitigate the health effects of stress, shame and anxiety.

Thus, a fruitful merger between the integrationist and neo-materialist approaches would be to consider the intervening role of material resources in the health effects of psychosocial processes. This question could be answered at both the macro and micro levels. For example, a parallel analysis to that performed here might be to consider an interaction of inequality with macro-level covariates capturing the prevalence of healthcare and health infrastructure. Alternatively, there are logical reasons to consider socioeconomic status (SES) as a moderator of the proposed psychological pathways linking inequality to health. SES is considered to be a fundamental cause of health inequality in part because of the individual level resources it provides (Link and Phelan 1995). If individuals in countries

with high inequality experience stressors related to status comparisons, but can utilize economic resources to alleviate these stresses, then we would expect that inequality would have a larger effect on individual health among those in the bottom of the income distribution. In such an analysis, we would expect that SES has a stronger moderating effect in countries with weaker healthcare systems and/or health infrastructure. In the individual analyses envisioned here, researchers should consider the lag structure of inequality's effects.

Notes

1. Some scholars have argued that the relationship between income inequality and health may be an artifact of the effect of individual income (e.g., Gravelle 1998; c.f. Subramanian and Kawachi 2004; Ellison 2002). Evidence illustrates that the artefactual effect is not the entire story, as an independent effect of income inequality and health is observed even after accounting for it (Wolfson, et al. 1999; Babones 2008).

2. Pop, et al. (2013) use the hybrid model of Allison (2009), where time-varying right hand side covariates enter the model as both country-specific means and deviations from these means. The country-specific averages are perfectly correlated with (and thus potentially biased by) unobserved time-invariant covariates in the hybrid model, while the deviated covariates are perfectly uncorrelated (and thus unbiased) with these unobservables.

3. Herzer and Nunnencamp's (2015) design requires balanced panels and thus results in a small sample of countries.

4. The study coming closest to such a design is Pop, et al. (2013), who include an interaction term between within-case deviated Gini and within-case deviated GDP per capita within each income group, and produce a null result.

5. We estimated models using non-interpolated variables to similar effect: estimates of the size of the global gradient and cases/population covered by significantly harmful effects were within the range reported below.

6. We do not suggest these findings contradict evidence for lagged inequality effects at the individual level (e.g., Zhang 2012). Macro level population health data represent something akin to a weighted average exposure rate to contextual effects like inequality, where the weights are historical trends in both inequality and the population age structure.

7. These percentages are based on the coefficients at the minimum and maximum GDP per capita.

8. This argument is distinct from those that suggest the association simply reflects the fact that there are more poor people in countries with bad health. See Pickett and Wilkinson (2015) for an extended critique.

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Tables and Figures

Table 1.1: Descriptive Statistics

		1	2	3	4	5	6
1	GDP per Capita*						
2	Infant Mortality	-0.914					
3	Gini Coefficient	-0.438	0.535				
4	Life Expectancy	0.824	-0.888	-0.478			
5	YLD per 100,000, non-communicable diseases	0.827	-0.868	-0.598	0.768		
6	YLD per 100,000, mental and substance abuse disorders	0.749	-0.741	-0.366	0.686	0.831	
	Mean	7.794	3.149	37.079	67.677	8246.269	1991.647
	S.D.	1.606	1.068	9.788	9.538	1687.232	298.712

Note: *Natural logarithm. YLD= Years Lived with Disability

Table 1.2: Multiple Imputation Fixed-effects Regressions of Infant Mortality (Log) on Income Inequality and Life Expectancy on Income Inequality

	Basic Models		Full Models	
	(1)	(2)	(3)	(4)
	Log Infant Mortality	Life Expectancy	Log Infant Mortality	Life Expectancy
Income Inequality	0.001	-0.036	-0.006	-0.339**
	(0.003)	(0.038)	(0.009)	(0.135)
Log GDP per Capita	-0.235***	0.515	-0.263***	-0.905
	(0.285)	(0.424)	(0.054)	(0.807)
Gini x Log GDP per			0.001	0.045**
			(0.001)	(0.017)
Year	-0.024***	0.255***	-0.025***	0.241***
	0(.002)	(0.035)	(0.002)	(0.035)
Constant	53.233***	-444.152***	54.018***	-405.717***
	(4.204)	(66.807)	(4.189)	(66.377)
N	4155	4243	4155	4243

Note: Serial correlation and heteroscedasticity consistent standard errors in parentheses, *** $p<0.001$, ** $p<0.01$, * $p<0.05$.

Table 1.3: Multiple Imputation Fixed-effects Regressions of Years Lived with Disability per 100,000 on Income Inequality

	Basic Models		Full Models	
	(1) Years Lived with Disability, NCD	(2) Years Lived with Disability, M-SA	(3) Years Lived with Disability, NCD	(4) Years Lived With Disability, M-SA
Income Inequality	7.894**	-0.515	35.146**	2.492
	(2.959)	(0.692)	(13.978)	(2.848)
Log GDP per Capita	139.876***	22.145***	286.354***	38.250*
	(29.884)	(6.096)	(76.119)	(15.479)
Gini x Log GDP per Capita			-3.989*	-0.440
			(1.981)	(0.415)
Year	33.336***	5.031***	33.950***	5.010***
	(2.541)	(0.616)	(2.596)	(0.629)
Constant	-59880.430***	-8232.139***	-62128.190***	-8481.973***
	(4914.013)	(1194.732)	(5158.954)	(1255.708)
N	2894	2894	2894	2894

Note: Serial correlation and heteroscedasticity consistent standard errors in parentheses, *** $p<0.001$, ** $p<0.01$, * $p<0.05$. NCD refers to Non-Communicable Diseases. M-SA refers to Mental or Substance Abuse Disorders.

Table 1.4: Fixed-effects Regressions of Infant Mortality and Life Expectancy on Alternative Gini

	Basic Models		Full Models	
	(1)	(2)	(3)	(4)
	Infant Mortality	Life Expectancy	Infant Mortality	Life Expectancy
Income Inequality	0.0003	-0.040	0.001	-0.478*
	(0.003)	(0.053)	(0.014)	(0.205)
Log GDP per Capita	-0.239***	0.695	-0.240**	-1.460
	(0.037)	(0.754)	(0.074)	(1.105)
Gini x Log GDP per Capita			0.001	0.060*
			(0.002)	(0.026)
Year	-0.019***	0.268**	-0.019***	0.267**
	(0.004)	(0.085)	(0.004)	(0.089)
Constant	43.461***	-469.191**	43.475***	-451.058**
	(7.398)	(162.386)	(7.554)	(171.436)
N	503	516	503	516
R^2	0.900	0.754	0.900	0.767

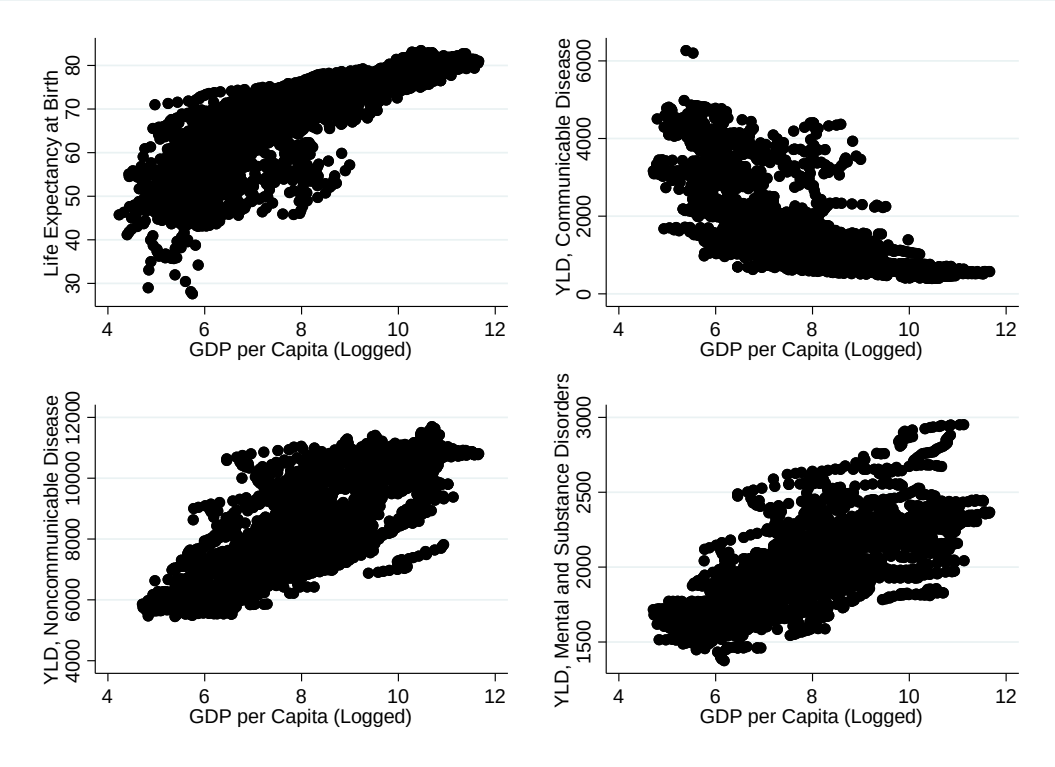
Note: Serial correlation and heteroscedasticity consistent standard errors in parentheses, *** $p<0.001$, ** $p<0.01$, * $p<0.05$. Controls for data source utilized in the model, but not reported here.

Table 1.5: Multiple Imputation Fixed Effects Regression of Life Expectancy and Years Lived with Disability per 100,000, Non-Communicable Diseases on Income Inequality

	(1) Life Expectancy	(2) Years Lived with Disability, NCD
Gini	-1.376***	13.751*
	(.334)	(5.665)
Log Real GDP per capita	-2.176	224.976***
	(1.385)	(31.074)
Gini x Log Real GDP per capita	0.150***	-1.409*
	(0.036)	(0.677)
Constant	86.713***	4193.874***
	(13.023)	(242.118)
Observations	542	2682

Note: NCD refers to Non-Communicable Diseases. Model 1 employs the life expectancy covariate from Beckfield (2004), along with its control (suppressed). All models include T-1 time dummies (suppressed). Serial correlation and heteroscedasticity consistent standard errors in parentheses *** p <0.001, ** p <0.01, * p <0.05.

Figure 1.1: Scatterplots of Life Expectancy by GDP per Capita versus Years Lived with Disability per 100,000 by GDP per Capita



Note: Abbreviation YLD refers to Years Lived with Disability per 100,000.

Figure 1.2: Interaction Terms When Gini is Lagged 1-10 Years

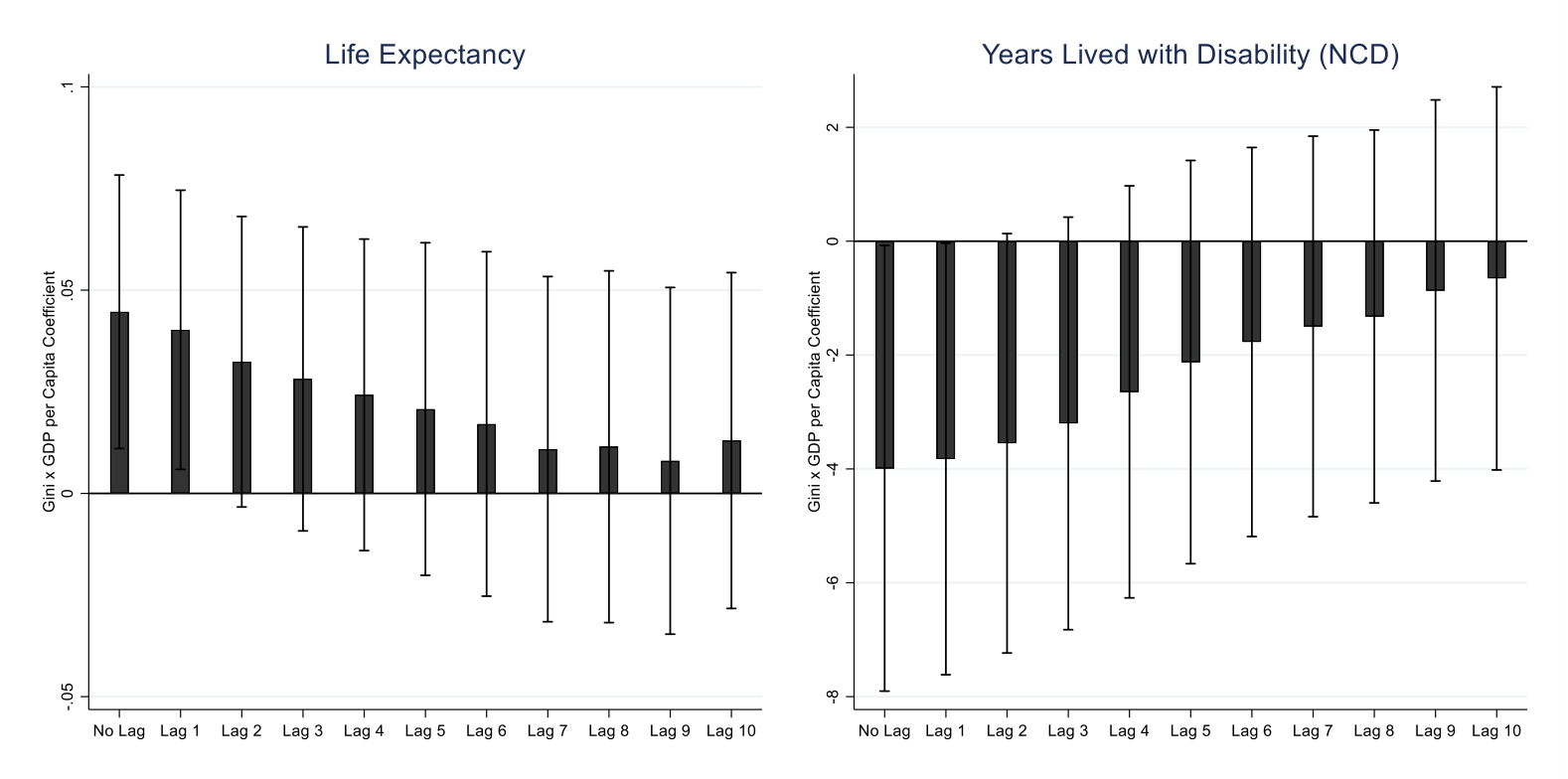
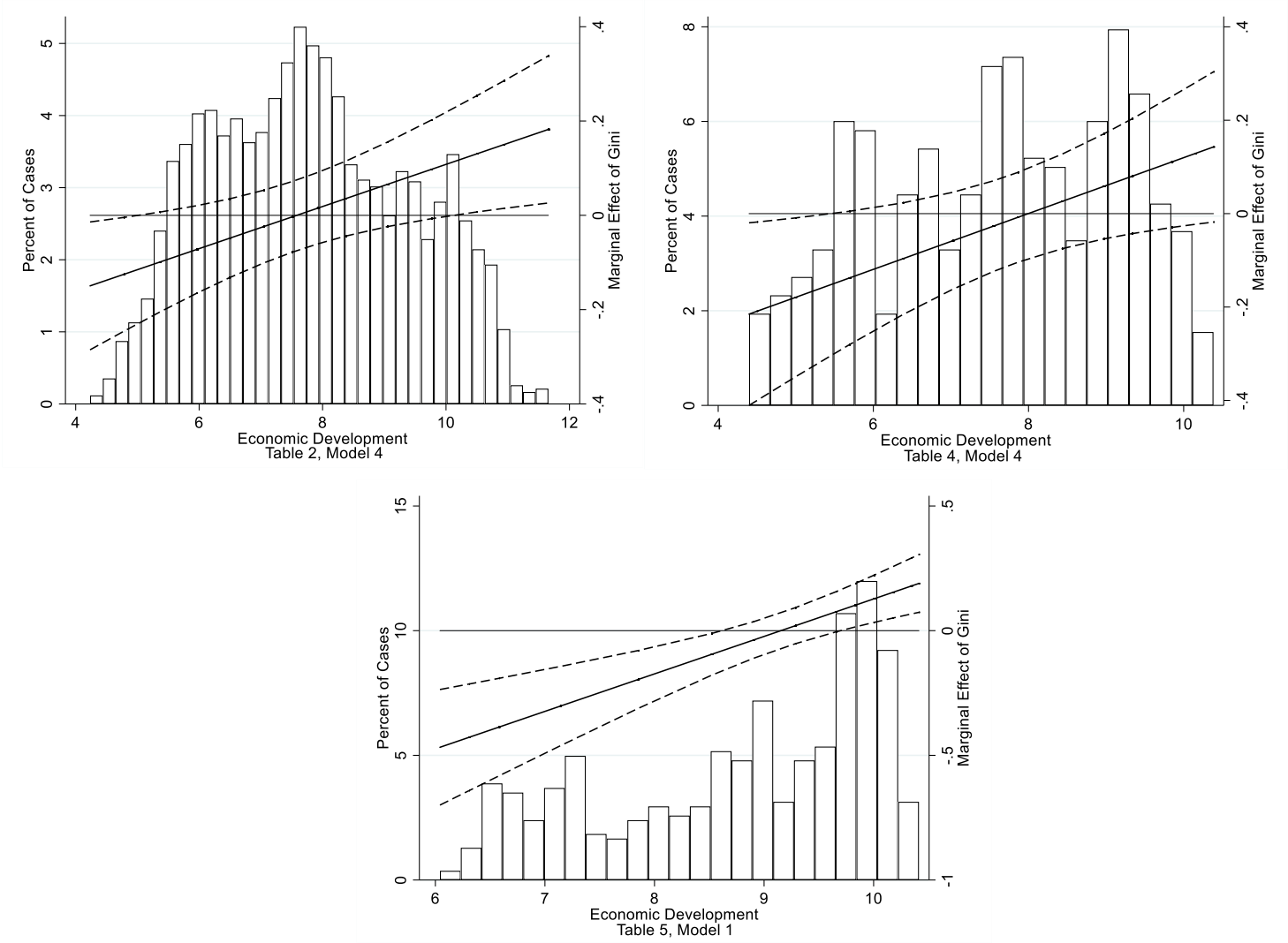
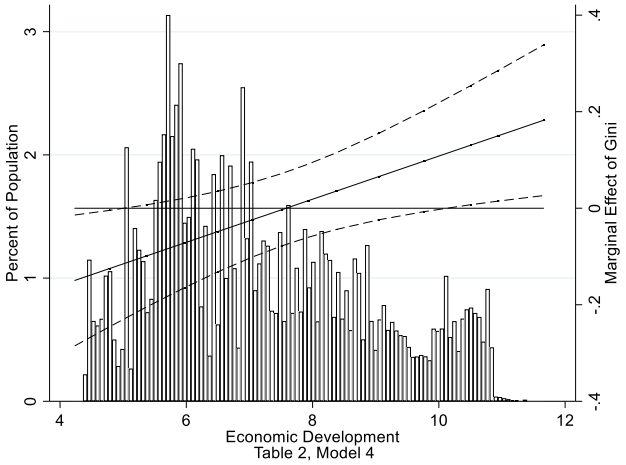
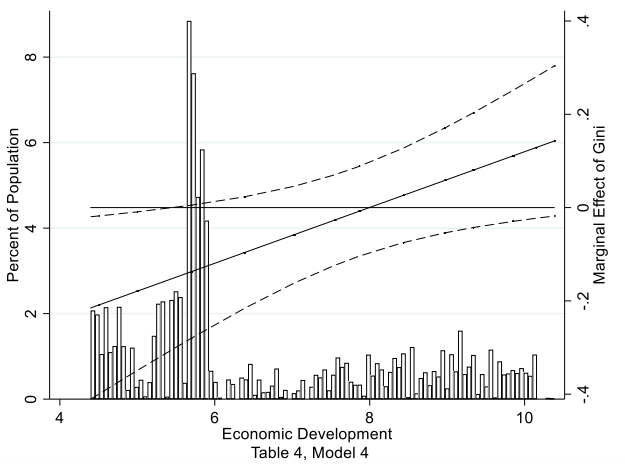


Figure 1.3: Marginal Effects of Gini on Life Expectancy across Observed Range of Economic Development



(b): Marginal Effects of Gini on Life Expectancy across Observed Range of Economic Development, Population-Weighted





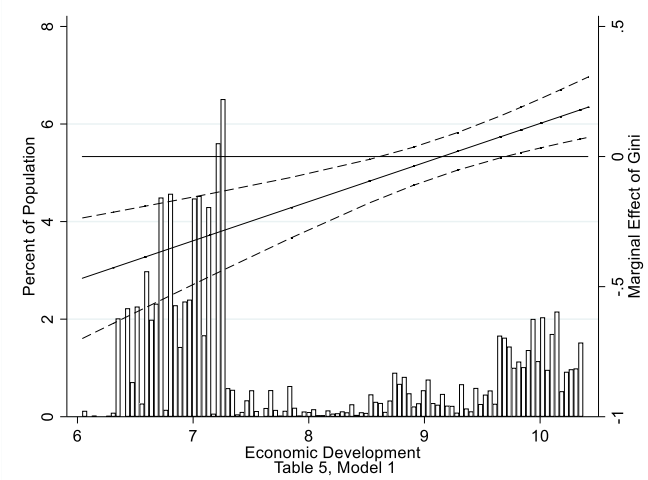
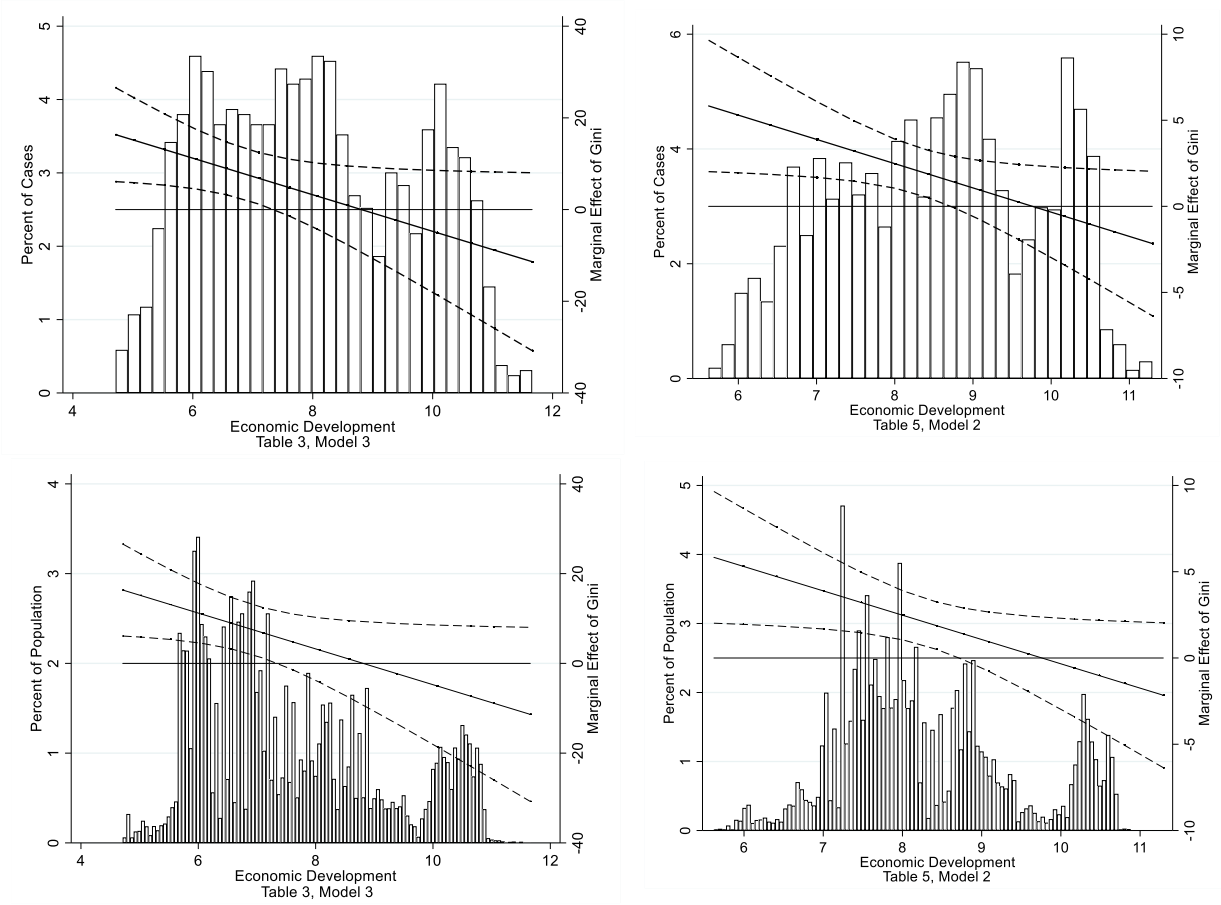


Figure 1.4: Marginal Effects of Gini on Years Lived with Disability per 100,000, Non-Communicable Diseases across Observed Range of Economic Development, Unweighted (top) and Population Weighted (bottom)



Chapter 2: Benefitting the Educated? Income Inequality and the Socioeconomic Status Health Gradient

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Abstract

Past research suggests that inequality may strengthen or weaken the effect of income on health, but it leaves unanswered key theoretical and empirical questions about the degree to which inequality shifts the socioeconomic status-health gradient. In this article, I propose that inequality may influence health disparities between resource rich and poor individuals, accounting for the mixed pattern of results in previous literature that examines the relationship between income inequality and individual-level health. I estimate two-way fixed effects linear probability models to examine the degree to which income inequality influences self-rated health disparities by income and education and whether or not economic development or political exclusion deepens the relationship between income inequality and socioeconomic status-health gradients. Consistent with my theorization, my results indicate that inequality strengthens the positive relationship between education and health, such that highly-educated individuals are significantly more likely to report good or excellent health in unequal contexts. Further, political exclusion of socioeconomic groups deepens inequality's moderating effect on the education-health relationship, consistent with a material narrative for the inequality-health hypothesis. My findings produce three broad generalizations. First, health appears to be influenced by both social position at the individual-level *and* income distribution at the country-level. Second, consistent with previous research, inequality appears to have a *proximate* effect on health

via steepening the SES-health gradient. Third, political exclusion of socioeconomic groups has important implications for inequality's effect on outcomes with social gradients, like health.

Keywords

[cross-national, health disparities, income inequality, population health; socioeconomic status]

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Introduction

In social epidemiology, two prominent lines of inquiry examine micro and macro social determinants of health, respectively. One focuses on explaining the enduring gradient between social position and health (Link and Phelan 1995; Marmot 2004; Mackenbach 2012). The other emphasizes the salience of income distribution at the population level (Lynch, et al. 2004; Kawachi et al. 1997: Pickett and Wilkinson 2015). While the existence of a socioeconomic gradient in health is well-established by decades of work (e.g., Adler, et al. 1994), the existence of a direct relationship between income inequality and health is subject to debate (Beckfield 2004; Wilkinson and Pickett 2006; Babones 2008). Social epidemiologists Pickett and Wilkinson (2015) contend a causal link between income inequality and poor health outcomes. Recent ecological studies suggest the existence of an effect of inequality on *population* health (e.g., Torre and Myrskylä 2014; Herzer and Nunnencamp 2015; Curran and Mahutga 2018). However, ecological studies focus on average health outcomes. They cannot examine the extent to which inequality impacts health disparities by social position, resulting in reduced, improved, or null effects on health *on average* (Truesdale and Jencks 2016).

Observers suggest that these two lines of inquiry are complementary and that the links between them may be illuminating for the inequality-health debate (Beckfield, Olafsdottir, and Bakhtiari 2013; Truesdale and Jencks 2016). Indeed, prior work illustrates that inequality may strengthen or weaken the effect of income on health (Wilkinson and Pickett 2008; Semyonov, Lewin-Epstein, and Maskileyson 2013). However, it leaves unanswered key theoretical and empirical questions about the degree to which inequality shifts the

socioeconomic status[1]-health gradient. Cross-level interactions of inequality with social position are necessary to explore these questions. Thus, individual-level data in a multi-level framework is required (Subramanian and Kawachi 2004; Jen, Jones, and Johnston 2009a; 2009b).

Prior work that utilizes cross-level interactions of inequality with individual income presents mixed results. Some findings suggest that richer individuals report better health when living in an area with high inequality (Kahn, et al. 2000; Subramanian, Kawachi, and Kennedy 2001), while others indicate that poor individuals report worse health in more unequal areas (Kennedy, et al. 1998; Lochner, et al. 2001; Dahl, et al. 2006). Some previous work reports null findings (Jen, Jones, and Johnston 2009b) or a diffuse, pollution-like effect of inequality such that all income groups report poorer health in less equal areas (Subramanian and Kawachi 2006; Wilkinson and Pickett 2008). This research tends to use income as the focal indicator for social position. Some studies extend the definition to include other social categories, like education, race, or welfare beneficiary status, within countries (e.g., Dahl, et al. 2006; Subramanian and Kawachi 2006), but results are also equivocal. Furthermore, pathways through which a contextual effect of inequality strengthen or weaken the effect of income or education on health are not well-articulated, which may account for the mixed results in prior work. Examination of these mechanisms requires theorization at both the macro- and micro- levels.

In what follows, I propose that the causal processes that generate socioeconomic gradients in health mirror those through which inequality may harm health (Truesdale and Jencks 2016; c.f. Wilkinson and Pickett 2008). Thus, examination of the inequality's contextual effect on health depends on the interactions between economic and political context and social position.[2]

Parallel Pathways: Income Inequality, SES, and Health

Though the exact mechanisms linking SES and health are contested, it may indicate *greater access to resources* through which an individual can avoid disease risks or minimize the consequences of illness. For this reason, SES is referred to as a fundamental cause of health disparities because the illness risks and profiles ultimately do not matter. The relationship between SES and health is reproduced over time and place by replacement of the intervening mechanisms between resources and disease. Because these resources are adaptable to changing health-related conditions, they are termed flexible resources. They include knowledge, money, power, prestige, and social connections that can be used to one's health advantage (Link and Phelan 1995; Phelan, et al. 2004; Phelan, Link, and Tehranifar 2010).

In similar vein, resource-based theories of inequality's effect on health contend that inequality is part of a constellation of political-economic processes that influence individuals' access to resources (e.g., access to technological innovation, medical care, etc.) and shape the availability of public goods (e.g., health services, environmental regulation, welfare-states, etc.) that support health (Muntaner and Lynch 1999; Lynch, et al. 2004; Singh, et al. 2016). This neo-material perspective suggests a stronger positive link

between SES and self-rated health in countries with high inequality. Because resources are concentrated in the hands of elites with limited social safety nets available for everyone else, higher SES provides a greater health benefit. At the macro-level, inequality is a reflection of the environment in which access to resources are distributed. At the micro-level, higher SES reflects ability to obtain and use those resources within the context of a given set of circumstances (Link and Phelan 2000). As such, I expect:

H1: People of higher SES in unequal societies report better health than people with lower SES in unequal societies.

By contrast, others have emphasized the relationship between SES and psychosocial stress due to subjective status positions. Here, greater SES is associated with *less psychosocial stress*[3] due to a higher position in the status hierarchy (Marmot 2004) or fewer harmful social comparisons (Wilkinson 2005; Wilkinson 1999). A perceived lack of control over one's surroundings increases stress, which puts pressure on one's health (Marmot 2004). Differences in status also create a gradient of relative deprivation whereby individuals are acutely aware of their status positions. This results in social comparisons, reduced cohesion, and malaise in the form of depression and anxiety (Kawachi et al. 1997; Wilkinson 1997). At the macro-level, inequality's harmful impact on health is related to social integration (Wilkinson and Pickett 2007; Layte 2012). Because inequality dampens social mobility, status differentiation becomes more important. As such, individuals become acutely aware of their relative status positions and engage in comparisons that result in stress and anxiety, leading to poorer health (Wilkinson 1999; Wilkinson and Pickett 2009; Wilkinson and Pickett 2017).

Pathways related to relative deprivation and those connected to social cohesion vary in their predictions. The relative deprivation narrative implies that the positive link between SES and health is likely to be stronger in countries with high inequality (Bernberg 2010). Testing the effect of status position on health in unequal countries yields a direct test of the relative deprivation hypothesis (Bernberg 2010; Wilkinson 1997). Status comparisons intensify in an environment with greater status differentiation, generating such an effect. Thus, the predictions from a relative deprivation standpoint are similar to that of the resource-based narratives. Social disintegration mechanisms imply a distributed, harmful effect of inequality on health. Inequality harms overall social cohesion by depressing civic and social participation, which generates a pollution from which no person can escape, even those with high SES (Lancee and Van de Werfhorst 2012; Kawachi et al. 1997; Subramanian and Kawachi 2006). As such, I expect:

H2: Inequality has a direct, negative effect on self-rated health, regardless of one's social position.

In Figure 1, I visualize the expected predictions from these perspectives. However, resource-based and relative deprivation mechanisms linking inequality to the SES-health association arrive at similar conclusions despite very different pathways. To adjudicate between these mechanisms further, I consider two potential macrostrucutral factors that may help to elucidate this theoretical debate.

Resources versus Relative Deprivation

Social integration mechanisms, such as relative deprivation, are presumed to play out more readily in affluent, democratic societies, as equal opportunity and individual achievement

become central cultural themes. Comparison points shift such that affluent groups become the benchmarks for success (Merton 1968; Alves and Rossi 1978; Bernberg 2010). This process of status comparison has deleterious implications for health. After epidemiological transition, psychosocial factors become more influential determinants of health (Wilkinson 1996). After basic human needs are met, people are more likely to attend to status comparisons. Thus, one might expect:

H3: Those with high SES in rich countries with high inequality report the best health.

By contrast, the neomaterial perspective specifically invokes structural dynamics related to material conditions such as political power as part of a constellation of factors that produce inequality's harmful effect on health (Muntaner and Lynch 1999; Lynch, et al. 2004). Elites restrict the availability of public goods, which intensifies the relationship between inequality, SES, and health (Stiglitz 2012). Furthermore, political power held by particular social groups has important implications for equitable distribution more generally (Korpi 1985; Jacobs and Dirlam 2016). If certain groups are excluded from political participation or benefits, it may serve as a deepening mechanism by increasing inequality's positive health returns to SES. As such, I expect:

H4: The health benefits of SES are stronger in countries with high inequality and high levels of political exclusion.

Data and Methods

I utilized data from four sources to create the dataset, the World Values Survey (Inglehart, et al. 2014), the Standardized World Income Inequality Database (Solt 2019), Penn World Tables (Feenstra, Inklaar, and Timmer 2015), and Varieties of Democracy or V-Dem

(Coppedge, et al. 2019). The WVS includes a broad sample of countries at various levels of economic development and includes health-related variables (Hopcroft and Bradley 2007; Beckfield, Olafsdottir, and Bakhtiari 2013). While sampling procedures vary across countries, the WVS is designed to be representative of the adult, non-institutionalized population (Inglehart, et al. 2014). I analyzed the longitudinal file, which covers the period of 1980-2014, broken down into six waves.[4]

Dependent Variable – Self-Rated Health

I drew my dependent variable from the WVS question asking respondents to rate their health. The question states, "All in all, how would you describe your state of health these days? Would you say it is . . ." with response categories of *very good*, *good*, *fair*, *poor*, and *very poor*. In line with previous research, I generated a dichotomous variable where 1 indicates *very good* or *good* health, and 0 includes *fair*, *poor*, or *very poor* health (Subramanian and Kawachi 2004; Beckfield, Olafsdottir, and Bakhtiari 2013). Self-rated health is generally predictive of mortality (Idler and Bernyamini 1997), though there is debate about utilizing it as a health measure in cross-national context (Babones 2009; Barford, Dorling, and Pickett 2010; Beckfield, Olafsdottir, and Bakhtiari 2013). However, as described below, my choice of modeling strategy helps to diminish this concern.

Key Independent Variable – Socioeconomic Status

Because the WVS does not provide adequate coverage for its SES variable (i.e., only 11 countries and 14,809 individuals for a total of 33 country-years), I opted to measure socioeconomic status utilizing income and education. For the income variable, I used the version harmonized into country-specific deciles. I generated an education variable by

harmonizing the WVS education level variable. This education level variable consisted of eight categories, “Inadequately completed elementary school,” “Completed elementary school,” “Incomplete secondary school: technical or vocational,” “Complete secondary school: technical or vocational,” “Incomplete secondary school: university prep,” “Complete secondary school: university prep,” “Some university without degree,” and “University with degree/higher education.” I harmonized this variable into four categories, “Less than High School Equivalent,” “High School Graduate Equivalent,” “Some College Equivalent,” and “College Graduate or Higher Equivalent.”

Key Moderating Variables: Inequality, Economic Development, and Political Exclusion

Limited numbers of observations and lack of comparability are common issues in cross-national income inequality research (Solt 2009). The Standardized World Income Inequality Database (SWIID) maximizes cross-national and temporal comparability by maximizing the sample pool of countries and years by drawing from several data sources, including the World Income Inequality Database and high-quality estimates from the Luxembourg Income Study. However, complete comparability is untenable as cross-national surveys vary in terms of quality and unit of observation and differing income definitions. To counter these issues, I used post-tax and transfer (or “disposable”) income inequality data from the Standardized World Income Inequality Database (SWIID), which is one of the best sources of income inequality in terms of data coverage and comparability (Solt 2009). The SWIID allows users to incorporate uncertainty in Gini estimates owing to residual incomparability. Furthermore, the SWIID is benchmarked using data from the Luxembourg Income Study such that incomes are equivalized by household size,

producing a measure of inequality in equivalent household incomes. Following Solt's (2009) recommendation, I estimated multiple-imputation models, which incorporated the residual incomparability in the Gini estimates into the coefficients and standard errors (see Jenkins 2005; Rubin 1996 for discussion).

To test the two key pathways through which inequality is presumed to harm health, I utilized real gross domestic product per capita (GDP per capita) in 2011 international dollars from Penn World Tables as the measure of development (Feenstra, Inklaar, and Timmer 2015). I logged the GDP per capita variable to ensure normality. I measured a country's degree of political exclusion by socioeconomic group with data from Varieties of Democracy or V-Dem (Coppedge, et al. 2019). V-Dem conceptualizes and measures democracy through many different multidimensional measures beyond that of presence of elections. It distinguishes between five high-level principles of democracy: electoral, liberal, participatory, deliberative, and egalitarian. I utilized V-Dem's variable Political Exclusion by Socioeconomic Group measure. It is an index (0, low – 1, high) that defines exclusion as occurring when people are denied access to services or governmental participation based on their belonging to a particular socioeconomic group. The index was created by taking point estimates from a Bayesian factor analysis utilizing the following indicators, power distributed by socio-economic group, socioeconomic position equality in respect for civil liberties, access to public services by socioeconomic group, access to state jobs by socio-economic group, and access to state business opportunities by socio-economic group. (Coppedge, et al. 2019).

Controls

I control for basic demographic characteristics at the individual-level utilized in past work. They included age in years, gender (where 1=female and 0=male), marital status (1=married, 0= not married), and employment (where 1=employed and 0=not employed). I standardized age by country.

Table 1 reports descriptive statistics for the key variables. The bivariate correlation between socioeconomic status and self-rated health was positive, consistent with a large body of previous research. The bivariate relationship between income inequality and self-rated health was positive, similar to previous research that utilizes WVS (e.g., Babones 2009).

Two-Way Fixed Effects Linear Probability Models

The data consist of longitudinal data at the country-level and cross-sectional data at the individual-level. This structure may introduce both unmeasured country- and period-specific heterogeneity bias. Thus, there may be substantial variation in the error term across countries, and correlation between individual-level error terms over time within countries. To guard against these biases, I estimated two-way fixed effects models. I opted for two-way fixed effects (FE) models rather than random effects models because statistical power in two-way FE estimation is less contingent on the number of units at the country-level (i.e., level 2) (Wooldridge 2002). Two-way FE models eliminate biases due to unobserved time-invariant country- and period-specific variation. Furthermore, the cross-national comparability of the self-rated health measure is subject to debate. While self-rated health measures within a single country might be unaffected by factors that influence cross-

national measures (e.g., cultural, institutional, and political heterogeneity), in comparative context, this is far less likely (Barford, Dorling, and Pickett 2010). However, the country FE eliminates biases due to unobserved time-invariant, country-specific heterogeneity such as that owing to time-invariant cultural, institutional, or political differences. Thus, the cross-national comparability of self-rated health is less of an issue with the FE modeling strategy.

Logistic regression coefficients are not easily comparable across models (Allison 1999; Ai and Norton 2003; Brady, Finnigan, and Hübgen 2018). Furthermore, interaction terms in logistic regression can be difficult to interpret due to group-wise heteroscedasticity (Allison 1999; Williams 2009). To minimize these issues, I estimated linear probability regressions models rather than logistic regression models. Linear probability models do not require me to estimate average marginal effects (AMEs) for comparability and interpretability of interaction terms, not an insignificant task for data with a multi-level structure. I also corrected for heteroscedasticity (as required for linear probability models) and arbitrary forms of autocorrelation within clusters (Rogers 1993).

Conceptually, I estimated the following basic-form equation to test the hypotheses:

$$Y_{ijt}=\alpha_j + \beta\tau_t + \beta x_{ijt} + \beta\gamma_{jt} + \beta\zeta_{jt} + \beta\zeta_{jt}\beta x_{ijt}\beta\gamma_{jt} + \beta\theta_{ijt} + \beta\tau_t + \varepsilon_{ijt}$$

In this equation, Y refers to the self-rated health for individual i in country j at time t, x is the income or education for individual i in country j at time t, γ is income inequality, ζ is the second moderator variable (either GDP per capita or political exclusion), the fourth term, $\beta\zeta jt\beta xijt\beta\gamma jt$, is the three-way interaction of income or education (SES) with income inequality and the political exclusion moderator, θ is a vector of individual-level controls

(e.g., gender, marital status, etc.), α refers to country-specific intercepts that obviate any unobserved time-invariant country-specific effects, τ refers to period-specific intercepts that net out any unobserved time-invariant period-specific effects, and ε is the error term.

Results

In table 2, I present results for the two-way fixed effects models for self-rated health with the Gini coefficient without individual income or education and self-rated health with the Gini coefficient including individual income and education. These models provide a test of hypothesis 2, which states that inequality should have a direct, negative impact on self-rated health regardless of socioeconomic status. Panel 1 illustrates the results without including individual socioeconomic status. Inequality has a negative impact on self-rated health, but this relationship fails to reach significance. Panel 2 presents results for the second hypothesis again, but with individual income included in the model. Inequality has a non-significant, negative impact on self-rated health. In Panel 3, I present findings with individual education included in the model. Inequality has a negative impact on self-rated health, but it fails to reach significance. Finally, in Panel 4, I include both income and education in the model. Again, inequality has a negative impact on self-rated health, and it fails to reach significance. This pattern of results is similar to previous cross-national findings that fail to display a significant effect of inequality on health after introducing individual, compositional factors into the model (Johnston, Jen, and Jones 2010). It is inconsistent with hypothesis 2.

Inequality does not appear to have a direct effect on health with or without controlling for individual income and education. This evidence suggests that inequality's influence on

health may not operate through a general pollution-type effect from which no one can escape. Inequality may influence the relationship between social position and health, such that its net effect on self-rated health is indistinguishable from zero, in line with predictions from resource-based and relative deprivation explanations for inequality's effect. Thus, I present an interactive model that adds the product of the two SES measures and Gini separately and together into the model in Table 3. Panel 1 presents results with the interaction of income and Gini. The interactions between each income group and Gini are positive but none are significant. In Panel 2, I present the interaction of educational attainment with inequality. Results indicate that inequality moderates the relationship between educational attainment and self-rated health by increasing the health returns to education as educational attainment increases. Those with greater education who live in an unequal country have a significantly greater probability of reporting good or excellent health than those with less than a high school education. Panel 3 replicates the results of Panel 2, but controls for income category. Here, results illustrate that income accounts for some of the observed moderation effect, but not all. For the highly-educated (those with a college degree or higher), inequality is still a significant moderator.

These results suggest that the impact of education on self-rated health varies significantly with the level of inequality, such that the more educated report better health in the context of high inequality. To examine the substantive importance of this effect, I plot the marginal effects of education by each group on self-rated health across the observed range of income inequality in figure 2 (based on results from Table 3, Panel 3). Education's returns to probability of reporting good or excellent health increase with the level of inequality. For

those with a high school diploma, the increase in probability of reporting good or excellent health amounts to about a 37% increase from the lowest observed inequality to the highest observed inequality. For those with some college, the increase across the observed range of inequality is about 41%. The largest rise is for those with a college degree or higher. Across the observed range of inequality, the increase in the probability of reporting good or excellent health is about 48%. The figure aligns with expectations drawn from H1 and is consistent with resource-based or relative deprivation explanations for inequality's effect on health.

Next, I utilize a counterfactual[5] exercise to illustrate how the maximum effect of education on self-rated health would shift if an individual suddenly moved from the lowest observed level of education) to the highest observed level of education across three levels of inequality: low, mean, and high. This exercise provides some insight into the substantive effects of inequality's impact on the education-health gradient. Figure 4 reports this shift from lowest to highest educational attainment across low (0.1735), mean (0.3507), and high (0.6226) inequality in the full model with all of the individual-level controls.

The bars represent the change in predicted probabilities of reporting good or excellent health with the shift from minimum levels of education (less than high school) to maximum levels of education (college graduate or higher) by level of inequality. These estimates are based on data presented in Table 3 in the third panel. If a person was able to improve her socioeconomic position by moving from less than high school diploma to becoming a college graduate (in an instant), her probability of reporting good or excellent health would increase by about 5% in a country with low income inequality (e.g., Slovakia in 1990). By

contrast, her probability of reporting good or excellent health would go up by about 14% if she moved from the minimum levels of educational attainment to the maximum levels of educational attainment in South Africa, the country with the highest inequality in the sample. This counterfactual exercise visualizes the increasing gap in reporting good or excellent health between those with less than a high school diploma and those with a college degree or higher with increasing inequality. The differences in predicted probabilities from minimum to maximum inequality is about 10%.

These findings, while suggestive, do little to resolve the theoretical debate about the underlying mechanisms driving the relationship between inequality and health. Status intensification via relative deprivation or greater resources at the top end of the distribution could produce this pattern of results. To adjudicate between these perspectives, I utilize cross-national variation in economic development and political exclusion by socioeconomic group in three-way interactions with inequality and SES in my next set of models. Table 4 reports the results of the three-way interaction between SES, Gini, and GDP per Capita for income (Panel 1) and education (Panel). GDP per capita has a negative impact on both the income- and education-Gini interactions, signaling that GDP per capita has a countervailing rather than a deepening effect on the interaction between inequality and SES. However, it fails to reach significance. Thus, this finding fails to support social integration mechanisms (hypothesis 3), which suggests that inequality's effect on the relationship between SES and health should become stronger in high-income countries where people are more likely to attend to status comparisons.

Table 5 introduces the political exclusion three-way interaction. In Panel 1, results show that greater political exclusion by SES is associated with a deepening in the Gini-income effect for all income groups. However, this effect fails to reach significance. Panel 2 presents the results for the political exclusion, Gini, and education three-way interaction. Here, results indicate that higher levels of political exclusion for socioeconomic groups deepens the effect of inequality on the education-health gradient. The political exclusion variable has a significant, positive impact on the education-Gini interaction. In line with resource-based conceptions of the inequality-health hypothesis, it deepens inequality's effect on the education-health gradient (hypothesis 4). In Panel 3, I introduce income, as a control, back into the model with the education three-way interaction. Again, income accounts for some of the observed effect, but not all. The three-way interaction is still positive and significant for all education groups. Political exclusion deepens the health premium to education in unequal countries.

In Figure 4, I explore the substantive findings of the three-way interaction between SES, inequality, and political exclusion further. I plot the marginal effects (y axis) of political exclusion (x axis) on the education-inequality interaction. This exercise illustrates political exclusion's deepening effect on the education-inequality relationship. At the lowest observed levels of political exclusion (i.e., where political power and benefits are largely equal by SES), the marginal effect of the education-Gini interaction is about -0.0473, implying a weak, negative moderation effect of inequality on the education-health gradient. It is not significant. In countries with a high degree of political exclusion by socioeconomic group, the effect of greater educational attainment on the probability of reporting good or

excellent health increases with the level of inequality. The marginal effect of the education-Gini interaction at the highest observed political exclusion is about 0.2491 and is significant, signaling that inequality's moderating effect deepens with greater political exclusion.

Sensitivity and Robustness Analyses

Evidence suggests that inequality's effects on health are lagged and cumulative (Lillard, et al. 2015; Shi, et al. 2004; Zheng 2012). Prior work illustrates that the health effects of a rise in inequality begin to appear about three years later and continue to impact health for twelve years later (Zheng 2012). In Appendix Tables 1 and 2, I report the results for regressions with inequality lagged by five, ten, and fifteen years for the inequality and education interaction (Table 1) and the inequality, education, and political exclusion three-way interaction (Table 2). Results do not differ substantially from the main models. Inequality's effects appear even over a fifteen-year span.

Choice of modeling strategy also may influence the results. Previous work that investigates the inequality-health hypothesis with individual-level data tends to utilize logistic regression estimation strategies than the linear probability models that I have employed in this study. Therefore, I estimate logistic models with inequality, income and education, and self-rated health. I present these results in Appendix Table 3. Results do not differ appreciably from the main models. Thus, results are robust to choice of modeling strategy. The observed three-way interaction between educational attainment, inequality, and political exclusion provides interesting insight into the role of structural factors in the inequality-SES-health relationship. However, the measure encompasses four aspects of

political exclusion. Decomposing the measure into its constituent parts would be elucidating for understanding which aspect of political exclusion drives the effect. Thus, I investigate three-way interactions with all of the constituent indices for political exclusion. They include the distribution of class equality in civil liberties, political power by socioeconomic group, access to public services by socioeconomic group, access to state jobs by socioeconomic group, and access to state business opportunities by socioeconomic group (Coppedge, et al. 2019). These constituent measures were originally ordinal scales such that 0 reflects very unequal distribution of political resources by wealth and 4 reflects equality in political resources, regardless of wealth.

I present the results with these constituent measures in Appendix Table 4. In Panel 1, I present the results for the class equality in civil liberties measure. Results indicate a significant countervailing effect of greater equality in civil liberties on the education-inequality relationship for all levels of educational attainment. Panel 2 provides results for the three-way interaction of education, inequality, and political power distribution by SES. Again, results illustrate a significant countervailing effect of greater political equality on the education-inequality relationship. Unlike civil liberties equality, however, the effect of greater equality in political power has a countervailing effect only for the highly-educated. In Panel 3, I present results for access to public services by SES. Increased access to public services does not appear to have a significant countervailing effect on the inequality-education interaction. Panel 4 enumerates results for access to state jobs by SES. Results indicate that wider access to state jobs significantly diminishes inequality's moderation effect on the education-health relationship for all levels of educational attainment. Finally,

in Panel 5, I provide results for access to state business opportunities by SES. Here, greater access to state business opportunities does not appear to have a significant bearing on inequality's moderation effect for the education-health relationship. Taken together, this pattern of results suggests that equality in civil liberties for socioeconomic groups and access to state jobs are important countervailing mechanisms that diminish inequality's moderation effect for education and self-rated health. Political power equality by SES is also an important factor as it diminishes inequality's moderation effect for the highly-educated.

Discussion

Despite a well-articulated theoretical rationale, the income inequality-health hypothesis has a mixed empirical record. In this study, I contend that inequality may influence health disparities between resource rich and poor individuals, accounting for the mixed pattern of results in the literature. My results indicate that inequality strengthens the positive relationship between high levels of education and better self-rated health. These findings are robust to modeling choice and lagged effects of inequality. My findings produce three broad generalizations. First, health appears to be influenced by both social position at the individual-level *and* income distribution at the country-level. Second, consistent with previous research, inequality appears to have a *proximate* effect on health. Third, political exclusion of socioeconomic groups has important implications for inequality's effect on outcomes with social gradients.

Social position at the individual-level *and* income distribution at the country-level influence self-rated health. However, the significance of education suggests that status

distinction alone cannot promote health in unequal environments. Relative deprivation narratives tend to focus on income as an important marker of status distinction (Marmot 2004; Wilkinson 2005). For example, Marmot (2004: 75) contends that above a certain level, income becomes a means for intensifying status competition rather than a resource through which one can promote health. In unequal environments, this intensified status competition becomes more important (Wilkinson and Pickett 2017). Thus, if relative deprivation was the entire story, the inequality-income cross-level interaction would be more important for health than inequality-education cross-level interaction. However, the data do not support this idea.

By contrast, resource-based explanations assume a two-fold process. First, a person must have access to resources in the first place in order to promote her health. Second, she must *utilize* the resources effectively (Phelan, et al. 2004). Education embodies a diverse set of potential resources, including knowledge. Enhanced knowledge may be important for understanding how to use resources effectively, particularly in an environment where they are less equally distributed. Therefore, if inequality deepens the effect of education on health more so than the effect of income on health, it may indicate the importance of *knowing* how to utilize resources effectively in an environment where one may not be able to rely on income as a health-promoting resource. It also mirrors previous work done by Beckfield, Olafsdottir, and Bakhtiari (2014), who find an association between country-level inequality and country-level education-health gradients.

The results suggest that inequality may be a *proximate* cause of poor health. Inequality does not exert a significant direct effect on self-rated health with income and education in

the model, contrary to expectations derived by social integration perspectives that contend a pollution-type effect of inequality (Kawachi et al. 1997; Subramanian and Kawachi 2006; Wilkinson and Pickett 2008). But, it does appear to influence health through its moderating effect on education, in line with resource-based and relative deprivation mechanisms (Lynch, et al. 2004; Bernberg 2010). The results provide some evidence that political exclusion by SES deepens inequality's health benefits to the highly-educated. This finding hints that resource-based mechanisms may be the salient causal pathway in the inequality-health relationship. Political power is a proposed part of the wider constellation of processes that influence differential exposure to material factors that impact health. Elite monopoly of political power leaves people with low SES residing in countries with high inequality more vulnerable than those living in environments with low inequality. However, material and psychosocial pathways may work together in a causal chain such that non-material processes have a material base (Fritzell, Lennartsson, and Lundberg 2007). Future research may seek to better integrate these distinct causal pathways.

Early-life inequality may have greater implications for the relationship between social position and health than inequality lags. Previous work demonstrates that early-life inequality has health implications for people as they age (Elgar, et al. 2017). Further, early-life poverty is related to health disadvantages across the life course (Pavalko and Caputo 2013; Pollitt, Rose, and Kaufman 2005). Some evidence also suggests that the relationship between individual income and health may shift over the life course (Lin, et al. 2003; Babones 2008). Future work may examine the moderating effects of early-life inequality on later life health resources.

Choice of reference group that people use when making social comparisons has important implications for hypotheses related to relative deprivation. Past work finds a relationship between relative income by reference group and health (Subramanyam, et al. 2009). Because WVS does not have robust income, race and ethnicity, or acculturation measures, I was not able to examine whether or not higher inequality influences income's effect on health relative to a reference group. Future research with more robust measures of income and clearly delineated reference groups may explore whether or not inequality influences the relationship between relative income and health.

Notes

1. Typically, socioeconomic status is operationalized as income, wealth, occupation, and/or educational attainment (e.g., Phelan, et al. 2004; Phelan, Link, and Tehranifar 2010; Mackenbach 2012). Measurement of socioeconomic status taps into a wide range of resources including money, knowledge, prestige, power, and social connections that can be used to advantage health. For the purposes of this study, I measure SES utilizing income and/or education.

2. In so doing, I build on innovative work by Beckfield, Olafsdottir, and Bakhtiari (2013) who investigated the association between country-level health gradients by social group. However, my research design differs in that I am interested in the social position of individuals within a country rather than the country-level gradient, consistent with my theorization. I also observe countries over multiple waves of data and utilize a design that allows me to remove time-invariant country-specific heterogeneity. See "Data and Methods" for details.

3. In this context, psychosocial stress refers to depression, anxiety, and fear, which lead to maladaptive health behaviors like drinking excessive amounts of alcohol, smoking, taking drugs, and comfort eating (Wilkinson and Pickett 2009; 2017).

4. The WVS represents a large portion of the world's population and includes survey data from high-, medium, and low-income countries (Inglehart, et al. 2014). For evaluating hypotheses related to economic development and political power, it provides excellent global coverage. However, a key limitation of the WVS is that it is cross-sectional and does not allow for a longitudinal investigation. It also does not include biometric data that would allow me to check self-rated health versus biological measures of health.

5. I utilize the term "counterfactual" in spirit. Due to data limitations, a true causal counterfactual exercise cannot be performed in this study.

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Tables and Figures

Table 2.1: Descriptive Statistics

		1	2	3	4	5	6
1	Self-Rated Health						
2	Gini coefficient	0.0648					
3	Income	0.1857	-0.0959				
4	Education	0.1170	-0.0752	0.2933			
5	GDP per Capita*	0.0537	-0.4503	0.1257	0.0412		
6	Political Exclusion by SES	0.0138	0.6612	-0.0681	-0.0171	-0.6183	
	Mean	0.6460	0.3510	4.7092	1.9681	9.4427	0.2597
	Standard Deviation	0.4782	0.0893	2.3827	1.0392	0.9860	0.2261

Note: *Natural logarithm. GDP = Gross Domestic Product.

Table 2.2: Multiple Imputation Fixed Effects Linear Probability Regressions of Self-Rated Health on Socioeconomic Status and Inequality

	(1)	(2)	(3)	(4)
Gini Coefficient	-0.238	-0.103	-0.205	-0.0987
	(0.270)	(0.245)	(0.286)	(0.255)
Income Category II		0.0356***		0.0327***
		(0.00648)		(0.00623)
Income Category III		0.0673***		0.0603***
		(0.00664)		(0.00624)
Income Category IV		0.107***		0.0960***
		(0.00759)		(0.00703)
Income Category V		0.132***		0.117***
		(0.00792)		(0.00732)
Income Category VI		0.167***		0.149***
		(0.00886)		(0.00803)
Income Category VII		0.177***		0.156***
		(0.00967)		(0.00887)
Income Category VII		0.202***		0.177***
		(0.00960)		(0.00888)
Income Category IX		0.204***		0.178***
		(0.0101)		(0.00960)
Income Category X		0.215***		0.184***
		(0.00962)		(0.00847)
High School Graduate			0.0653***	0.0461***
			(0.00739)	(0.00651)
Some College			0.0977***	0.0637***
			(0.00965)	(0.00825)
College Graduate or Higher			0.123***	0.0824***
			(0.0112)	(0.00930)
Age	-0.120***	-0.114***	-0.113***	-0.110***
	(0.00616)	(0.00589)	(0.00612)	(0.00589)
Married	0.0379***	0.0269***	0.0406***	0.0300***
	(0.00449)	(0.00402)	(0.00397)	(0.00383)
Female	-0.0416***	-0.0405***	-0.0406***	-0.0400***
	(0.00545)	(0.00533)	(0.00549)	(0.00534)
Employed	0.0572***	0.0379***	0.0398***	0.0287***
	(0.00583)	(0.00512)	(0.00498)	(0.00472)
Real GDP per Capita	-0.00799	-0.0163	-0.000574	-0.00987
	(0.0289)	(0.0275)	(0.0303)	(0.0281)
Constant	0.707**	0.653**	0.619*	0.597*
	(0.253)	(0.229)	(0.275)	(0.241)
Country FE	YES	YES	YES	YES
Period FE	YES	YES	YES	YES
Countries	83	83	83	83
Observations	237524	237524	237524	237524

Note: Serial correlation and heteroscedasticity consistent standard errors in parentheses, *** $p<0.001$, ** $p<0.01$, * $p<0.05$.

Table 2.3: Multiple Imputation Fixed Effects Linear Probability Regressions of Self-Rated Health on Socioeconomic Status and Inequality

	(1)	(2)	(3)
Gini Coefficient	-0.146	-0.339	-0.187
	(0.249)	(0.295)	(0.263)
Income Category II	0.0167		0.0321***
	(0.0317)		(0.00613)
Income Category III	0.0575*		0.0589***
	(0.0266)		(0.00614)
Income Category IV	0.0966***		0.0946***
	(0.0275)		(0.00695)
Income Category V	0.120***		0.116***
	(0.0258)		(0.00727)
Income Category VI	0.136***		0.147***
	(0.0290)		(0.00793)
Income Category VII	0.139***		0.154***
	(0.0338)		(0.00888)
Income Category VII	0.184***		0.175***
	(0.0336)		(0.00904)
Income Category IX	0.178***		0.176***
	(0.0381)		(0.00983)
Income Category X	0.156***		0.183***
	(0.0362)		(0.00877)
Income Category II * Gini	0.0460		
	(0.0776)		
Income Category III * Gini	0.0226		
	(0.0664)		
Income Category IV * Gini	0.0232		
	(0.0670)		
Income Category V * Gini	0.0276		
	(0.0627)		
Income Category VI * Gini	0.0800		
	(0.0731)		
Income Category VII * Gini	0.0992		
	(0.0855)		
Income Category VII * Gini	0.0435		
	(0.0812)		
Income Category IX * Gini	0.0652		
	(0.0945)		
Income Category X * Gini	0.157		
	(0.0866)		
High School Graduate		0.00169	0.00723
		(0.0234)	(0.0238)
Some College		-0.00450	0.00349
		(0.0349)	(0.0330)
College Graduate or Higher		-0.00824	-0.00991
		(0.0384)	(0.0356)
High School Graduate * Gini		0.160*	0.0976
		(0.0614)	(0.0631)
Some College * Gini		0.266**	0.157
		(0.0965)	(0.0908)

College Graduate or Higher * Gini		0.347**	0.245*
		(0.108)	(0.0987)
Age	-0.114***	-0.114***	-0.110***
	(0.00586)	(0.00605)	(0.00582)
Married	0.0272***	0.0415***	0.0307***
	(0.00394)	(0.00383)	(0.00370)
Female	-0.0405***	-0.0406***	-0.0400***
	(0.00533)	(0.00547)	(0.00533)
Employed	0.0380***	0.0397***	0.0286***
	(0.00511)	(0.00495)	(0.00470)
Real GDP per Capita	-0.0157	0.00277	-0.00773
	(0.0277)	(0.0301)	(0.0281)
Constant	0.665**	0.635*	0.608*
	(0.231)	(0.273)	(0.241)
Country FE	YES	YES	YES
Period FE	YES	YES	YES
Countries	83	83	83
Observations	237524	237524	237524

Note: Serial correlation and heteroscedasticity consistent standard errors in parentheses, *** $p<0.001$, ** $p<0.01$, * $p<0.05$.

Table 2.4: Multiple Imputation Fixed Effects Linear Probability Regressions of Self-Rated Health on Socioeconomic Status, Inequality, and GDP per Capita

	(1)	(2)
Gini Coefficient	0.661	-0.647
	(2.402)	(2.390)
Income Category II	0.282	
	(0.317)	
Income Category III	-0.146	
	(0.334)	
Income Category IV	-0.00194	
	(0.388)	
Income Category V	-0.352	
	(0.519)	
Income Category VI	-0.593	
	(0.632)	
Income Category VII	-0.906	
	(0.710)	
Income Category VII	-0.229	
	(0.637)	
Income Category IX	-0.0190	
	(0.729)	
Income Category X	0.370	
	(0.568)	
Income Category II * Gini	-0.917	
	(0.826)	
Income Category III * Gini	0.277	
	(0.903)	
Income Category IV * Gini	0.254	
	(1.050)	
Income Category V * Gini	1.250	
	(1.447)	
Income Category VI * Gini	2.011	
	(1.805)	
Income Category VII * Gini	2.892	
	(2.024)	
Income Category VII * Gini	1.388	
	(1.802)	
Income Category IX * Gini	0.765	
	(2.080)	
Income Category X * Gini	-0.0913	
	(1.545)	
Real GDP Per Capita	0.0120	-0.0110
	(0.0838)	(0.0897)
Income Category II * Real GDP per Capita	-0.0295	
	(0.0330)	
Income Category III * Real GDP per Capita	0.0203	
	(0.0351)	
Income Category IV * Real GDP per Capita	0.0102	
	(0.0406)	
Income Category V * Real GDP per Capita	0.0498	
	(0.0547)	

Income Category VI * Real GDP per Capita	0.0771	
	(0.0666)	
Income Category VII * Real GDP per Capita	0.110	
	(0.0746)	
Income Category VII * Real GDP per Capita	0.0450	
	(0.0670)	
Income Category IX * Real GDP per Capita	0.0223	
	(0.0759)	
Income Category X * Real GDP per Capita	-0.0194	
	(0.0589)	
Gini * Real GDP per Capita	-0.0991	0.0296
	(0.263)	(0.260)
Income Category II * Gini * Real GDP per Capita	0.107	
	(0.0872)	
Income Category III * Gini * Real GDP per Capita	-0.0228	
	(0.0963)	
Income Category IV * Gini * Real GDP per Capita	-0.0240	
	(0.112)	
Income Category V * Gini * Real GDP per Capita	-0.130	
	(0.155)	
Income Category VI * Gini * Real GDP per Capita	-0.206	
	(0.193)	
Income Category VII * Gini * Real GDP per Capita	-0.298	
	(0.215)	
Income Category VII * Gini * Real GDP per Capita	-0.147	
	(0.192)	
Income Category IX * Gini * Real GDP per Capita	-0.0785	
	(0.220)	
Income Category X * Gini * Real GDP per Capita	0.0185	
	(0.164)	
High School Graduate		-0.482
		(0.360)
Some College		-0.0006
		(0.490)
College Graduate or Higher		-0.853
		(0.495)
High School Graduate * Gini		1.348
		(1.003)
Some College * Gini		0.187
		(1.427)
College Graduate or Higher * Gini		2.568
		(1.368)
High School Graduate * Real GDP per Capita		0.0510
		(0.0382)
Some College * Real GDP per Capita		-0.0005
		(0.0522)
College Graduate or Higher * Real GDP per Capita		0.0894
		(0.0519)
High School Graduate * Gini * Real GDP per Capita		-0.126
		(0.108)
Some College * Gini * Real GDP per Capita		0.0091
		(0.154)
College Graduate or Higher * Gini * Real GDP per Capita		-0.237

		(0.146)
Age	-0.114***	-0.114***
	(0.00585)	(0.00606)
Married	0.0274***	0.0413***
	(0.00399)	(0.00383)
Female	-0.0406***	-0.0406***
	(0.00532)	(0.00545)
Employed	0.0378***	0.0397***
	(0.00507)	(0.00496)
Constant	0.455	0.785
	(0.758)	(0.815)
Country FE	YES	YES
Period FE	YES	YES
Countries	83	83
Observations	237524	237524

Note: Serial correlation and heteroscedasticity consistent standard errors in parentheses, *** $p<0.001$, ** $p<0.01$, * $p<0.05$.

Table 2.5: Multiple Imputation Fixed Effects Linear Probability Regressions of Self-Rated Health on Socioeconomic Status, Inequality, and Political Exclusion

	(1)	(2)	(3)
Gini Coefficient	0.247	0.299	0.340
	(0.402)	(0.456)	(0.399)
Income Category II	0.0015		0.0334***
	(0.0416)		(0.00635)
Income Category III	0.0843		0.0588***
	(0.0446)		(0.00642)
Income Category IV	0.130**		0.0950***
	(0.0487)		(0.00713)
Income Category V	0.180**		0.116***
	(0.0552)		(0.00727)
Income Category VI	0.225***		0.147***
	(0.0591)		(0.00814)
Income Category VII	0.209**		0.154***
	(0.0763)		(0.00917)
Income Category VII	0.258***		0.173***
	(0.0678)		(0.00941)
Income Category IX	0.171*		0.177***
	(0.0713)		(0.00982)
Income Category X	0.210**		0.181***
	(0.0665)		(0.00918)
Income Category II * Gini	0.128		
	(0.111)		
Income Category III * Gini	-0.0194		
	(0.128)		
Income Category IV * Gini	-0.0599		
	(0.142)		
Income Category V * Gini	-0.137		
	(0.163)		
Income Category VI * Gini	-0.173		
	(0.176)		
Income Category VII * Gini	-0.0957		
	(0.235)		
Income Category VII * Gini	-0.212		
	(0.206)		
Income Category IX * Gini	0.0947		
	(0.218)		
Income Category X * Gini	-0.0273		
	(0.208)		
Political Exclusion (ESG)	0.582	0.797	0.727
	(0.583)	(0.741)	(0.623)
Income Category II * ESG	-0.00651		
	(0.109)		
Income Category III * ESG	-0.130		
	(0.108)		
Income Category IV * ESG	-0.102		
	(0.127)		
Income Category V * ESG	-0.168		
	(0.137)		

Income Category VI * ESG	-0.270		
	(0.150)		
Income Category VII * ESG	-0.212		
	(0.184)		
Income Category VII * ESG	-0.128		
	(0.179)		
Income Category IX * ESG	0.0408		
	(0.202)		
Income Category X * ESG	-0.0321		
	(0.197)		
Gini * ESG	-1.074	-1.642	-1.396
	(1.076)	(1.342)	(1.126)
Income Category II * Gini * ESG	-0.0926		
	(0.249)		
Income Category III * Gini * ESG	0.234		
	(0.263)		
Income Category IV * Gini * ESG	0.241		
	(0.327)		
Income Category V * Gini * ESG	0.432		
	(0.357)		
Income Category VI * Gini * ESG	0.713		
	(0.396)		
Income Category VII * Gini * ESG	0.556		
	(0.506)		
Income Category VII * Gini * ESG	0.491		
	(0.471)		
Income Category IX * Gini * ESG	-0.0987		
	(0.551)		
Income Category X * Gini * ESG	0.218		
	(0.483)		
High School Graduate Equivalent		0.115*	0.0976*
		(0.0463)	(0.0460)
Some College Equivalent		0.110	0.0935
		(0.0645)	(0.0582)
College Graduate or Higher Equivalent		0.170**	0.131*
		(0.0639)	(0.0582)
High School Graduate * Gini		-0.149	-0.151
		(0.142)	(0.140)
Some College * Gini		-0.0680	-0.106
		(0.196)	(0.173)
College Graduate or Higher * Gini		-0.172	-0.174
		(0.199)	(0.177)
High School Graduate * ESG		-0.341**	-0.261*
		(0.108)	(0.112)
Some College * ESG		-0.317*	-0.246
		(0.153)	(0.139)
College Graduate or Higher * ESG		-0.497**	-0.365*
		(0.158)	(0.151)
High School Graduate * Gini * ESG		0.866**	0.678*
		(0.296)	(0.306)
Some College * Gini * ESG		0.871*	0.686
		(0.415)	(0.373)
College Graduate or Higher * Gini * ESG		1.369**	1.047*

		(0.426)	(0.403)
Age	-0.114***	-0.114***	-0.110***
	(0.00608)	(0.00629)	(0.00603)
Married	0.0272***	0.0414***	0.0305***
	(0.00416)	(0.00395)	(0.00382)
Female	-0.0411***	-0.0415***	-0.0408***
	(0.00559)	(0.00571)	(0.00558)
Employed	0.0399***	0.0415***	0.0303***
	(0.00507)	(0.00493)	(0.00473)
Real GDP per Capita	-0.0189	0.0122	-0.00673
	(0.0331)	(0.0360)	(0.0341)
Constant	0.493	0.269	0.347
	(0.304)	(0.348)	(0.314)
Country FE	YES	YES	YES
Period FE	YES	YES	YES
Countries	83	83	83
Observations	237524	237524	237524

Note: Serial correlation and heteroscedasticity consistent standard errors in parentheses, *** $p<0.001$, ** $p<0.01$, * $p<0.05$; ESG = Political Exclusion by Socioeconomic Group

Figure 2.1: Predictions from Neo-Material, Relative Deprivation, and Social Cohesion Perspectives

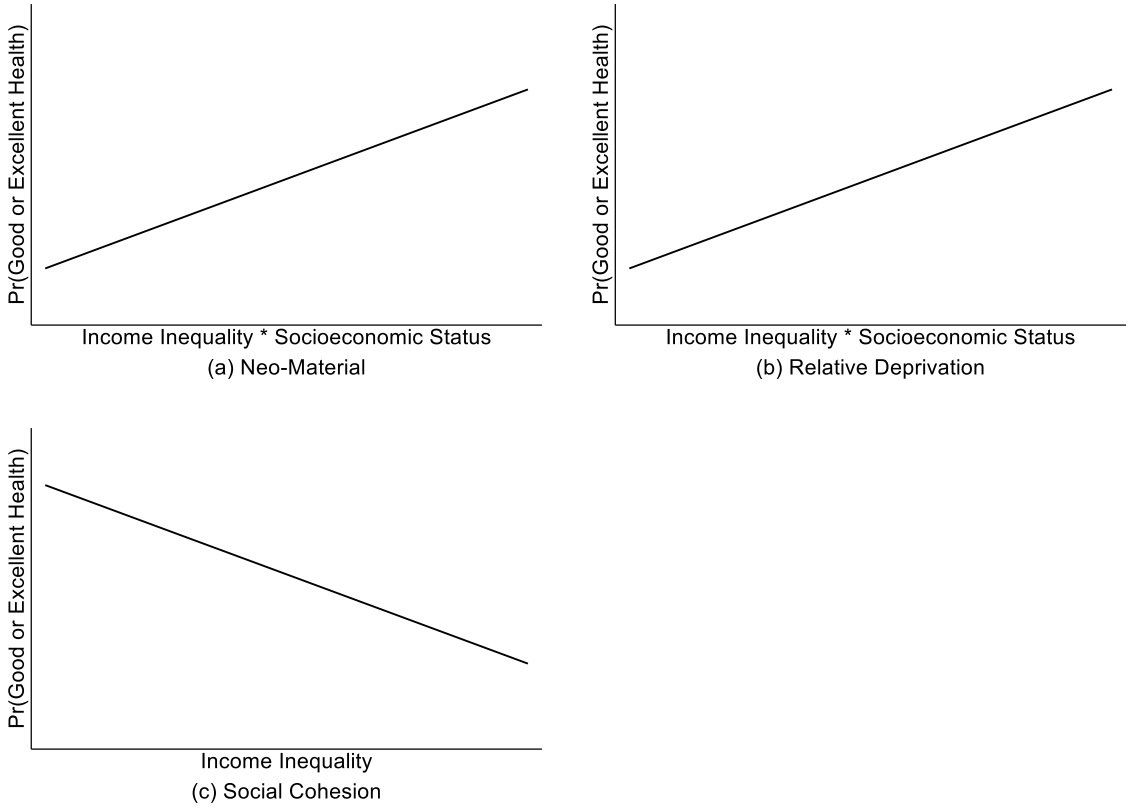


Figure 2.2: Marginal Effects of Educational Attainment on Self-Rated Health across Observed Range of Income Inequality

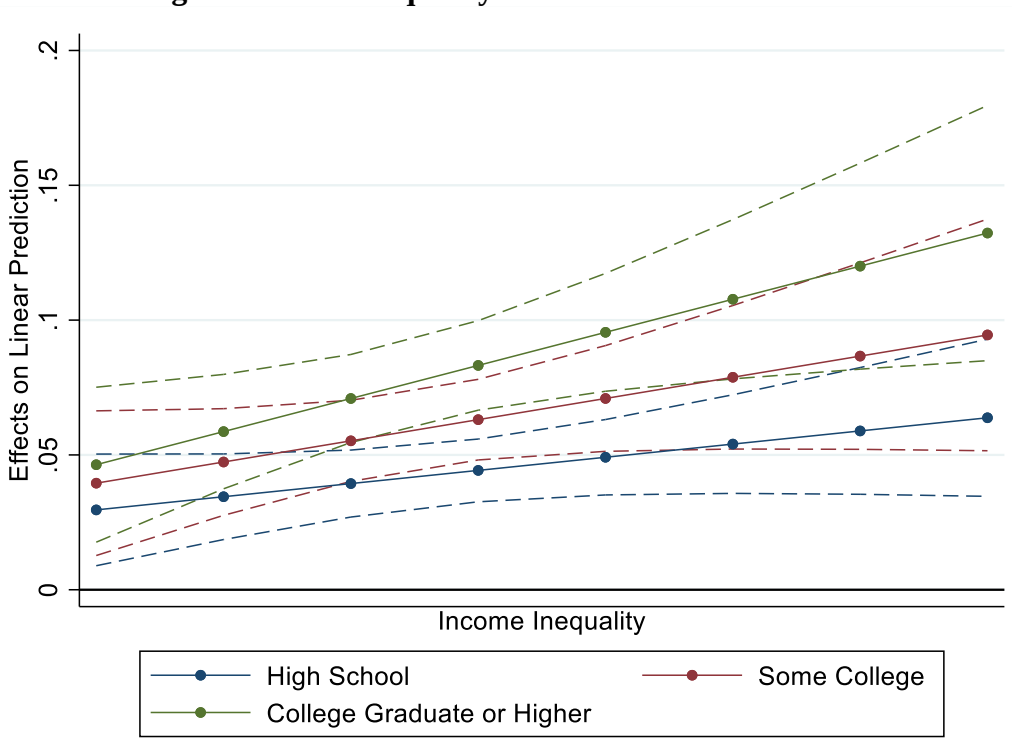


Figure 2.3: Predicted Probability of Good or Excellent Self-Rated Health with Maximum Change in Observed Educational Attainment by Level of Inequality

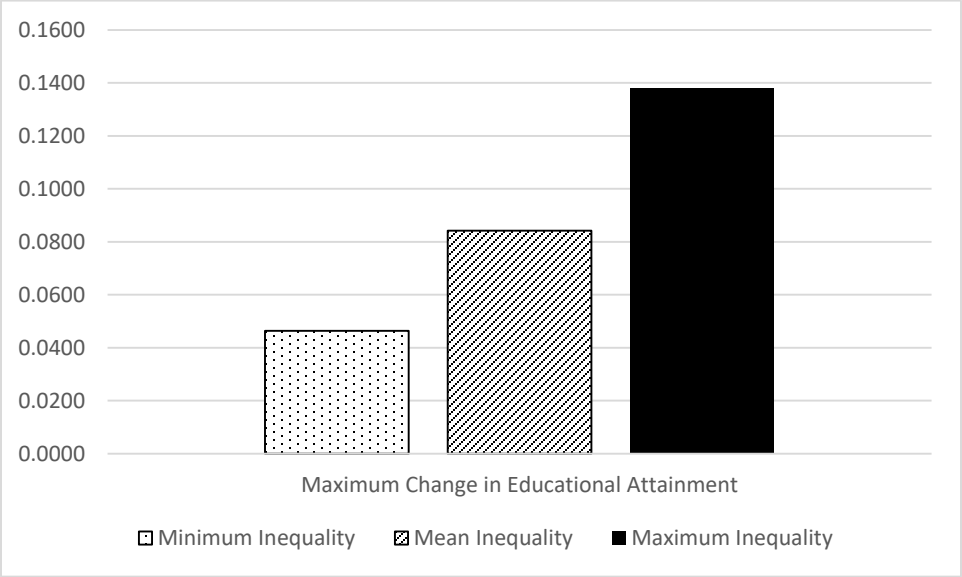
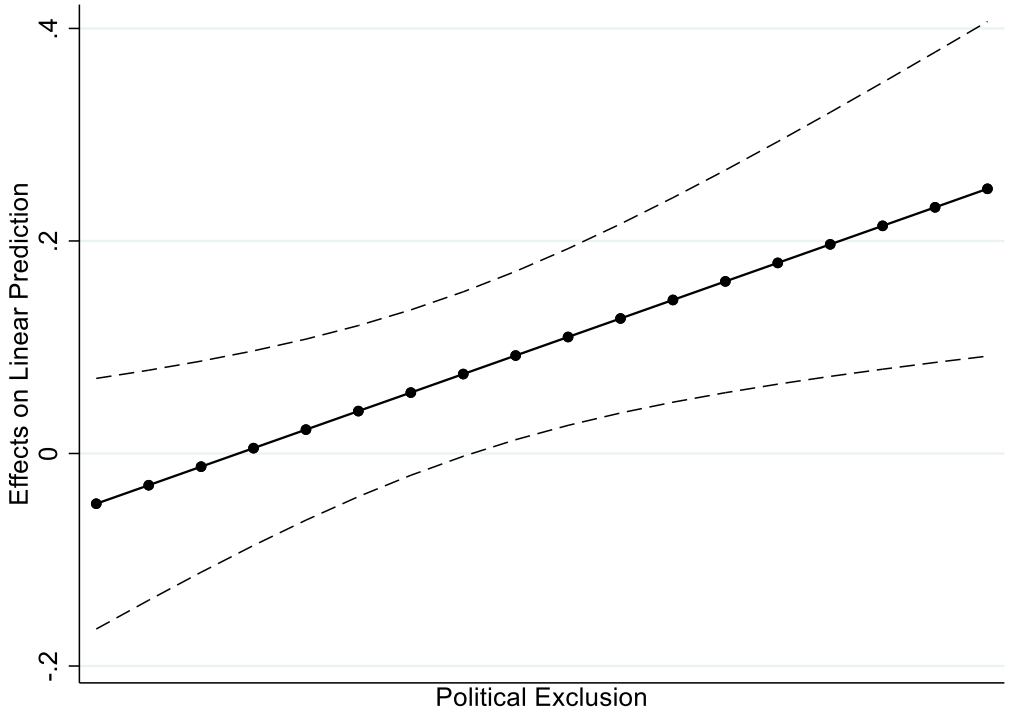


Figure 2.4: Marginal Effects of Educational Attainment and Gini Interaction on Self-Rated Health across Observed Range of Political Exclusion by SES



Supplemental Analyses

Table 2.A1: Fixed Effects Linear Probability Regressions of Self-Rated Health on Socioeconomic Status and Inequality Lagged Five, Ten, and Fifteen Years

	(1)	(2)	(3)
Gini Coefficient (5 Year Lag)	-0.218		
	(0.274)		
High School Graduate	0.00645	0.00632	0.00649
	(0.0239)	(0.0239)	(0.0238)
Some College	0.00185	0.00190	0.00204
	(0.0326)	(0.0326)	(0.0326)
College Graduate or Higher	-0.0122	-0.0124	-0.0126
	(0.0357)	(0.0357)	(0.0357)
High School Graduate * Gini (5 Year Lag)	0.0995		
	(0.0632)		
Some College * Gini (5 Year Lag)	0.161		
	(0.0896)		
College Graduate or Higher * Gini (5 Year Lag)	0.251*		
	(0.0988)		
Gini Coefficient (10 Year Lag)		-0.213	
		(0.270)	
High School Graduate * Gini (10 Year Lag)		0.0997	
		(0.0632)	
Some College * Gini (10 Year Lag)		0.161	
		(0.0896)	
College Graduate or Higher * Gini (10 Year Lag)		0.252*	
		(0.0989)	
Gini Coefficient (15 Year Lag)			-0.208
			(0.265)
High School Graduate * Gini (15 Year Lag)			0.0993
			(0.0631)
Some College * Gini (15 Year Lag)			0.161
			(0.0895)
College Graduate or Higher * Gini (15 Year Lag)			0.252*
			(0.0990)
Income Category II	0.0321***	0.0322***	0.0321***
	(0.00613)	(0.00611)	(0.00612)
Income Category III	0.0589***	0.0590***	0.0589***
	(0.00614)	(0.00612)	(0.00614)
Income Category IV	0.0946***	0.0948***	0.0948***
	(0.00694)	(0.00692)	(0.00692)
Income Category V	0.116***	0.116***	0.116***
	(0.00726)	(0.00723)	(0.00724)
Income Category VI	0.147***	0.147***	0.147***
	(0.00791)	(0.00792)	(0.00793)
Income Category VII	0.154***	0.154***	0.154***
	(0.00886)	(0.00886)	(0.00886)
Income Category VII	0.175***	0.175***	0.175***
	(0.00902)	(0.00903)	(0.00902)
Income Category IX	0.176***	0.176***	0.176***
	(0.00980)	(0.00981)	(0.00980)
Income Category X	0.183***	0.183***	0.183***

	(0.00875)	(0.00876)	(0.00875)
Age	-0.110***	-0.110***	-0.110***
	(0.00582)	(0.00582)	(0.00582)
Married	0.0307***	0.0306***	0.0306***
	(0.00369)	(0.00368)	(0.00368)
Female	-0.0400***	-0.0399***	-0.0399***
	(0.00533)	(0.00532)	(0.00531)
Employed	0.0286***	0.0286***	0.0286***
	(0.00470)	(0.00470)	(0.00470)
Real GDP per Capita	-0.00812	-0.00778	-0.00736
	(0.0281)	(0.0278)	(0.0276)
Constant	0.624*	0.618*	0.613*
	(0.237)	(0.236)	(0.235)
Country FE	YES	YES	YES
Period FE	YES	YES	YES
Countries	83	83	83
Observations	237539	237543	237508

Note: Serial correlation and heteroscedasticity consistent standard errors in parentheses, *** $p<0.001$, ** $p<0.01$, * $p<0.05$.

Table 2.A2: Fixed Effects Linear Probability Regressions of Self-Rated Health on Socioeconomic Status and Inequality Lagged Five, Ten, and Fifteen Years

	(1)	(2)	(3)
Gini Coefficient (5 Year Lag)	0.370		
	(0.377)		
High School Graduate	0.0981*	0.0979*	0.0984*
	(0.0459)	(0.0459)	(0.0459)
Some College	0.0934	0.0941	0.0937
	(0.0578)	(0.0577)	(0.0577)
College Graduate or Higher	0.131*	0.132*	0.133*
	(0.0578)	(0.0578)	(0.0578)
High School Graduate * Gini (5 Year Lag)	-0.153		
	(0.139)		
Some College * Gini (5 Year Lag)	-0.104		
	(0.172)		
College Graduate or Higher * Gini (5 Year Lag)	-0.176		
	(0.176)		
Political Exclusion by Socioeconomic Group (ESG)	0.827	0.822	0.824
	(0.585)	(0.583)	(0.581)
High School Graduate * ESG	-0.268*	-0.268*	-0.268*
	(0.112)	(0.111)	(0.112)
Some College * ESG	-0.255	-0.256	-0.255
	(0.130)	(0.130)	(0.130)
College Graduate or Higher * ESG	-0.377*	-0.377*	-0.379*
	(0.151)	(0.151)	(0.151)
Gini (5 Year Lag) * ESG	-1.583		
	(1.034)		
High School Graduate * Gini (5 Year Lag) * ESG	0.693*		
	(0.305)		
Some College * Gini (5 Year Lag) * ESG	0.705*		
	(0.351)		
College Graduate or Higher * Gini (5 Year Lag) * ESG	1.074**		
	(0.403)		
Gini Coefficient (10 Year Lag)		0.369	
		(0.375)	
High School Graduate * Gini (10 Year Lag)		-0.152	
		(0.139)	
Some College * Gini (10 Year Lag)		-0.106	
		(0.172)	
College Graduate or Higher * Gini (10 Year Lag)		-0.178	
		(0.176)	
Gini (10 Year Lag) * ESG		-1.573	
		(1.029)	
High School Graduate * Gini (10 Year Lag) * ESG		0.693*	
		(0.304)	
Some College * Gini (10 Year Lag) * ESG		0.709*	
		(0.351)	
College Graduate or Higher * Gini (10 Year Lag) * ESG		1.075**	
		(0.402)	
Gini Coefficient (15 Year Lag)			0.369
			(0.371)

High School Graduate * Gini (15 Year Lag)			-0.153
			(0.139)
Some College * Gini (15 Year Lag)			-0.104
			(0.172)
College Graduate or Higher * Gini (15 Year Lag)			-0.180
			(0.176)
Gini (15 Year Lag) * ESG			-1.575
			(1.026)
High School Graduate * Gini (15 Year Lag) * ESG			0.694*
			(0.305)
Some College * Gini (15 Year Lag) * ESG			0.703*
			(0.351)
College Graduate or Higher * Gini (15 Year Lag) * ESG			1.081**
			(0.403)
Income Category II	0.0334***	0.0334***	0.0334***
	(0.00636)	(0.00636)	(0.00637)
Income Category III	0.0588***	0.0587***	0.0587***
	(0.00643)	(0.00644)	(0.00646)
Income Category IV	0.0950***	0.0950***	0.0950***
	(0.00713)	(0.00712)	(0.00713)
Income Category V	0.116***	0.115***	0.115***
	(0.00725)	(0.00724)	(0.00724)
Income Category VI	0.147***	0.147***	0.147***
	(0.00813)	(0.00812)	(0.00812)
Income Category VII	0.154***	0.154***	0.154***
	(0.00914)	(0.00913)	(0.00912)
Income Category VII	0.173***	0.173***	0.173***
	(0.00940)	(0.00940)	(0.00940)
Income Category IX	0.177***	0.177***	0.177***
	(0.00977)	(0.00977)	(0.00976)
Income Category X	0.181***	0.181***	0.181***
	(0.00916)	(0.00915)	(0.00915)
Age	-0.110***	-0.110***	-0.110***
	(0.00603)	(0.00603)	(0.00603)
Married	0.0306***	0.0305***	0.0305***
	(0.00381)	(0.00381)	(0.00380)
Female	-0.0408***	-0.0407***	-0.0407***
	(0.00558)	(0.00558)	(0.00557)
Employed	0.0302***	0.0303***	0.0302***
	(0.00472)	(0.00472)	(0.00472)
Real GDP per Capita	-0.00763	-0.00756	-0.00794
	(0.0342)	(0.0339)	(0.0335)
Constant	0.336	0.336	0.339
	(0.303)	(0.301)	(0.299)
Country FE	YES	YES	YES
Period FE	YES	YES	YES
Countries	83	83	83
Observations	225744	225746	225710

Note: Serial correlation and heteroscedasticity consistent standard errors in parentheses, *** $p<0.001$, ** $p<0.01$, * $p<0.05$; ESG = Political Exclusion by Socioeconomic Group

Table 2.A3: Multiple Imputation Fixed Effects Logistic Regressions of Self-Rated Health on Socioeconomic Status and Inequality

	(1)	(2)
Gini Coefficient	0.370	4.644
	(0.518)	(9.994)
High School Graduate	0.980	1.524*
	(0.124)	(0.313)
Some College	0.962	1.503
	(0.177)	(0.436)
College Graduate or Higher	0.866	1.985*
	(0.183)	(0.614)
High School Graduate * Gini	1.951	0.634
	(0.668)	(0.393)
Some College * Gini	2.786*	0.866
	(1.445)	(0.753)
College Graduate or Higher * Gini	5.049**	0.487
	(3.038)	(0.467)
Political Exclusion by Socioeconomic Group (ESG)		45.79
		(146.9)
High School Graduate * ESG		0.231**
		(0.116)
Some College * ESG		0.207*
		(0.152)
College Graduate or Higher * ESG		0.0792***
		(0.0598)
Gini * ESG		0.000764
		(0.00443)
High School Graduate * Gini * ESG		34.16**
		(46.43)
Some College * Gini * ESG		49.44
		(98.41)
College Graduate or Higher * Gini * ESG		839.6***
		(1714.9)
Income Category II	1.164***	1.173***
	(0.0345)	(0.0361)
Income Category III	1.322***	1.322***
	(0.0409)	(0.0428)
Income Category IV	1.577***	1.582***
	(0.0558)	(0.0570)
Income Category V	1.761***	1.764***
	(0.0655)	(0.0653)
Income Category VI	2.121***	2.127***
	(0.0920)	(0.0945)
Income Category VII	2.224***	2.240***
	(0.108)	(0.111)
Income Category VII	2.574***	2.559***
	(0.134)	(0.137)
Income Category IX	2.584***	2.613***
	(0.140)	(0.136)
Income Category X	2.731***	2.716***
	(0.150)	(0.156)

Age	0.570***	0.569***
	(0.0170)	(0.0177)
Married	1.137***	1.137***
	(0.0208)	(0.0216)
Female	0.802***	0.797***
	(0.0232)	(0.0243)
Employed	1.165***	1.178***
	(0.0308)	(0.0316)
Real GDP per Capita	0.913	0.924
	(0.140)	(0.171)
Constant	3.816	0.958
	(4.717)	(1.540)
Country FE	YES	YES
Period FE	YES	YES
Countries	83	83
Observations	237524	237524

Note: Odd-Ratios Reported; Serial correlation and heteroscedasticity consistent standard errors in parentheses, *** $p<0.001$, ** $p<0.01$, * $p<0.05$; ESG = Political Exclusion by Socioeconomic Group

Table 2.A4: Multiple Imputation Fixed Effects Linear Probability Regressions of Self-Rated Health on Socioeconomic Status, Inequality, and Constituent Measures of Political Exclusion

	(1)	(2)	(3)	(4)	(5)
Gini Coefficient	-0.239	-0.320	-0.119	-0.658	-0.249
	(0.342)	(0.308)	(0.298)	(0.337)	(0.419)
High School Graduate Equivalent	-0.0886*	-0.0407	-0.0103	-0.0630	-0.0201
	(0.0385)	(0.0367)	(0.0449)	(0.0413)	(0.0359)
Some College Equivalent	-0.0744	-0.0347	-0.00226	-0.0469	-0.0101
	(0.0467)	(0.0489)	(0.0589)	(0.0547)	(0.0459)
College Graduate or Higher Equivalent	-0.103	-0.0680	-0.0146	-0.0889	-0.0432
	(0.0520)	(0.0465)	(0.0651)	(0.0618)	(0.0514)
High School Graduate * Gini	0.312**	0.213*	0.134	0.279**	0.155
	(0.0952)	(0.0960)	(0.107)	(0.0960)	(0.0859)
Some College * Gini	0.343**	0.247	0.171	0.299*	0.191
	(0.115)	(0.130)	(0.136)	(0.128)	(0.109)
College Graduate or Higher * Gini	0.463***	0.388**	0.254	0.469**	0.322*
	(0.134)	(0.122)	(0.156)	(0.142)	(0.126)
Class Equality in Civil Liberties (CECL)	-0.00236				
	(0.0780)				
High School Graduate * CECL	0.0630**				
	(0.0194)				
Some College * CECL	0.0611**				
	(0.0186)				
College Graduate or Higher * CECL	0.0682**				
	(0.0248)				
Gini * CECL	0.0186				
	(0.135)				
High School Graduate * Gini * CECL	-0.145**				
	(0.0458)				
Some College * Gini * CECL	-0.159**				
	(0.0489)				
College Graduate or Higher * Gini * CECL	-0.173*				
	(0.0671)				
Distribution of Political Power by SES (PPS)		-0.0765			
		(0.0597)			

High School Graduate * PPS	0.0531		
	(0.0275)		
Some College * PPS	0.0410		
	(0.0389)		
College Graduate or Higher * PPS	0.0696*		
	(0.0311)		
Gini * PPS	0.176		
	(0.122)		
High School Graduate * Gini * PPS	-0.138		
	(0.0761)		
Some College * Gini * PPS	-0.105		
	(0.119)		
College Graduate or Higher * Gini * PPS	-0.189*		
	(0.0882)		
Access to Public Services by SES (APS)		0.0480	
		(0.0529)	
High School Graduate * APS		0.0182	
		(0.0199)	
Some College * APS		0.0139	
		(0.0255)	
College Graduate or Higher * APS		0.0324	
		(0.0271)	
Gini * APS		-0.142	
		(0.140)	
High School Graduate * Gini * APS		-0.0396	
		(0.0606)	
Some College * Gini * APS		-0.0372	
		(0.0756)	
College Graduate or Higher * Gini * APS		-0.0953	
		(0.0848)	
Access to State Jobs by SES (ASJ)			-0.351*
			(0.140)
High School Graduate * ASJ			0.0753**
			(0.0258)
Some College * ASJ			0.0676
			(0.0346)

College Graduate or Higher * ASJ				0.104**	
				(0.0354)	
Gini * ASJ				0.619*	
				(0.270)	
High School Graduate * Gini * ASJ				-0.213**	
				(0.0654)	
Some College * Gini * ASJ				-0.204*	
				(0.0910)	
College Graduate or Higher * Gini * ASJ				-0.316***	
				(0.0862)	
Access to State Business Opportunities (ABO)					-0.0987
					(0.119)
High School Graduate * ABO					0.0317
					(0.0207)
Some College * ABO					0.0277
					(0.0253)
College Graduate or Higher * ABO					0.0498
					(0.0262)
Gini * ABO					0.164
					(0.326)
High School Graduate * Gini * ABO					-0.0741
					(0.0539)
Some College * Gini * ABO					-0.0759
					(0.0653)
College Graduate or Higher * Gini * ABO					-0.130
					(0.0692)
Income Category II	0.0323***	0.0326***	0.0327***	0.0330***	0.0327***
	(0.00624)	(0.00622)	(0.00615)	(0.00651)	(0.00634)
Income Category III	0.0589***	0.0591***	0.0581***	0.0582***	0.0584***
	(0.00623)	(0.00622)	(0.00629)	(0.00645)	(0.00640)
Income Category IV	0.0944***	0.0945***	0.0945***	0.0946***	0.0947***
	(0.00697)	(0.00697)	(0.00710)	(0.00693)	(0.00705)
Income Category V	0.116***	0.116***	0.115***	0.116***	0.116***
	(0.00728)	(0.00727)	(0.00732)	(0.00715)	(0.00727)
Income Category VI	0.147***	0.147***	0.147***	0.147***	0.147***
	(0.00798)	(0.00790)	(0.00820)	(0.00808)	(0.00815)

Income Category VII	0.154***	0.154***	0.154***	0.154***	0.154***
	(0.00890)	(0.00880)	(0.00927)	(0.00902)	(0.00924)
Income Category VII	0.175***	0.174***	0.173***	0.173***	0.174***
	(0.00912)	(0.00904)	(0.00939)	(0.00927)	(0.00943)
Income Category IX	0.176***	0.176***	0.177***	0.177***	0.178***
	(0.00973)	(0.00963)	(0.00992)	(0.00966)	(0.0101)
Income Category X	0.182***	0.181***	0.182***	0.181***	0.182***
	(0.00868)	(0.00868)	(0.00917)	(0.00914)	(0.00932)
Age	-0.110***	-0.110***	-0.110***	-0.110***	-0.111***
	(0.00582)	(0.00582)	(0.00602)	(0.00600)	(0.00608)
Married	0.0305***	0.0306***	0.0306***	0.0308***	0.0308***
	(0.00366)	(0.00367)	(0.00382)	(0.00379)	(0.00386)
Female	-0.0402***	-0.0401***	-0.0407***	-0.0406***	-0.0414***
	(0.00530)	(0.00531)	(0.00559)	(0.00557)	(0.00561)
Employed	0.0287***	0.0286***	0.0304***	0.0303***	0.0302***
	(0.00467)	(0.00468)	(0.00475)	(0.00473)	(0.00482)
Real GDP per Capita	-0.00562	-0.0101	-0.0110	-0.00636	-0.00344
	(0.0280)	(0.0299)	(0.0337)	(0.0329)	(0.0352)
Constant	0.622*	0.693*	0.608*	0.922**	0.614
	(0.268)	(0.281)	(0.284)	(0.337)	(0.351)
Country FE	YES	YES	YES	YES	YES
Period FE	YES	YES	YES	YES	YES
Countries	83	83	80	80	79
Observations	237524	237524	225725	225725	222587

Note: Serial correlation and heteroscedasticity consistent standard errors in parentheses, *** $p<0.001$, ** $p<0.01$, * $p<0.05$; CECL = Class Equality in Civil Liberties; PPS = Distribution of Political Power by SES; APS = Access to Public Services by SES; ASJ = Access to State Jobs by SES; ABO = Access to State Business Opportunities by SES

Chapter 3: Childhood Poverty Deepens the Harmful Effect of Early-Life Income Inequality on Health in Adulthood

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Abstract

Early-life adversity has important implications for health across the life course. Evidence suggests that inequality is related to deleterious outcomes in children and young adults. However, it is less clear the extent to which early-life inequality exposure affects health over the life course, or whether or not childhood socioeconomic disadvantage intensifies these effects. In this article, I expand upon the previous empirical work by examining the lagged and cumulative effects of early-life inequality utilizing data from the Panel Study of Income Dynamics. I also examine the conditional hypothesis that the harmful effect of early-life inequality on health varies by childhood socioeconomic circumstances. I estimate hybrid panel models of early-life income inequality and poverty on three measures of health. My results indicate that the effects of early-life inequality on self-rated health, psychological distress, and activities of daily living varies by childhood socioeconomic context. Early-life inequality has a deleterious effect on health later in life for individuals who characterize themselves as growing up in a poor household. By contrast, early-life inequality has a positive effect on health later in life for those who characterize themselves as either middle- or upper-class. The pattern of results does not suggest an overall pollution effect of early-life inequality on later life health.

Instead, early-life inequality appears to impact differentially those who grew up in poverty versus those who lived in middle- and upper-class households as child. Early-life inequality and poverty operate in tandem to shape later life health in a cumulative inequality process.

Keywords

[accumulation; early-life adversity, hybrid panel model; income inequality, poverty]

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Introduction

Early-life adversity has important implications for health across the life course (Morton, Schafer, and Ferraro 2012; Turner, Thomas, and Brown 2016; Ferraro and Schafer 2017). In particular, childhood socioeconomic disadvantage influences health later in life (Chen and Paterson 2006; Politt, et al. 2005; Pavalko and Caputo 2013). Because income inequality is associated with wider socioeconomic gradients in health, early life exposure to it may also impact later life health (Wilkinson and Pickett 2008; Semyonov, Lewin-Epstein, and Maskileyson 2013; Elgar, et al. 2015). Furthermore, evidence suggests that inequality is related to deleterious outcomes in children and young adults, including poor self-rated health (Rözer and Volker, 2016; Elgar, et al. 2017), school bullying (Elgar, et al. 2009), teenage pregnancy (Pickett, et al. 2005), and child maltreatment (Eckenrode, et al. 2014). However, it is less clear the extent to which early-life inequality exposure affects health over the life course, or whether or not childhood socioeconomic disadvantage intensifies these effects.

Past research investigating lagged or early-life effects of income inequality present mixed results. Results from a study utilizing Current Population Study (CPS) data indicate that inequality exposure 15 years prior is more strongly associated with poorer self-rated health than contemporaneous inequality (Blakely et al. 2000). Other research illustrates that inequality's harmful health effects may be most salient five to seven years after exposure and begin to diminish after twelve years (Zheng 2012). Evidence from 19 high-income countries provides evidence for a lagged, negative effect of income inequality on activities of daily living and life expectancy (Karlsson, et al. 2010). Other work finds a negative

association between national income inequality and health in old age (De Vries, Blane, and Netuveli 2004).[1] Utilizing Panel Study of Income Dynamics (PSID) data, Lillard and colleagues (2015) show small, significant negative effects of national inequality in early life (up to age four) on health later in life.[2] Results from Elgar, et al. (2016) also indicate a negative relationship between early life (up to age 10) national income inequality in forty countries, psychosomatic symptoms, and life satisfaction in adolescence. By contrast, Mellor and Milyo (2003) find no significant lagged effect of inequality on self-rated health after introducing state fixed effects into the model. Results from another study of twelve countries provide no support for an association between national income inequality (either lagged or contemporaneous) and infant mortality, homicide, or suicide (Leigh and Jencks 2007). Other country-level studies that utilize lagged effects of inequality on health find little support for them (Torre and Myrskylä 2014; Curran and Mahutga 2018).

Thus, the question of whether or not income inequality has lagged effects is subject to debate. The relevant window of exposure also varies by type of data and research design. All of these prior studies seek to establish that the exposure of income inequality precedes poor health, an important aspect of causal inference (Gordis 2013). The temporality of exposure also has important implications for untangling inequality's causal mechanisms. However, many of these analyses are cross-sectional in nature, which will not allow for modeling this temporality. Furthermore, most of the past research relies on national-level income inequality indicators and aggregated health measures. National-level inequality measures obscure localized contextual geographical effects (Subramanian and Kawachi 2004; Pickett and Wilkinson 2015). As a contextual effect, income inequality's geographic

scale measurement may reflect distinct interpretations of its effect on health (Chen and Crawford 2012). Aggregated health measures obscure the potential confounding effects of individual income and other characteristics (Elgar, et al. 2017).

Past studies also do not consider the extent to which income inequality's impact on health varies by other forms of childhood disadvantage, such as poverty. Early-life poverty is associated with health disadvantage later in life (Politt, et al. 2005; Evans and Kim 2012; Pavalko and Caputo 2013). Childhood poverty may deepen the effect of income inequality on later life health by exposing a person to greater vulnerability via a cumulative inequality process. Such health inequalities manifest over the life course via demographic and developmental processes. Personal trajectories are shaped by accumulation of risks, available resources, perceived trajectories, and human agency. Childhood conditions are especially important to health in adulthood when differences in experience and status emerge early (Ferraro and Shippee 2009; Ferraro and Schafer 2017). Poverty exposes people to status differences quite early in life, rendering their accumulation of health risks much higher than those who did not experience poverty as a child. This exposure may intensify the deleterious effects of income inequality through one of two pathways: psychosocial or neo-material.

Psychosocial pathways emphasize the role of income inequality in generating harmful status comparisons, erosion of trust and cohesion, and reduced social capital (Kawachi, et al. 1999; Pickett and Wilkinson 2015; Wilkinson and Pickett 2017). These pathways emphasize the *psychosocial* experience of inequality in the form of stress, depression, and anxiety, which leads to the uptake of harmful health behaviors, such as smoking, drinking,

or risky sex (Wilkinson and Pickett 2006; Wilkinson and Pickett 2009a; 2009b; Layte 2012). In this narrative, inequality operates like a pollutant from which no one can escape (Subramanian and Kawachi 2006; Wilkinson and Pickett 2008). Thus, according to this narrative, early life socioeconomic advantage confers no protection against the harmful effects of income inequality. As such, I expect:

H1: The harmful effect of early-life inequality on later life health does not vary by early-life socioeconomic context.

By contrast, neo-material pathways contend that inequality is part of a collection of political-economic processes that shapes both access to health-promoting resources (e.g., medical innovations, quality care, etc.) and availability of public goods (e.g., environmental regulation, subsidized medical care, etc.) that may be utilized to improve health (Muntaner and Lynch 1999; Lynch, et al. 2004; Singh, et al. 2016). This perspective emphasizes the *structural problems* that high inequality generates (Muntaner and Lynch 1999; Lynch, et al. 2000; Lynch, et al. 2004). This underinvestment in public goods translates to less resources for low-income families. Thus, children in families with a high degree of socioeconomic disadvantage may be particularly vulnerable to inequality's deleterious effects. In the context of cumulative inequality, disadvantage at the micro-level (family socioeconomic circumstance) may add to structural disadvantages (Ferraro and Shippee 2009). As such, I expect:

H2: The deleterious effect of early-life inequality on later life health is greater for those who grew up in poor households than those who did not.

In this study, I expand upon the previous empirical work by examining the lagged and cumulative effects of early-life inequality utilizing data from the Panel Study of Income Dynamics. With the PSID data, I am able to better establish the temporality of inequality exposure, something that cross-sectional, ecological studies are unable to do (Blakely et al. 2000; Mellor and Milyo 2003; Leigh and Jencks 2007). Rather than focus on national-level income inequality (e.g., Lillard, et al. 2015; Elgar, et al. 2017), I utilize rich state-level variation in both early-life inequality and contemporaneous inequality. This strategy allows me to investigate localized patterns of inequality both early in life and later in life (Chen and Crawford 2012), as well as avoid potential confounding of period and cohort effects (Lillard, et al. 2015). I extend the timeframe of the cumulative effects into adulthood, observing individuals' health at multiple points in time, rather than focusing on adolescents (Elgar, et al. 2017). As a result, I am able to observe and control for later life socioeconomic trajectory, an important aspect of cumulative inequality (Ferraro and Shippee 2009; Ferraro and Schafer 2017).

I also examine the conditional hypothesis that the harmful effect of early-life inequality on health varies by childhood socioeconomic circumstances. Most of the past research controls for family affluence and parental education. However, they stop short of investigating whether or not inequality's harmful health effects are the same across early-life socioeconomic circumstances. Whether or not inequality's deleterious health effects are not distributed evenly by socioeconomic status remains an important open question (Subramanian and Kawachi 2006; Wilkinson and Pickett 2008). Furthermore, the theoretical mechanisms through which income inequality are presumed to harm health

warrant the exploration of these conditional effects. Later life socioeconomic and health trajectories are likely to be shaped at the intersection of macro- and micro-inequalities (Ferraro and Shippee 2009).

Estimating age, period, and cohort effects while ameliorating omitted variable bias is a challenge in investigations of income inequality's health effects in individuals. Following Elgar, et al. (2017), I utilize the hybrid panel estimator which combines the virtues of fixed effects (FE) models with the flexibility of random effects (RE) models. The hybrid panel estimator allows me to identify the parameters of key time-invariant variables (e.g., early-life inequality, childhood poverty, etc.), while still providing unbiased and consistent estimates of time-varying variables even if they are correlated with individual-specific unobserved variables. Thus, I am able to include characteristics that vary between individuals, such as early life circumstances, and changes in characteristics that vary within individuals, such as contemporaneous income, education, partnership status, and income inequality.

My results indicate that the effects of early-life inequality on self-rated health, psychological distress, and activities of daily living varies by childhood socioeconomic context. Early-life inequality has a deleterious effect on health later in life for individuals who characterize themselves as growing up in a poor household. By contrast, early-life inequality has a positive effect on health later in life for those who characterize themselves as either middle- or upper-class. These findings are consistent with past work that has examined contemporaneous cross-level interactions, as some past work shows that richer individuals report better health when living in an area with high inequality (Kahn, et al.

2000; Subramanian, Kawachi, and Kennedy 2001), while others indicate that poor individuals report worse health in more unequal areas (Kennedy, et al. 1998; Lochner, et al. 2001; Dahl, et al. 2006). The pattern of results does not suggest an overall pollution effect of early-life inequality on later life health (c.f. Subramanian and Kawachi 2006; c.f. Wilkinson and Pickett 2008). Instead, early-life inequality appears to impact differentially those who grew up in poverty versus those who lived in middle- and upper-class households as child. Early-life inequality and poverty operate in tandem to shape later life health in a cumulative inequality process (Ferraro and Shippee 2009).

Data and Methods

I utilized data from two sources to create the dataset, the Panel Study of Income Dynamics (PSID) and the Frank, et al. (2015) inequality series. The PSID follows individuals from the year they first participate until they die or leave the study. The head of household reports data for all of the family members. PSID also is intergenerational. It follows children into adulthood as they establish their own families, and now includes up to three generations of respondents. I utilize the WZB-PSID file, which combines household-level variables and individual-variables (originally separate) into one longitudinal dataset (Brady and Kohler 2019). Variables are assigned to the individual to which they refer such that everyone in the family has their own line. It covers the years 1969 to 2015, with annual coverage from 1969 to 1997 and biennial coverage from 1997 to 2015. The WZB-PSID file combines traditional PSID variables with harmonized income variables from the Cross-National Equivalent File (CNEF). Because I do not have state of residence in youth for individuals born prior to 1970, I start my analysis with individuals who were born in 1970

or later as PSID has excellent coverage for state of residence and early life socioeconomic context as soon as a person enters the dataset. As a result, I estimate health outcomes from early adulthood into middle age. I restrict my analysis to only heads of household to avoid bias due to proxy reporting of health status.[3]

The Frank-Sommeiller-Price inequality series includes annual Gini coefficient estimates and top income shares by U. S. state from 1917 to 2015. It utilizes a benchmarking methodology similar to that of the Piketty-Saez top incomes dataset. However, because of state-level lack of data on the composition of incomes (in particular, realized capital gains) by brackets, it is not quite the same as the Piketty-Saez methodology. Comparisons of the two series yield minimal differences. However, they adjust each state series by year by the ratio of the Piketty-Saez series to the Sommeiller-Frank series for the entire U. S. for the corresponding year to further correct the data (Frank, et al. 2015).

Dependent Variables – Self-Rated Health, Psychological Distress, and Life Satisfaction

I draw three measures of health from the PSID. The first, *self-rated health*, asked respondents to rate their health as one of five categories, *Poor, Fair*, *Good, Very good,* and *Excellent*. Rather than dichotomize the variable to *Excellent/Good/Very Good* and *Fair/Poor*, I retain the full variation for the analysis (Lillard, et al 2015). In general, self-rated health is predictive of mortality so it serves as a valid health summary measure (Idler and Bernyamini 1997). The self-rated health variable appears in PSID from 1985 onward.

My second dependent variable is *psychological distress*, which is based upon the Kessler scale. The Kessler scale includes six items that measure the degree to which a respondent

is facing psychological distress. These items include how often a person felt *nervous*, *hopeless*, *restless or fidgety*, *so depressed that nothing could cheer them up*, *that everything was an effort*, and *worthless*. Response categories include *All of the Time (4), Most of the Time (3), Some of the Time (2), A little of the Time (1),* and *None of the Time (0).* The scores for each question are summed. A score of 13 or higher indicates sensitivity around the threshold for the clinically significant range for nonspecific distress (Kessler, et al. 2010). The psychological distress questions are asked in 2003 and from 2007 on.

The third dependent variable is *life satisfaction*, which asks respondents, "Please think about your life as a whole. How satisfied are you with it? Are you completely satisfied, very satisfied, somewhat satisfied, not very satisfied, or not at all satisfied?" Life satisfaction is a general measure of subjective well-being, or the quality of one's life as whole (Lucas, Freedman, and Cornman 2018). The life satisfaction question is asked from 2011 on.

Key Independent Variable: Early-Life Income Inequality

I utilize the Gini coefficient variable for each U.S. state from the Frank-Sommeiller-Price inequality series as the key independent variable. I match state-level Gini coefficients to individuals based on their place of residence from ages one to fifteen. Then, I generate rolling averages for ages one to five, one to ten, and one to fifteen by taking the mean Gini coefficients during those periods of the respondents' life. This strategy ensures that the measure picks up any variation in Gini during those periods due to moving from one state to another.

By matching individuals to their state Gini coefficients, it also retains rich geographic variation in income inequality rather than obviating it by focusing on national inequality during certain years of life.

Key Moderating Variable: Early Life Poverty

To examine whether or not the effect of early-life inequality varies by childhood poverty, I utilize the PSID question that asks the respondent if their parents were poor when they were growing up. It includes three response categories, *Poor, Average,* and *Pretty well off*. I dichotomize this variable such that 0 is equal to average/middle-class or affluent and 1 is equal to poor.

Control Variables

I utilize *parents' education attainment* (categories include Less than High School, High School, Some College, College Graduate or Higher), *race/ethnicity* (White, Black, Other), *contemporaneous income*, *educational attainment* (years of schooling), and *partnership status* (where 0 = single and 1 = partnered) as control variables. I also include age group (five year increments) and wave fixed effects to parcel out age and period effects.

Table 1 reports descriptive statistics for key variables. Early-life income inequality does not appear to be correlated with self-rated health or psychological distress. It appears to have a moderate, negative correlation with activities of daily living, contrary to the income inequality-health hypothesis. Childhood poverty is not strongly correlated with any health measure, nor with income inequality.

The Hybrid Panel Estimator

The data are panel data, with individuals observed at multiple points in time with equal spacing. Ideally, I would utilize the traditional fixed effects (FE) estimator because it generates unbiased, consistent estimates of coefficients for time-varying covariates even if they are correlated with individual-specific unobserved variables (Wooldridge 2002; Halaby 2004; Alison 2009). However, my theoretical and empirical intervention requires the ability to identify the parameters for time-invariant variables, such as cumulative, early-life income inequality and childhood poverty. Unfortunately, because it only utilizes within group estimators, the FE model is incapable of identifying the parameters of these covariates. The hybrid panel estimator combines the benefits of FE estimation with the flexibility of random effects (RE) estimation.

To estimate the hybrid panel model, I proceed as follows. First, I generate two versions of the time-variant covariates representing within-individual variation and between-individual variation. I accomplish this decomposition via group (in this case, individual) mean centering (Alison 2009; Elgar, et al. 2017). Next, I place both versions of each time-varying predictor, along with the relevant time invariant predictors, into the RE model framework. The RE estimation will provide estimates for the time invariant predictors. The within-individual estimates are equivalent to the classic FE estimates while the between-individual estimates are not useful as they are confounded by other unobserved variables. However, I report both sets of estimates in the table for completeness. I also correct for heteroscedasticity and arbitrary forms of autocorrelation within clusters (Rogers 1993).

Conceptually, I estimate the following equation to test the moderation hypothesis:

$$(1)\ Y_{it} = a \quad + \beta t_t \ + \beta \lambda_a + \ \beta x_i + \beta \gamma_i + \beta x_i \gamma_i + \beta \theta (Z_{it-} \overline{Z}_\iota) + \beta \theta \overline{Z}_\iota + \varepsilon_{jt}$$

In equation 1, Y refers to the health outcome (self-rated health, psychological distress, or activities of daily living) for individual *i* at time *t*. a is the intercept, τ refers to wave-specific intercepts that net out any unobserved time-invariant wave-specific effects, and λ refers to age-group specific intercepts that net out an unobserved time-invariant age-specific effects, and ε is the error term. x and γ are averaged early-life income inequality and childhood poverty, respectively. The fifth term refers to the interaction of early-life income inequality and childhood poverty. $\beta\theta(Z_{it-}\overline{Z}_\iota)$ is a vector of within-individual covariates and $\beta\theta\overline{Z}_\iota$ is a vector of between-individual covariates. ε is the error-term. The interaction term allows for a test of the hypothesis that the harmful health effects of early-life inequality varies by whether or not a respondent grew up in an impoverished household.

Results

I estimate two hybrid panel models per dependent variable: a basic model including early-life Gini (age 1-5), childhood poverty, and controls, and an interactive model that adds the product of early-life Gini and childhood poverty. The results for self-rated health, psychological distress, and life expectancy are presented in Table 2. The first panel reports the results for the basic models for all of the dependent variables (Models 1, 2, and 3). Contrary to expectations, early-life income inequality appears to have a small positive and significant effect on self-rated health. It does not appear to impact psychological distress

or life satisfaction. Childhood poverty has a significant, positive effect on psychological distress and a significant, negative effect on life satisfaction. The interaction term appears in Models 4, 5, and 6. Model 4 reveals a significant, negative effect of early-life income inequality on self-rated health for individuals who grew up in poverty, which aligns with the expectations of H2 (that early-life inequality has a deleterious effect for those who grew up in impoverished households). In Model 5 for psychological distress, the early-life inequality and poverty interaction is positive, but fails to reach significance. Results from Model 6 show a positive interaction term for early-life inequality and poverty, which runs counter to expectations, but it fails to reach significance.

Gender Differences

In Table 3, I examine whether or not the effects of early-life inequality and poverty on self-rated health are similar for male versus female heads of household. Panel 1 reports the results for the basic and full hybrid panel models for men. In the basic model (Model 1), early-life inequality appears to have a significant, positive effect on self-rated health, contrary to expectations derived from the income inequality-health hypothesis. Living in an impoverished household has a negative effect on self-rated health, but it fails to reach significance. Model 2 demonstrates that early-life inequality has a significant, positive effect on self-rated health if a man grew up in a middle-class or upper-class household. The interaction term between Gini and childhood poverty is negative, but it fails to reach significance.

In Panel 2, I examine the results for women. Findings from the basic model illustrate a positive effect of early-life income inequality on self-rated health, similar to the results for men. However, unlike in male heads of household, this effect fails to reach significance. Childhood poverty has a negative effect on self-rated health, but it fails to reach significance. In Model 4, I present the results for women for the interactive model. Here, the findings indicate that early-life inequality has a significant, positive effect on self-rated health if a woman grew up in a middle-class or upper-class household. The interaction term between Gini and childhood poverty is negative and significant, indicating that significant, negative effect for women who grew up in poverty, which aligns with the expectations of H2 (that early-life inequality has a deleterious effect for those who grew up in impoverished households). These results suggest that early-life inequality and poverty are particularly harmful for women's health.

Robustness Checks

I conduct two additional analyses to ensure that my findings are robust to measurement of poverty and income inequality. The PSID measure of poverty that I utilize in the main models asks respondents to characterize their parents' financial resources while they were children. Thus, it is subject to the respondent's perception of their early-life circumstances. The WZB-PSID contains harmonized household income data for each respondent, including records from a respondent's childhood. I utilize the household income variable for respondents to generate poverty thresholds by state and wave. I calculate a relative measure of poverty, in this case, 50% of the state median for a given year, average it the time period when a respondent was aged one to five, and generate a dichotomous variable

such that 1 means that a respondent's household income fell below the poverty threshold during that period of their life. Relative measures of poverty capture the difference in living conditions between the poor and the majority of society. Thus, they are grounded in context and reflect prevailing standards of necessities (Brady 2003).

I present the results from models that use this alternative measure of poverty in Table 4. Panel 1 provides estimates from the basic models. Model 1 illustrates that early-life inequality has a significant, positive effect on self-rated health later in life. According to Model 2, early-life inequality has a positive effect on psychological distress, but it fails to reach significance. Model 3 demonstrates a negative impact of early-life inequality on life satisfaction later in life, but the coefficient fails to reach significance. In Panel 2, I present the results from the interactive models of early-life income inequality and childhood poverty. Model 4 illustrates that early-life inequality has a positive, significant impact on self-rated health for those living above the poverty line. The interaction term between early-life Gini and childhood poverty is positive, but fails to reach significance. These results differ from the main models, which suggests that *perception* of childhood adversity may reflect a distinct process that influences health differently than material accounting of adversity. In Model 6, the results for life satisfaction indicate a significant, negative interaction of early-life inequality and childhood poverty. This finding differs from that observed in the main models, where the interaction term was positive but failed to reach significance. Past work suggests that life satisfaction tend to reflect people's overall evaluation of the quality of their lives as whole (Lucas, Freedman, and Cornman 2018).

As such, one's rating may reflect long-term, cumulative life circumstances. Thus, subjective well-being may be more sensitive to actual material adversity than perception of it.

In Table 5, I utilize an alternative measure of income inequality from Frank, et al. (2015). Past work suggests that different inequality measures reflect unique characteristics of income distributions and produce unique effects on a given outcome variable (De Maio 2007; Jorgenson, Schor, and Huang 2017). Thus, I estimate models using income share of the top 5% rather than Gini. This measure allows me to examine whether or not the results are robust to a particular section of the income spectrum. In Panel 1, I present results from the basic models. Model 1 demonstrates that income share of the top 5% in early-life has a small positive, significant impact on self-rated health. This finding is similar to that of the main models. Income inequality does not appear to have a significant effect on psychological distress (Model 2) or life satisfaction (Model 3). Panel 2 provides the results for the full, interactive models. Again similar to the main models, Model 4 illustrates a significant, negative effect of early-life income inequality on self-rated health for individuals who grew up in poverty, which aligns with the expectations of H2 (that early-life inequality has a deleterious effect for those who grew up in impoverished households). In Model 5 for psychological distress, the early-life inequality and poverty interaction is negative, but fails to reach significance. Results from Model 6 show a positive, significant interaction term for early-life inequality and poverty, which runs counter to expectations.

Taken together, these results suggest additional support for H2 for self-rated health, similar to that of the main models. The findings for self-rated health appear to be robust to choice of inequality measure.

Substantive Significance

The results suggest that the impact of early-life income inequality on self-rated health varies significantly with childhood poverty and has more harmful effects for those who grew up in poverty. To examine the substantive importance of this variation, I examine the marginal effects of childhood poverty on self-rated health as it varies by early-life income inequality. Figure 1 presents the results from Table 2, Model 4. This figure illustrates that differences in self-rated health between those who grew up poor versus non-poor are not significant at the lowest observed levels of early-life income inequality. However, these gaps widen and become significant (from 0.02^{ns} to -0.30*) as inequality increases. Higher early-life income inequality is significantly more harmful for those who grew up in poverty.

In Figure 2, I repeat the same exercise illustrated in Figure 1, however, this time I focus on the marginal effects of childhood poverty on self-rated health as it varies by early-life income inequality for women only. This figure is based upon data from Table 3, Model 4. The pattern in Figure 2 is very similar of the main model, although the trajectory is a bit steeper. It demonstrates that differences in self-rated health between women who were poor in childhood versus those who were middle- or upper-class are not significant at the lowest observed levels of early-life income inequality. However, these gaps widen and become significant (from 0.02^{ns} to -0.43**) as inequality increases.

Higher early-life income inequality is significantly more harmful for women who grew up in poverty, and the effect is steeper than in the models that utilize all heads of household.

Discussion

Past research that explores lagged or early-life effects of income inequality on health provide a mixed picture. Some illustrate substantial lagged or early-life effects of income inequality on health (Blakely et al. 2000; De Vries, Blane, and Netuveli 2004; Zheng 2012; Elgar, et al. 2016). Other studies indicate more modest lag or early-life effects (Lillard, et al. 2015; Karlsson, et al. 2010). Still others provide no support for lagged or early-life effects (Mellor and Milyo 2003; Leigh and Jencks 2007). However, these studies vary quite a bit by type of data and research design. Many of them are cross-sectional, which is not amenable to temporal ordering of inequality exposure. Some of them rely on aggregate-level measures of income inequality and health, which obscures the potential confounding effects of region, individual income, and other characteristics. Past studies may also present mixed results because they do not consider the extent to which income inequality's impact on health varies by other forms of childhood disadvantage, such as poverty. Childhood poverty may deepen the harmful effect of income inequality on health. In this study, I utilize panel data with state-level measures of income inequality to establish how early-life exposure impacts health throughout adulthood. I also examine whether or not the deleterious effect of early-life inequality on later life health is greater for those who grew up in poor households than those who did not, suggestive of a cumulative inequality process rooted in material exposures.

My results indicate that early-life income inequality (age 1 – 5) has a particularly harmful effect for individuals who characterize their childhood households as impoverished. By contrast, those from middle- and upper-class appear to benefit from higher early-life inequality. These findings are consistent with past work that has examined contemporaneous cross-level interactions, as some past work shows that richer individuals report better health when living in an area with high inequality (Kahn, et al. 2000; Subramanian, Kawachi, and Kennedy 2001), while others indicate that poor individuals report worse health in more unequal areas (Kennedy, et al. 1998; Lochner, et al. 2001; Dahl, et al. 2006). These results are not consistent with an overall pollution effect of early-life inequality on later life health (c.f. Subramanian and Kawachi 2006; c.f. Wilkinson and Pickett 2008). Instead, early-life inequality appears to impact health in a particularly harmful way later in life for those who grew up in impoverished households. Indeed, early-life inequality and poverty influence health trajectories years after exposure, consistent with a cumulative inequality process (Ferraro and Shippee 2009).

An important limitation of this study is that due to the requirement to match early-life residency to inequality, individuals born on or after 1970 only are included in the analysis. Thus, I only track individuals' health during their young adult through the early middle-age years. Unfortunately, this precludes analysis that allows me to determine the life course effects of early-life inequality and poverty for elderly people. Accumulation processes play an important role in the aging process (Ferraro and Morton 2018).

Future work might utilize datasets focused on mid-life (i.e., MIDUS) or the elderly (i.e., Health and Retirement Study) to better investigate longer-term effects of early-life inequality exposure. State-level income inequality data that extends back to 1917 exists (Frank, et al. 2015).

Income inequality's relationship to intergenerational mobility is subject to considerable debate (Corak 2013; Bloome 2015; Chetty, et al. 2017). However, past work has not yet untangled the complicated relationships between income inequality, intergenerational mobility, and observed health disparities. Macro-level factors related to policy, such as income inequality, may strongly constrain the choices available to individuals to promote their health, including via constrained mobility. Furthermore, social positions, such as gender, race/ethnicity, and social class, may either enhance or impede these health-related choices (Bird and Rieker 2008). Future work may investigate the extent to which early-life inequality and poverty constrains intergenerational mobility as a mediator in the relationship between income inequality and health outcomes.

Notes

1. De Vries, Blane, and Netuveli (2004) average national income inequality over a 46-year period for sixteen countries. Thus, they investigate the effects of income inequality exposure up to middle-age, rather than focusing on early-life or transition to adulthood.
2. Lillard, et al. (2015) investigate these health effects in a single cohort within the United States using national-level income inequality measures. Thus, inequality only varied with developmental stages, not between contexts or individuals.

3. Unfortunately, the PSID is antiquated in its gendered view of head of household. The head of household is generally a man with a female partner. However, there are enough female heads of household to generate a sufficient analysis by gender.

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Tables and Figures

Table 3.1: Descriptive Statistics

		1	2	3	4	5	6	7	8	9	10	11	12
1	Self-Rated Health												
2	Psychological Distress	-0.27											
3	Life Satisfaction	0.26	-0.35										
4	Income Inequality (Age 1-5)	-0.02	-0.00	0.04									
5	Childhood Poverty	0.02	0.12	-0.07	0.02								
6	Father's Education	0.25	-0.03	0.04	0.02	0.02							
7	Mother's Education	0.23	-0.02	0.02	0.11	0.02	0.62						
8	Years of Education	0.33	-0.12	0.08	-0.04	-0.04	0.41	0.41					
9	Partnership	0.12	-0.12	0.14	-0.19	-0.23	0.04	0.04	0.14				
10	Household Income*	0.22	-0.21	0.15	0.31	-0.18	0.30	0.27	0.45	0.21			
11	Current Income Inequality	-0.00	0.00	-0.01	0.64	0.07	0.18	0.15	0.23	-0.01	0.56		
12	Age	-0.33	-0.06	0.01	-0.24	-0.25	-0.21	-0.24	-0.13	0.47	0.15	0.10	
	Mean	3.55	3.36	3.85	0.52	0.09	1.69	1.74	12.11	0.39	9.16	0.54	35.20
	Standard Deviation	1.09	3.99	0.85	0.05	0.28	0.98	0.91	2.79	0.49	1.01	0.06	26.32

Note: *Equivalized; Natural Logarithm.

Table 3.2: Hybrid Panel Models of Early-Life Inequality and Poverty on Health

	Basic Models			Full Models		
	(1) Self-Rated Health	(2) Psychological Distress	(3) Life Satisfaction	(4) Self-Rated Health	(5) Psychological Distress	(6) Life Satisfaction
Early-Life Gini (Age 1 -5)	1.826**	3.355	0.0981	2.436***	2.711	-0.317
	(0.659)	(3.008)	(0.690)	(0.712)	(3.183)	(0.736)
Childhood Poverty	-0.0343	0.474***	-0.104***	0.785*	-0.409	-0.681
	(0.0293)	(0.136)	(0.0303)	(0.390)	(1.786)	(0.372)
Early-Life Gini * Childhood Poverty				-1.675*	1.763	1.141
				(0.784)	(3.558)	(0.732)
Race/Ethnicity (REF=White)						
Black	-0.00321	-0.473**	-0.0448	-0.00511	-0.470**	-0.0423
	(0.0304)	(0.149)	(0.0320)	(0.0304)	(0.149)	(0.0320)
Other	-0.0902	0.272	-0.0596	-0.0927	0.276	-0.0553
	(0.0722)	(0.381)	(0.0744)	(0.0720)	(0.381)	(0.0744)
Father's Education (REF = No HS)						
Father High School	0.0852*	-0.516**	0.0225	0.0861*	-0.516**	0.0223
	(0.0360)	(0.195)	(0.0417)	(0.0360)	(0.195)	(0.0417)
Father Some College	0.0890	-0.570*	-0.0253	0.0887	-0.569*	-0.0249
	(0.0454)	(0.225)	(0.0502)	(0.0453)	(0.225)	(0.0502)
Father College Degree or Higher	0.113*	-0.209	0.0371	0.112*	-0.207	0.0369
	(0.0478)	(0.252)	(0.0538)	(0.0478)	(0.252)	(0.0539)
Mother's Education (REF = No HS)						
Mother High School	0.0344	-0.0550	-0.0102	0.0363	-0.0587	-0.0134
	(0.0388)	(0.208)	(0.0455)	(0.0388)	(0.208)	(0.0456)
Mother Some College	0.00264	0.247	-0.0763	-0.0000237	0.249	-0.0760
	(0.0469)	(0.233)	(0.0519)	(0.0468)	(0.233)	(0.0520)
Mother College Degree or Higher	0.0875	0.362	-0.0808	0.0868	0.361	-0.0825
	(0.0524)	(0.257)	(0.0536)	(0.0523)	(0.257)	(0.0536)
Individual FE Components						
Household Income (Equivalized)	0.0343**	-0.102	0.0303*	0.0343**	-0.102	0.0303*
	(0.0110)	(0.0606)	(0.0149)	(0.0110)	(0.0606)	(0.0149)
Years of Schooling	-0.00783	-0.0389	0.0135	-0.00799	-0.0389	0.0135
	(0.00812)	(0.0446)	(0.0151)	(0.00812)	(0.0446)	(0.0151)

Partnered	0.00848	-0.407**	0.235***	0.00741	-0.407**	0.235***
	(0.0244)	(0.147)	(0.0457)	(0.0244)	(0.147)	(0.0457)
Individual RE Components						
Household Income (Equivalized)	0.136***	-0.774***	0.100***	0.137***	-0.774***	0.100***
	(0.0216)	(0.115)	(0.0209)	(0.0216)	(0.115)	(0.0209)
Years of Schooling	0.0428***	-0.154***	0.0184*	0.0420***	-0.154***	0.0188*
	(0.00844)	(0.0418)	(0.00861)	(0.00846)	(0.0418)	(0.00863)
Partnered	0.230***	-1.033***	0.476***	0.230***	-1.033***	0.476***
	(0.0379)	(0.161)	(0.0346)	(0.0380)	(0.162)	(0.0346)
Constant	1.061*	12.77***	2.357***	0.762	13.08***	2.566***
	(0.449)	(2.012)	(0.442)	(0.470)	(2.069)	(0.467)
Wave FE	YES	YES	YES	YES	YES	YES
Age FE	YES	YES	YES	YES	YES	YES
Observations	14736	8860	6723	14736	8860	6723
R^2	0.09	0.08	0.10	0.09	0.08	0.10

Note: Serial correlation and heteroscedasticity consistent standard errors in parentheses, *** $p<0.001$, ** $p<0.01$, * $p<0.05$.

Table 3.3: Hybrid Panel Models of Early-Life Inequality and Poverty on Self-Rated Health

	Men		Women	
	(1) Self-Rated Health	(2) Self-Rated Health	(3) Self-Rated Health	(4) Self-Rated Health
Early-Life Gini (Age 1 -5)	1.750*	2.052*	1.460	2.506*
	(0.856)	(0.920)	(1.039)	(1.130)
Childhood Poverty	-0.0138	0.393	-0.0704	1.323*
	(0.0380)	(0.519)	(0.0444)	(0.572)
Early-Life Gini * Childhood Poverty		-0.836		-2.830*
		(1.047)		(1.145)
Race/Ethnicity (REF=White)				
Black	0.0386	0.0388	-0.0453	-0.0535
	(0.0412)	(0.0412)	(0.0450)	(0.0454)
Other	-0.0949	-0.0940	-0.0973	-0.111
	(0.0863)	(0.0862)	(0.121)	(0.121)
Father's Education (REF = No HS)				
High School	0.105*	0.106*	0.0472	0.0451
	(0.0496)	(0.0497)	(0.0515)	(0.0514)
Some College	0.114	0.115	0.0284	0.0237
	(0.0604)	(0.0603)	(0.0696)	(0.0695)
College Degree or Higher	0.104	0.104	0.105	0.102
	(0.0642)	(0.0642)	(0.0723)	(0.0726)
Mother's Education (REF = No HS)				
High School	0.0300	0.0303	0.0358	0.0417
	(0.0515)	(0.0515)	(0.0590)	(0.0591)
Some College	0.0355	0.0333	-0.0464	-0.0478
	(0.0633)	(0.0632)	(0.0689)	(0.0690)
College Degree or Higher	0.105	0.104	0.0381	0.0398
	(0.0691)	(0.0690)	(0.0801)	(0.0802)
Individual FE Components				
Household Income (Equivalized)	0.0402**	0.0401**	0.0197	0.0200
	(0.0139)	(0.0139)	(0.0184)	(0.0183)
Years of Schooling	-0.0145	-0.0144	0.00528	0.00385
	(0.0104)	(0.0104)	(0.0128)	(0.0128)
Partnered	-0.0108	-0.0113	0.0455	0.0460
	(0.0265)	(0.0266)	(0.132)	(0.132)
Individual RE Components				
Household Income (Equivalized)	0.108***	0.109***	0.148***	0.150***
	(0.0277)	(0.0278)	(0.0348)	(0.0346)
Years of Schooling	0.0565***	0.0559***	0.0408**	0.0398**
	(0.0114)	(0.0114)	(0.0133)	(0.0134)
Partnered	0.182***	0.183***	0.207	0.209
	(0.0468)	(0.0469)	(0.141)	(0.142)
Constant	1.466**	1.320*	0.823	0.298
	(0.563)	(0.588)	(0.731)	(0.761)
Wave FE	YES	YES	YES	YES
Age FE	YES	YES	YES	YES
Observations	9506	9506	5230	5230
R^2	0.08	0.08	0.07	0.08

Note: Serial correlation and heteroscedasticity consistent standard errors in parentheses, *** $p<0.001$, ** $p<0.01$, * $p<0.05$.

Table 3.4: Hybrid Panel Models of Early-Life Inequality and Poverty on Health, Alternative Measure of Poverty

	Basic Models			Full Models		
	(1) Self-Rated Health	(2) Psychological Distress	(3) Life Satisfaction	(4) Self-Rated Health	(5) Psychological Distress	(6) Life Satisfaction
Early-Life Gini (Age 1 -5)	1.788***	1.388	-0.0396	1.776***	0.721	0.340
	(0.498)	(2.255)	(0.514)	(0.513)	(2.358)	(0.530)
Childhood Poverty	0.00180	0.0875	0.0585	-0.0199	-1.175	0.767*
	(0.0293)	(0.144)	(0.0307)	(0.316)	(1.562)	(0.333)
Early-Life Gini * Childhood Poverty				0.0428	2.438	-1.363*
				(0.622)	(3.014)	(0.636)
Race/Ethnicity (REF=White)						
Black	-0.00516	-0.401**	-0.0633*	-0.00510	-0.396**	-0.0657*
	(0.0255)	(0.126)	(0.0264)	(0.0255)	(0.126)	(0.0264)
Other	-0.114	0.117	-0.0992	-0.114	0.110	-0.0951
	(0.0585)	(0.307)	(0.0621)	(0.0585)	(0.308)	(0.0621)
Father's Education (REF = No HS)						
High School	0.0414	-0.364*	0.0290	0.0413	-0.369*	0.0322
	(0.0314)	(0.163)	(0.0347)	(0.0314)	(0.163)	(0.0348)
Some College	0.0613	-0.530**	-0.00800	0.0612	-0.535**	-0.00496
	(0.0384)	(0.186)	(0.0417)	(0.0385)	(0.186)	(0.0417)
College Degree or Higher	0.0783*	-0.188	0.0383	0.0782*	-0.189	0.0391
	(0.0389)	(0.201)	(0.0420)	(0.0389)	(0.201)	(0.0420)
Mother's Education (REF = No HS)						
High School	0.0451	-0.340	0.0484	0.0451	-0.341	0.0489
	(0.0337)	(0.174)	(0.0383)	(0.0337)	(0.174)	(0.0382)
Some College	0.0278	0.0624	-0.0239	0.0278	0.0615	-0.0235
	(0.0394)	(0.195)	(0.0429)	(0.0394)	(0.195)	(0.0429)
College Degree or Higher	0.0792	-0.0800	-0.00945	0.0792	-0.0794	-0.0100
	(0.0414)	(0.204)	(0.0435)	(0.0414)	(0.204)	(0.0435)
Individual FE Components						
Household Income (Equivalized)	0.0299***	-0.104*	0.0197	0.0299***	-0.104*	0.0200
	(0.00831)	(0.0457)	(0.0116)	(0.00831)	(0.0457)	(0.0116)
Years of Schooling	-0.00349	-0.0245	0.00164	-0.00349	-0.0247	0.00175
	(0.00682)	(0.0358)	(0.0124)	(0.00682)	(0.0358)	(0.0124)

Partnered	0.00399	-0.445***	0.221***	0.00399	-0.446***	0.222***
	(0.0185)	(0.115)	(0.0359)	(0.0185)	(0.115)	(0.0359)
Individual RE Components						
Household Income (Equivalized)	0.120***	-0.562***	0.0674***	0.120***	-0.565***	0.0687***
	(0.0169)	(0.0838)	(0.0152)	(0.0169)	(0.0841)	(0.0152)
Years of Schooling	0.0456***	-0.156***	0.0259***	0.0456***	-0.155***	0.0253***
	(0.00681)	(0.0331)	(0.00701)	(0.00681)	(0.0332)	(0.00702)
Partnered	0.289***	-1.139***	0.467***	0.289***	-1.146***	0.471***
	(0.0309)	(0.134)	(0.0284)	(0.0309)	(0.134)	(0.0286)
Constant	1.155**	11.80***	2.597***	1.161**	12.15***	2.399***
	(0.354)	(1.500)	(0.329)	(0.357)	(1.549)	(0.335)
Wave FE	YES	YES	YES	YES	YES	YES
Age FE	YES	YES	YES	YES	YES	YES
Observations	24062	13779	10467	24062	13779	10467
R^2	0.09	0.06	0.08	0.09	0.06	0.08

Note: Serial correlation and heteroscedasticity consistent standard errors in parentheses, *** $p<0.001$, ** $p<0.01$, * $p<0.05$.

Table 3.5: Hybrid Panel Models of Early-Life Inequality and Poverty on Health, Alternative Measure of Inequality

	Basic Models			Full Models		
	(1) Self-Rated Health	(2) Psychological Distress	(3) Life Satisfaction	(4) Self-Rated Health	(5) Psychological Distress	(6) Life Satisfaction
Early-Life Gini (Age 1 -5)	0.0201*	-0.0168	0.000691	0.0289**	-0.0107	-0.00715
	(0.00834)	(0.0360)	(0.00802)	(0.00902)	(0.0391)	(0.00843)
Childhood Poverty	-0.0339	0.476***	-0.104***	0.596*	0.924	-0.691**
	(0.0293)	(0.136)	(0.0302)	(0.275)	(1.223)	(0.266)
Early-Life Gini * Childhood Poverty				-0.0268*	-0.0185	0.0240*
				(0.0115)	(0.0501)	(0.0108)
Race/Ethnicity (REF=White)						
Black	-0.00472	-0.472**	-0.0448	-0.00642	-0.474**	-0.0417
	(0.0304)	(0.149)	(0.0321)	(0.0304)	(0.149)	(0.0320)
Other	-0.0945	0.287	-0.0598	-0.0960	0.285	-0.0549
	(0.0723)	(0.382)	(0.0747)	(0.0722)	(0.381)	(0.0746)
Father's Education (REF = No HS)						
High School	0.0864*	-0.510**	0.0226	0.0876*	-0.510**	0.0215
	(0.0360)	(0.195)	(0.0417)	(0.0360)	(0.195)	(0.0417)
Some College	0.0918*	-0.564*	-0.0250	0.0924*	-0.563*	-0.0262
	(0.0455)	(0.224)	(0.0502)	(0.0454)	(0.224)	(0.0502)
College Degree or Higher	0.115*	-0.203	0.0372	0.115*	-0.203	0.0366
	(0.0477)	(0.252)	(0.0538)	(0.0478)	(0.252)	(0.0539)
Mother's Education (REF = No HS)						
High School	0.0358	-0.0588	-0.0101	0.0380	-0.0559	-0.0153
	(0.0388)	(0.209)	(0.0456)	(0.0388)	(0.208)	(0.0457)
Some College	0.00383	0.257	-0.0762	0.00143	0.256	-0.0762
	(0.0469)	(0.233)	(0.0519)	(0.0468)	(0.233)	(0.0520)
College Degree or Higher	0.0896	0.362	-0.0807	0.0890	0.362	-0.0834
	(0.0524)	(0.257)	(0.0537)	(0.0523)	(0.257)	(0.0536)
Individual FE Components						
Household Income (Equivalized)	0.0340**	-0.103	0.0303*	0.0340**	-0.102	0.0302*
	(0.0110)	(0.0606)	(0.0149)	(0.0110)	(0.0606)	(0.0149)
Years of Schooling	-0.00815	-0.0406	0.0135	-0.00835	-0.0406	0.0134
	(0.00813)	(0.0445)	(0.0151)	(0.00812)	(0.0446)	(0.0151)

Partnered	0.00803	-0.404**	0.235***	0.00704	-0.404**	0.235***
	(0.0244)	(0.147)	(0.0457)	(0.0244)	(0.147)	(0.0457)
Individual RE Components						
Household Income (Equivalized)	0.133***	-0.787***	0.100***	0.135***	-0.786***	0.0996***
	(0.0215)	(0.115)	(0.0208)	(0.0215)	(0.115)	(0.0208)
Years of Schooling	0.0426***	-0.152***	0.0184*	0.0415***	-0.153***	0.0192*
	(0.00846)	(0.0418)	(0.00862)	(0.00848)	(0.0419)	(0.00863)
Partnered	0.230***	-1.049***	0.476***	0.231***	-1.049***	0.476***
	(0.0379)	(0.162)	(0.0346)	(0.0380)	(0.162)	(0.0346)
Constant	1.483***	15.03***	2.394***	1.275***	14.90***	2.579***
	(0.366)	(1.483)	(0.299)	(0.376)	(1.514)	(0.310)
Wave FE	YES	YES	YES	YES	YES	YES
Age FE	YES	YES	YES	YES	YES	YES
Observations	14736	8860	6723	14736	8860	6723
R^2	0.09	0.08	0.10	0.09	0.08	0.10

Note: Serial correlation and heteroscedasticity consistent standard errors in parentheses, *** $p<0.001$, ** $p<0.01$, * $p<0.05$.

Figure 3.1: Marginal Effects of Poverty on Self-Rated Health across Observed Range of Income Inequality

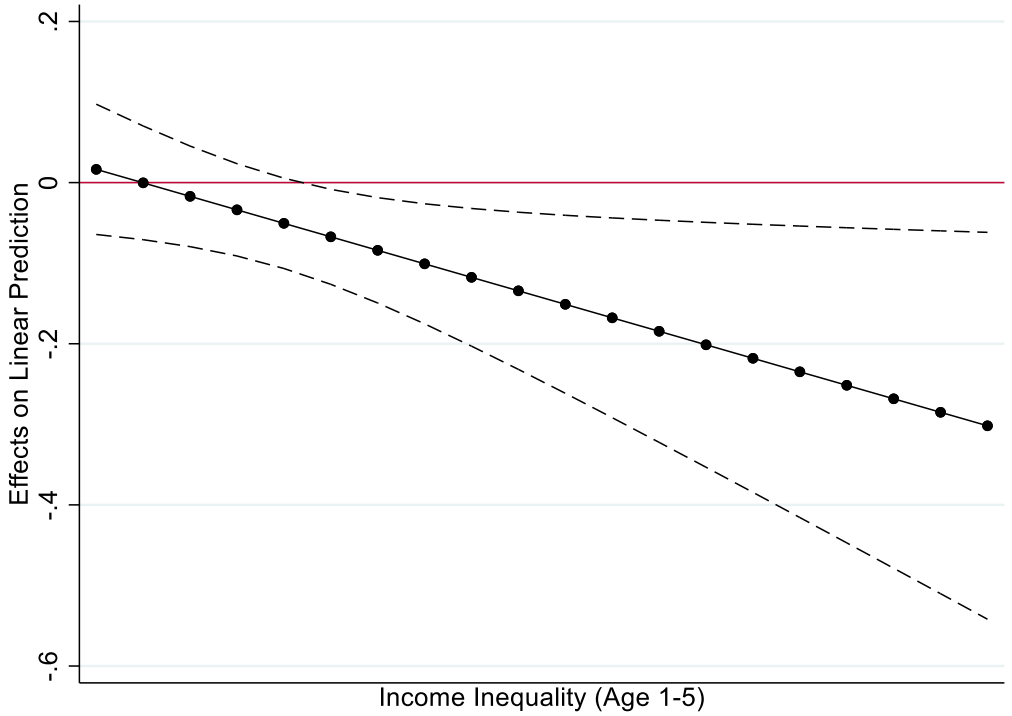
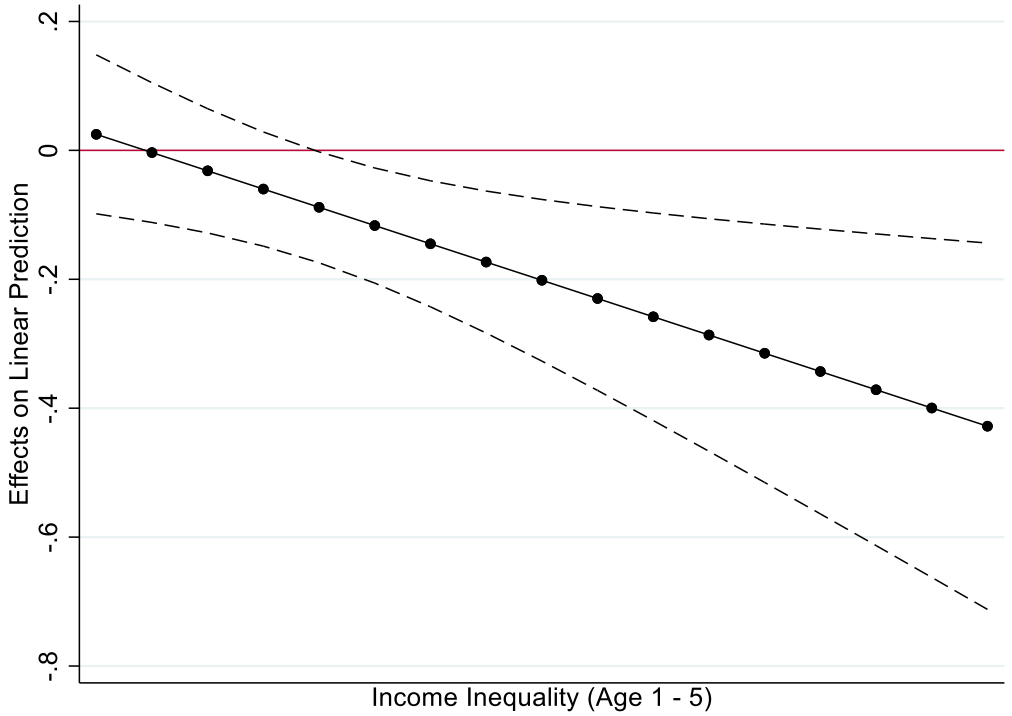


Figure 3.2: Marginal Effects of Poverty on Self-Rated Health across Observed Range of Income Inequality, Women



Conclusion

Support for the income inequality-health hypothesis is far from unequivocal. Several key issues remain open. These debates include the appropriate level of geographic measurement for both income inequality and health, untangling the key mechanisms of action through which inequality is presumed to harm health, tying together the macro-level (i.e., income distribution) and the micro-level (e.g., socioeconomic status, social position, health resources, etc.) for a complete picture of health stratification, and the timing of income inequality exposure and its implications for health across the life course.

My dissertation builds on these key debates in several ways. First, I extend upon previous country-level studies in my first chapter by illustrating a global gradient in the effect of income inequality on population health. Second, I demonstrate in my first and second empirical chapter that income inequality does not appear to impact health in high-income countries at all, consistent with neo-material, rather than psychosocial mechanisms. Income inequality's harmful health impacts appear to operate primarily in low- and middle-income countries. Third, in my second empirical chapter, I integrate macro- and micro-level literatures by showing that income inequality influences the education-health gradient. I also illustrate that political exclusion deepens the effect of inequality on the education-health gradient, suggestive of the role of power resources in reproducing inequalities. Finally, in my third empirical chapter, I expand upon the literature that examines lagged and cumulative effects of inequality on health later in life using panel data with state-level income inequality measures for greater geographic precision. I also explore the conditional hypothesis that the harmful effect of early-life inequality on health varies

by childhood socioeconomic circumstances, showing that the effects of early-life inequality on self-rated health, psychological distress, and activities of daily living varies by childhood socioeconomic context.

In the sections that follow, I outline potential future directions to pursue post-dissertation. I draw these future lines of inquiry from the three empirical chapters of my dissertation. They focus on integrating the two primary perspectives in the income inequality-health hypothesis literature, integrating life course pathways into future work, investigating methods for better defining and exploring relative deprivation (as a key component of Wilkinson's 1996 theory), and exploring the relationship between early-life income inequality exposure, intergenerational mobility, and health across the life course. I plan to pursue these issues throughout my future scholarly career.

Future Directions

Integrating the Neo-Material and Psychosocial Perspectives

The first empirical chapter finding of more deleterious health effects in poor countries is inconsistent with the notion that psychosocial mechanisms should produce bigger effects in richer countries (e.g., Wilkinson 1996; Wilkinson and Pickett 2009a). Nevertheless, future work should consider modes of analysis that could assess the degree to which psychosocial mechanisms operate in poorer countries.

Some recent research suggests that psychosocial pathways are also important for health in less-developed countries (Walker, Kyomuhendo, Chase, and Choudhry 2013). Walker, et al. (2013) find that poor people in diverse developmental contexts experience a common pattern of "pretence, withdrawal, self-loathing, 'othering', despair, depression, thoughts of suicide and…reductions in self efficacy" (215).

Thus, results from this chapter suggest that psychosocial factors interact with material ones to produce a negative effect of inequality on population health in poorer countries. That is, social comparisons and status positions underling the stress, shame, and anxiety-mediated health effects may be worse in poorer countries. In the absence of a robust healthcare or health insurance infrastructure, for example, individuals have fewer resources with which to mitigate the health effects of stress, shame and anxiety. A fruitful merger between the integrationist and neo-materialist approaches would be to consider the intervening role of material resources in the health effects of psychosocial processes.

This question could be answered at both the macro and micro levels. For example, a parallel analysis to that performed here might be to consider an interaction of inequality with macro-level covariates capturing the prevalence of healthcare and health infrastructure. Alternatively, there are logical reasons to consider socioeconomic status (SES) as a moderator of the proposed psychological pathways linking inequality to health. SES is considered to be a fundamental cause of health inequality in part because of the individual level resources it provides (Link and Phelan 1995). If individuals in countries with high inequality experience stressors related to status comparisons, but can utilize economic resources to alleviate these stresses, then we would expect that inequality would have a

larger effect on individual health among those in the bottom of the income distribution. In such an analysis, we would expect that SES has a stronger moderating effect in countries with weaker healthcare systems and/or health infrastructure. In the individual analyses envisioned here, researchers should consider the lag structure of inequality's effects.

Early-Life Income Inequality and Health Resources across the Life Course

The third empirical chapter examines the relationships between early-life inequality, childhood poverty, and health. Results indicate that early-life inequality has a deleterious effect on health later in life for individuals who characterize themselves as growing up in a poor household. By contrast, early-life inequality has a positive effect on health later in life for those who characterize themselves as either middle- or upper-class. However, some evidence also suggests that the relationship between resources and health may shift over the life course, which may mean that the effect of early-life inequality influences whether or not individuals obtain or use health-related resources (Lin, et al. 2003; Babones 2008). Future work may examine the moderating effects of early-life inequality on later life health resources.

Early-Life Inequality and Accumulation Processes in Mid-life and Old Age

In my third empirical chapter, I examine the effects of early life inequality on health later and life, as well as explore whether or not the impact of early-life inequality varies by childhood poverty. An important limitation of this study is that due to the requirement to match early-life residency to inequality, individuals born on or after 1970 only are included in the analysis. Thus, I only track individuals' health during their young adult through the

early middle-age years. Unfortunately, this precludes analysis that allows me to determine the life course effects of early-life inequality and poverty for elderly people. Accumulation processes play an important role in the aging process (Ferraro and Morton 2018). Future work might utilize datasets focused on mid-life (i.e., MIDUS) or the elderly (i.e., Health and Retirement Study) to better investigate longer-term effects of early-life inequality exposure. State-level income inequality data that extends back to 1917 exists (Frank, et al. 2015).

Relative Deprivation and Reference Groups for Comparisons

The second empirical chapter examines whether or not income inequality operates through a mechanism of relative deprivation. However, because WVS does not have robust income, race and ethnicity, or acculturation measures, I was not able to examine whether or not higher inequality influences income's effect on health relative to a reference group. Choice of reference group that people use when making social comparisons has important implications for hypotheses related to relative deprivation. Past work finds a relationship between relative income by reference group and health (Subramanyam, et al. 2009). Future research with more robust measures of income and clearly delineated reference groups may explore whether or not inequality influences the relationship between relative income and health.

Income Inequality, Intergenerational Mobility, and Health Disparities

Income inequality's relationship to intergenerational mobility is subject to considerable debate (Corak 2013; Bloome 2015; Chetty, et al. 2017). However, past work has not yet

untangled the complicated relationships between income inequality, intergenerational mobility, and observed health disparities. Macro-level factors related to policy, such as income inequality, may strongly constrain the choices available to individuals to promote their health, including via constrained mobility. Furthermore, social positions, such as gender, race/ethnicity, and social class, may either enhance or impede these health-related choices (Bird and Rieker 2008). Future work may investigate the extent to which early-life inequality and poverty constrains intergenerational mobility as a mediator in the relationship between income inequality and health outcomes.

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