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ZERO-SUM ENVIRONMENTS, THE EVOLUTION OF  
EFFORT-SUPPRESSING BELIEFS, AND ECONOMIC DEVELOPMENT

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### **ABSTRACT**

We study the evolution of belief systems that suppress productive effort, including beliefs about envy, the importance of luck for success, witchcraft beliefs, and disdain for competitive effort. Demotivating beliefs evolve when interactions are zero-sum. They improve short-run material welfare by limiting excessive competition but reduce long-run growth. Demotivating beliefs also drive a wedge between how well people do and how well they think they do. Whereas material welfare is hump-shaped in demotivating beliefs, subjective well-being is decreasing. These predictions are supported by data from two samples in the Democratic Republic of Congo and the World Values Survey.

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## 1. Introduction

Beliefs and values that discourage effort and productive activity are surprisingly widespread today and throughout history. They often take the form of warnings against, and even punishment for, personal ambition and success. A well-known example is belief in witchcraft and the evil eye, i.e., the ability of certain people to intentionally cause harm via supernatural means, which acts as a psychic tax on success (Gershman, 2014, 2015, 2022b, Henrich, 2009). However, demotivating beliefs come in many forms and can even be found, although perhaps more subtly, in industrialized countries. For example, in the Nordic countries, the laws of Jante state, “Du skal ikke tro at du er noget” (“do not think that you are anything”), discourage personal pride or aggrandizement. Similarly, in Australia and New Zealand, “tall poppy” beliefs encourage people to cut down those who stand out in terms of personal achievement. In Japan, a common phrase warns that “the nail that sticks out will be hammered down.”<sup>1</sup> Other forms of demotivating belief systems include pessimistic beliefs in an “unjust world” (Bénabou and Tirole, 2006), fatalism (Whelan, 1996), and anti-materialistic beliefs that reduce the enjoyment of consumption (Flouri, 1999). If such beliefs reduce effort and investment, why are they prevalent across the world and throughout history?

We study this question theoretically and empirically by building on insights from anthropology about the ‘image of limited good,’ first highlighted by George Foster (1962, 1965, 1967, 1972). According to Foster, the limited and fixed nature of resources in some settings means that anything “good” in society is scarce and competed over. “If ‘Good’ exists in limited amounts which cannot be expanded,” Foster writes (1965, p. 296), “and if the system is closed, it follows that *an individual or a family can improve their position only at the expense of others*” (emphasis in original). In other words, the dominant presumption in many small-scale societies is that if one person does better, somebody else must do worse. Based on ethnographic research, Foster argued that this zero-sum worldview was at the root of individual decision-making and cultural traits that curb daily social, economic, and political ambition. Such traits include beliefs in the importance of moderation, feelings of envy and concerns about the envy of others, witchcraft beliefs, an emphasis on the importance of sharing, and a de-emphasis on the value of hard

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<sup>1</sup>Sometimes these beliefs and norms are embedded in class-based status systems that stigmatize aspiration and effort as “social climbing” (McCloskey, 2010). Accordingly, British Prime Minister Herbert Asquith praised the students of his Oxford College for exhibiting “effortless superiority.”

work and thrift. Foster believed that this worldview inhibited entrepreneurial activity, wealth accumulation, innovation, and economic development.

The first contribution of this paper is to develop an evolutionary model exploring Foster's hypothesis.<sup>2</sup> We find that demotivating beliefs can emerge and spread despite reducing incentives for productive effort and inhibiting economic development. They do so in zero-sum environments, where benefits to one person are obtained at the expense of others. In the model, members of the population match and engage in production. While an individual's effort increases their output, a fraction  $\alpha$  of their output comes at the cost of their partner; thus,  $\alpha$  represents the zero-sumness of the environment. This production function captures a range of economic interactions with different degrees of rivalry, ranging from merchants competing over a fixed set of customers (a completely zero-sum situation) to business partners working together in an enterprise but dividing the profits from their joint endeavor (a partially zero-sum situation).

In the model, individuals can hold demotivating beliefs  $\theta$ , i.e., incorrect beliefs about the return to effort. Individuals can also have a neutral belief system ( $\theta = 0$ ) corresponding to the true return to effort.<sup>3</sup> While individuals choose effort based on subjective beliefs, cultural evolution is driven by the (true) material payoffs. Despite the distortions in effort generated by demotivating beliefs, we show that such beliefs can survive and spread when economic interactions are partly zero-sum and there is positive sorting (e.g., when people with the same cultural beliefs are geographically or socially clustered). In such environments, the direct cost of holding a demotivating belief is overwhelmed by the benefit of being matched with players who hold demotivating beliefs and do not compete excessively with others. More broadly, people's views of the world tend to be distorted, and these distortions reflect the externalities present in their environment.

When interactions are zero-sum, effort is socially inefficient since it primarily redistributes resources, and demotivating beliefs improve short-run efficiency by limiting excessive competition. As a result, within a society with a given degree of zero-sumness, there is an intensity of demotivating belief  $\theta^* > 0$  that maximizes an individual's income. Thus, the model predicts a

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<sup>2</sup>Evolutionary models are underutilized in economics, especially in connection with empirical work. Given the extensive evidence that cultural values change and adapt to the external environment (e.g., Tabellini, 2008, Bisin and Verdier, 2017), it is crucial to have theory and predictions in a setting where values and beliefs are in motion and not assumed to be fixed or in some stable equilibrium.

<sup>3</sup>We use the term 'belief system' or simply 'belief' to denote a cultural trait such as belief in witchcraft or an unjust world rather than a probability distribution over known states of the world, as is conventional in economics. Hence, we treat these beliefs as being updated not through Bayesian learning based on frequent feedback from the environment but through social learning and other forms of cultural evolution.

hump-shaped (strictly concave) relationship between demotivating beliefs and economic welfare. However, this same relationship is not found for subjective well-being. Because demotivating beliefs make an individual's situation seem worse than it is, it reduces their perceived well-being. For a given degree of zero-sumness, subjective well-being is maximized at the true (non-demotivating) belief  $\theta = 0$ , strictly convex, and typically decreasing in demotivating beliefs. Thus, our model generates testable predictions about the divergence between material welfare and subjective well-being.

Having derived predictions focusing on cross-individual variation in an environment with a fixed degree of zero-sumness, we then turn to the model's predictions across societies and environments with different degrees of zero-sumness. Looking across groups, the model predicts a positive relationship between the zero-sumness of the environment and demotivating beliefs. Additionally – and in contrast to predictions within a fixed zero-sum environment – the model predicts that both the zero-sumness of the environment and demotivating beliefs are negatively related to material welfare and subjective well-being. These negative relationships are due to the direct negative effect of zero-sum interactions on both objective and subjective payoffs.

Having formalized and further developed Foster's arguments, we turn to the data and test the model's predictions. We begin by analyzing data collected from Kananga, an urban hub and provincial capital in the Democratic Republic of the Congo (DRC). The city is home to approximately 1.8 million people originally from villages and towns across the provinces of Kasai, Kasai Central, and Kasai Oriental. Although it houses a large, diverse population, the city remains pre-industrial. By some accounts, it is the largest city in the world without consistent electricity or running water. Nearly all roads are unpaved, and agriculture and animal husbandry are common even on urban properties. We use this urban, pre-industrial setting to test the model's prediction of a positive relationship between the zero-sumness of a person's environment and their demotivating beliefs. We analyze data from two samples: a 200-person sample from surveys collected in 2015 and a 1,000-person sample collected in 2019. We use the 2015 sample to develop our zero-sum measure and explore its relationship with demotivating beliefs. We then replicate and validate the findings in the larger 2019 sample.

To measure the zero-sumness of a respondent's environment –  $\alpha$  in the model – we use multiple survey questions asking whether each of the following types of gains comes at the expense of others: earnings, profits, wealth, gains in trade, power, and happiness. Using principal

components analysis, we can distill one factor that captures the extent to which a person views their world as being zero-sum, which is the baseline zero-sum measure used in the analysis.

We estimate the relationship between the zero-sumness of a person's environment and the demotivating beliefs that were the focus of Foster's ethnography: envy and traditional religious beliefs, commonly called 'witchcraft.' We also consider beliefs in Christianity, which is the alternative to traditional religion in the area. In contrast to traditional beliefs, Christianity, particularly in popular Pentecostal denominations, emphasizes that devotion and hard work lead to prosperity and blessing from God. In both samples, respondents who report a more zero-sum environment are more envious of the success of others, more likely to hold traditional religious beliefs, and less likely to hold Christian beliefs. The estimates are consistent with the model's prediction of a positive relationship between zero-sumness  $\alpha$  and demotivating beliefs  $\theta$ .

We then examine the same relationships globally using data from the World Values Survey (WVS). Although it does not ask about envy or witchcraft, the survey does elicit a broader set of demotivating beliefs relevant in more developed countries, which comprise most of the WVS sample. These include the perceived importance of hard work for economic success, skepticism about the role of effort in determining success, and the acceptability of receiving help from others. In line with the model's predictions, there is again a robust positive association between zero-sum perceptions and demotivating beliefs. Thus, although the specific beliefs vary between the Congolese and WVS samples, in both settings, demotivating beliefs co-move with the zero-sumness of one's environment.

The global WVS sample also allows us to test our model's predictions regarding material welfare and subjective well-being. Consistent with the model's predictions, a more zero-sum environment is associated with lower material welfare, measured using questions about income, educational attainment, savings, and occupational status. It is also associated with lower subjective well-being, measured using questions about life satisfaction and happiness.

We then use the global WVS sample to test the model's prediction that there is an optimal level of demotivating belief within a fixed zero-sum environment, i.e., the predicted hump-shaped relationship between demotivating beliefs and economic welfare. Our empirical analysis confirms this prediction: among individuals with the same degree of zero-sum perceptions, those with an intermediate level of demotivating beliefs have the highest incomes. By contrast, the model predicts that within a fixed zero-sum environment, subjective well-being is maximized by the

true (non-demotivating) belief  $\theta = 0$ , is strictly convex, and (generally) decreases in  $\theta$ . We also find support for this prediction in the WVS data. Among individuals with the same zero-sum environment, those with stronger demotivating beliefs report lower life satisfaction and happiness.

Lastly, motivated by Foster’s arguments, we connect demotivating beliefs to long-run growth by adding technological innovation through learning-by-doing to our model. We find that demotivating beliefs can have harmful long-term consequences on innovation. When technological innovation arises from productive effort, demotivating beliefs can trap a society in a low-technology state by discouraging such effort. Thus, demotivating belief systems can act as a *kludge*: an adaptation that compensates for but does not eliminate and even deepens inefficiencies (Ely, 2011). However, we also show that a temporary decline in the zero-sumness of the environment can trigger a permanent transition from a low- to a high-growth regime because of a cultural shift to a less demotivating belief system. This dynamic provides potential insights into the cultural changes that economic historians have argued helped fuel the Industrial Revolution.

In short, by providing a formal theory that builds on Foster’s insights and testing its predictions, we establish a strong link between an environment’s zero-sumness, the existence of demotivating beliefs, and economic activity in pre-industrial and industrialized societies.

This paper provides a rare empirical application and test of an evolutionary game-theoretic model in economics. Whereas much of the existing literature has focused on the evolution of trust and other-regarding preferences, we introduce the notion of a demotivating belief system.<sup>4</sup> While distorted beliefs also arise in models of motivated reasoning (Bénabou and Tirole, 2006) and misspecified beliefs (Esponda and Pouzo, 2016, Massari and Newton, 2020), neither psychological motivations nor belief misspecification are assumed in our model. Instead, we follow the literature in economics on the evolution of preferences (or indirect evolution) (Frank, 1987, Güth and Yaari, 1992) and show how demotivating beliefs can emerge via cultural evolution.<sup>5</sup> In particular, we employ the approach of Alger and Weibull (2013, 2016) which relies on positive assortativity. One particularly novel aspect of our analysis is that we place some structure on the

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<sup>4</sup>See the pioneering work on cultural evolution by Boyd and Richerson (1988, 2005), as well as the literature on the evolution of cooperation under cultural group selection (e.g., Cooper and Wallace, 2004, Henrich, 2004).

<sup>5</sup>The basic analysis assumes that preferences are observable and can thus alter the behavior of one’s partners in an interaction (Schelling, 1960, Becker, 1976, Frank, 1988). Due to this strategic (commitment) effect, preferences can diverge from the objective fitness function (Ok and Vega-Redondo, 2001, Ely and Yilankaya, 2001, Heifetz, Shannon and Spiegel, 2007). See also Bisin and Verdier (2000, 2017) on the cultural transmission of preferences.

divergence between material and subjective payoffs and take these predictions to the data.

Our empirical findings also contribute to an important and growing empirical literature on intergenerationally transmitted cultural traits (e.g., Giuliano, 2007, Fernandez, 2007, Fernández and Fogli, 2009, Voigtländer and Voth, 2012). In particular, our analysis contributes to the literature that seeks to shed light on how the external environment affects the evolution of cultural traits (Nunn and Wantchekon, 2011, Guiso, Sapienza and Zingales, 2016, Grosjean and Khattar, 2018, Schulz, Bahrami-Rad, Beauchamp and Henrich, 2019, Buggle and Durante, 2021, Giuliano and Nunn, 2021), as well as our understanding of the consequences of these evolved traits for economic development (Spolaore and Wacziarg, 2009, Becker and Woessmann, 2009, Guiso, Sapienza and Zingales, 2009, Algan and Cahuc, 2010, Enke, 2019, Alesina, Hohmann, Michalopoulos and Papaioannou, 2023). We add to this literature an understanding of demotivating beliefs, their connection to economic environments that are zero-sum in nature, and their consequences for economic development.

Our belief-based channel contrasts with and complements prior work on social institutions (e.g., Carvalho, 2013, Nunn and de la Sierra, 2017, Akerlof, Matouschek and Rayo, 2020). Most closely related is Gershman’s (2015, 2016, 2020) seminal work on witchcraft and evil-eye beliefs within economics. Theoretically, Gershman (2015) develops a model in which these beliefs emerge to reduce an individual’s output and thereby discourage envious destruction. Empirically, consistent with our findings, he documents a positive relationship between the ‘image of limited good’ and witchcraft beliefs (Gershman, 2022a) and a negative relationship between witchcraft beliefs and subjective well-being (Gershman, 2023). Our findings also speak to work on sharing norms (Platteau, 2000). For example, Bowles (2006) shows that sharing norms and other forms of reproductive leveling favor the evolution of cooperation by reducing the gains from defection. We show how a seemingly unproductive cultural trait – i.e., demotivating beliefs equivalent to *incorrect* beliefs that output will be confiscated and burned rather than redistributed – can improve short-run efficiency and propagate when the economic environment is zero-sum.

Finally, our findings complement the analysis of Chinoy, Nunn, Sequeira and Stantcheva (2023), which shows the importance of Foster’s insights for contemporary U.S. politics. Their empirical analysis documents relationships between thinking in zero-sum terms and political views and shows that they explain much of the variation not captured by party affiliation. They also document that people’s measured perceptions of the zero-sumness of their world are shaped



in systematic ways by the reality of the environment. They show that economic mobility and immigration are associated with weaker zero-sum perceptions, while enslavement is associated with stronger zero-sum perceptions. These findings are an important building block for our study, which uses survey-based measures of perceived zero-sumness to capture the true zero-sumness of the environment.

## **2. The “Image of Limited Good”**

In the introduction, we provided examples of demotivating beliefs. At first glance, it is paradoxical that beliefs and value systems that depress productive effort could emerge and survive. To help elucidate this puzzle, we turn to the work of anthropologist George Foster (Foster, 1967). Based on fieldwork in rural Mexico in the 1960s, he argued that people in most pre-industrial societies viewed the world as zero-sum. According to this “image of limited good,” if one person gets ahead, someone else must fall behind.

A zero-sum cognitive orientation arises in a world where essential resources and assets are indeed in limited supply. Land is limited, so more land for one individual means less land for another. Similar scarcity applies to romantic partners, authority, and social status. In such environments, one can only ahead at the expense of others. Although Foster first proposed the “image of limited good” as a model of rural Mexican society, he subsequently argued that zero-sum beliefs emerged around the world, driven by the actual zero-sumness of social and economic life, particularly in pre-industrial societies with limited trade or economic growth (Foster, 1962, 1967, 1972). He also described a relationship between a zero-sum world and demotivating beliefs, noting that zero-sum societies appear to lack what McClelland (1961) calls the “need for achievement” (Foster, 1965).

The paper’s first goal is to combine these insights into a formal model that connects a zero-sum world, demotivating beliefs, effort, material welfare, and economic growth. The second is to take the model and its predictions to the data. In doing so, an important consideration is identifying and measuring demotivating beliefs. Foster’s writings emphasize envy and supernatural beliefs like witchcraft and the evil eye, primarily because of his interest in small-scale pre-industrial societies. Our empirical analysis begins by examining these beliefs, which remain prevalent across the developing world. We analyze the relationship between perceived zero-sumness of the environment, indigenous supernatural beliefs, and envy in the DRC. Indigenous supernatural

beliefs are commonly labeled “witchcraft” in Western European cultures. One feature of such belief systems, which can lead them to discourage effort, is that success is often thought to derive from the use of witchcraft at the expense of others. Envy is another common demotivating belief that relates to a zero-sum view of achievement – i.e., the idea that one person’s fortune creates misfortune for another.<sup>6</sup>

The specific content of demotivating beliefs may differ in contemporary post-industrial societies. But, as noted in the introduction with examples from Scandinavia, Australia, New Zealand, and Japan, many beliefs explicitly discourage personal ambition and success. We use data from the World Values Survey to examine the relationship between perception of the zero-sumness of the environment and beliefs that discourage ambition and effort globally.

### 3. The Model

We now turn to a model that examines the evolution of demotivating beliefs in an environment that is more or less zero-sum.

#### A. Basic Set Up

**PLAYERS.** The set of players is a continuum of mass one. We view this as a population of individuals who live in the same environment and can interact with each other. For example, the population could be a neighborhood within a city, a social group, a village, a district within a country, or a country. We later extend the analysis to multiple populations.

**TIME.** Time is continuous and denoted by  $t \in \mathbb{R}_+$ .

**BELIEF SYSTEMS.** There is a potentially large but finite set of belief systems  $\Theta = \{\theta_1, \theta_2, \dots, \theta_n\}$ , where the intensity of belief  $i$  is  $\theta_i \in [0,1]$ ,  $i = 1, 2, \dots, n$ . As we shall see,  $\theta_i = 0$  is the true belief, and any  $\theta_i > 0$  is a demotivating belief. We view these as cultural beliefs rather than the more conventional notion of beliefs as probability distributions over known states of the world. The share of each belief type  $i$  in the population is denoted by  $q_i$ , with the population state denoted by  $\mathbf{q} = (q_1, q_2, \dots, q_n)$  and  $\sum_{i=1}^n q_i = 1$ .

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<sup>6</sup>Envy can also fuel the use of witchcraft. Indeed, envy has been associated with harm, either through intentional (witchcraft) or unintentional (evil eye) supernatural means.

**ACTIONS.** Individuals are paired and engage in production. The effort exerted by type  $i$  is denoted by  $x_i \in \mathbb{R}_+$ . The cost of production is  $\frac{1}{2}x_i$ , and the production function is  $A\sqrt{x_i}$ , where  $A > 0$  is the state of technology in the economy (which we endogenize in Section 6).

Environments vary in their degree of rivalry or zero-sumness. The degree to which the environment is zero-sum is measured by  $\alpha \in (0, 1]$ , which we assume is known by individuals. One interpretation is that a fraction  $\alpha$  of tasks are zero-sum in nature, meaning that the benefit to the individual undertaking the task comes at the expense of the player with whom they are paired.<sup>7</sup> For example, if player  $i$  invests in better marketing for her shop, an increase in sales can come from newly created demand or stealing of player  $j$ 's customers.

**PAYOFFS.** The true (objective) payoff function to type  $i$  when matched with type  $j$  is

$$\begin{aligned} U(x_i, x_j) &= A [\alpha (\sqrt{x_i} - \sqrt{x_j}) + (1 - \alpha)\sqrt{x_i}] - \frac{1}{2}x_i \\ &= A [\sqrt{x_i} - \alpha\sqrt{x_j}] - \frac{1}{2}x_i. \end{aligned} \tag{1}$$

If  $\alpha = 0$ , we have a simple production decision: each individual's payoff is independent of their partner's effort. If  $\alpha = 1$ , the environment is purely zero-sum: all gains come at the expense of one's partner. This is what Foster (1965) describes as a "limited good" environment.

Players maximize a potentially distorted version of the true payoff function. Specifically, a type  $i$  player chooses production effort  $x_i$  to maximize the following subjective payoff:

$$\hat{U}_i(x_i, x_j) = A [(1 - \theta_i) \sqrt{x_i} - \alpha\sqrt{x_j}] - \frac{1}{2}x_i. \tag{2}$$

That is, an individual with belief system  $i$  discounts the return to her effort by a factor  $(1 - \theta_i) \in [0, 1]$ . Our results are robust to alternative specifications of the subjective payoff function, e.g., beliefs that overestimate the cost of effort or discount the value of total output (see Appendix B.I). This specification captures various kinds of demotivating belief systems. For example, individuals may have a (potentially inaccurate) perception about the economic return to effort in the economy (Bénabou and Tirole, 2006).  $\theta_i > 0$  could also be the product of a supernatural belief, such as belief in the evil eye, according to which envious individuals cause harm to others through supernatural forces (Gershman, 2014, 2015). Hence, envy exacts a kind of supernatural tax on effort, with believers expecting to lose a fraction  $\theta_i$  of their output. These

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<sup>7</sup>An alternative incomplete-information interpretation is that the environment is zero-sum with probability  $\alpha$ . In this case, whatever type  $i$  gains through production, their partner  $j$  loses. With probability  $1 - \alpha$ ,  $i$ 's effort is fully productive and does not come at the expense of  $j$ .

belief systems reduce perceived returns to effort and are thus demotivating. The higher the belief intensity  $\theta_i$ , the more demotivating the belief of individual  $i$ .

Maximizing (2) with respect to  $x_i$ , we get optimal production effort for each type  $i$ :<sup>8</sup>

$$x_i^* = \arg \max_{x_i \in \mathbb{R}_+} \hat{U}_i(x_i, x_j) = (1 - \theta_i)^2 A^2. \quad (3)$$

**MATCH PAYOFFS.** As in the literature on indirect evolution (e.g., Güth and Yaari, 1992, Ok and Vega-Redondo, 2001), while individual choices are based on their subjective payoff functions given by (2), evolution is determined by the true payoff function (1).<sup>9</sup> Denote the equilibrium (true) payoff to a type  $i$  individual matched with a type  $j$  individual by

$$\begin{aligned} U_{ij} &= U(x_i^*, x_j^*) \\ &= (1 - \theta_i - \alpha(1 - \theta_j) - \frac{1}{2}(1 - \theta_i)^2) A^2. \end{aligned}$$

By observation, the payoff to  $i$  in an  $i, j$  match is strictly decreasing in the intensity of  $i$ 's belief  $\theta_i$  and strictly increasing in the intensity of  $j$ 's belief  $\theta_j$ . Therefore, one would ideally wish to hold the true belief  $\theta_i = 0$ , but be matched with individuals who hold a demotivating belief  $\theta_j > 0$ .

**ASSORTATIVE MATCHING.** The success of trait  $i$  is based on its “cultural fitness,” which we denote by  $F_i(\mathbf{q})$ , and is given by the expected payoff across all possible matches; it is, thus, a function of the population state  $\mathbf{q}$ . We assume partial assortative matching as in Cavalli-Sforza and Feldman (1981). Specifically, we introduce a degree of positive assortativity  $\sigma$  such that a fraction  $\sigma$  of the population matches with its type and a fraction  $1 - \sigma$  is matched at random with another member of the population. In many biological models, positive assortativity is generated by a “limited dispersal,” i.e., a spatial structure to reproduction in which genetic/cultural offspring occupy neighboring locations so that interactions are more likely among genetic/cultural relatives (e.g., Hamilton, 1964, West, Griffin and Gardner, 2007).<sup>10</sup> Another interpretation is that  $\sigma$  is a proxy for group-level selection in the population. For example, consider the population being split into two groups, labeled 1 and 2. Suppose trait  $i$  has achieved fixation (i.e., is present in 100% of the population) in group 1 and trait  $j$  has achieved fixation in group 2. The index of assortativity  $\sigma$  is then the likelihood of a within-population match.

<sup>8</sup>Since  $i$ 's marginal utility is independent of  $j$ 's choice, the results do not depend on whether individuals have complete or incomplete information regarding their partner's type.

<sup>9</sup>Our results are preserved when the fitness function is a convex combination of material and subjective payoffs.

<sup>10</sup>Positive assortativity could also be generated by social institutions, e.g., groups that select for specific traits or rituals that screen out non-believers (e.g., Iannaccone, 1992, Carvalho and Sacks, 2021a).

Given an index of assortativity  $\sigma$ , the cultural fitness of trait  $i$  is

$$\begin{aligned} F_i(\mathbf{q}) &= \sigma U_{ii} + (1 - \sigma) \sum_{j=1}^n q_j U_{ij} \\ &= (1 - \theta_i) \left(1 - \frac{1}{2}(1 - \theta_i)\right) A^2 - \sigma \alpha (1 - \theta_i) A^2 - (1 - \sigma) \alpha A^2 \sum_{j=1}^n q_j (1 - \theta_j). \end{aligned} \quad (4)$$

## B. Cultural Evolution

The evolution of beliefs in the population is given by a dynamic system operating on the  $n$ -dimensional unit simplex. We place a minimal restriction that the distribution of beliefs  $\mathbf{q}$  evolves according to a deterministic payoff monotone dynamic: for all  $i, j$  such that  $q_i > 0$  and  $q_j > 0$ ,

$$F_i(\mathbf{q}) \begin{matrix} \geq \\ < \end{matrix} F_j(\mathbf{q}) \iff \frac{dq_i}{dt} \begin{matrix} \geq \\ < \end{matrix} \frac{dq_j}{dt}.$$

That is, if the payoff to type  $i$  is higher than the payoff to type  $j$ , then  $i$ 's population share grows faster. A leading example is the replicator dynamic, which can be the product of natural selection, imitation, or reinforcement learning (Sandholm, 2010).

We first show that the belief intensity with the highest cultural fitness vis-à-vis any other belief intensity is  $\theta^* = \sigma\alpha$ , i.e., the product of the degree of positive sorting in interactions and the degree to which the environment is zero-sum. Recall that the (true) non-demotivating belief is  $\theta = 0$ . We denote the population shares of these beliefs at time  $t$  by  $q^*(t)$  and  $q^0(t)$ , respectively.

**Proposition 1 . Evolution of Demotivating Beliefs.** *Cultural evolution selects a belief system as follows. If there is a belief close to  $\theta^* = \sigma\alpha$ , then the true belief  $\theta = 0$  will be driven to extinction, and all individuals will have a 'distorted' view of the world. If  $\theta^*$  is in the set of beliefs, then eventually, the entire population will hold this belief. Formally:*

- (i) *If the set of beliefs  $\Theta$  contains  $\theta_i < 2\sigma\alpha$  and the initial state is such that  $q^0(0) < 1$ , then  $q^0(t)$  converges monotonically to zero. Otherwise,  $\lim_{t \rightarrow \infty} q^0(t) = 1$ .*
- (ii) *If the set of beliefs  $\Theta$  contains  $\theta^* = \sigma\alpha$  and the initial state is such that  $q^*(0) > 0$ , then  $q^*(t)$  converges monotonically to one.*

All proofs are in Appendix A.

Even though they represent inaccurate representations of the world, demotivating belief systems can survive and spread through the population. According to part (i) of the proposition,

as long as demotivating beliefs are present initially and are not too intense given the degree of zero-sumness  $\alpha > 0$  and index of assortativity  $\sigma > 0$ , the true belief  $\theta = 0$  will be driven to extinction. Only demotivating beliefs will survive in the population. Part (ii) tells us that the demotivating belief with intensity  $\theta^* = \sigma\alpha$  will win out, driving all other belief systems to extinction. Hence, under positive assortativity ( $\sigma > 0$ ), the belief intensity that is selected is strictly increasing in the degree of zero-sumness  $\alpha$ .<sup>11</sup> These results do not depend on the specific form of the payoff monotone cultural dynamic. In addition, even when  $q^*(0) = 0$ , Corollary 2 in Appendix A shows that evolution will select a belief intensity in support of  $\mathbf{q}(0)$  that is approximately equal to  $\theta^*$ .

The intuition for the survival of (incorrect) demotivating beliefs is as follows. The belief  $\theta > 0$  depresses effort below the first-best level by discounting the return to effort. The direct effect of this distortion is to reduce cultural fitness. There is also an indirect effect we call the ‘interactive effect,’ which is an increase in the likelihood of being matched with someone with demotivating beliefs and who exerts little effort. When interactions are primarily zero-sum ( $\alpha$  is large) and there is a high degree of assortative matching ( $\sigma$  is large), the interactive effect dominates. Demotivating beliefs evolve to internalize part of the negative externalities in such environments.

These results are connected to Alger and Weibull’s work on *Homo moralis* and altruistic preferences (Alger and Weibull, 2012). It can be shown that the same effort choices are generated by these approaches. This equivalence is interesting from a theoretical perspective. From an empirical perspective, we need to identify the specific belief systems or preferences at work. In Appendix B.II, we show that demotivating beliefs generate distinct empirical predictions from altruistic preferences.<sup>12</sup> In Appendix B.III, we also show that our results are robust to the inclusion of different types of effort, i.e., pro-social and anti-social, with demotivation only occurring with respect to the latter. Finally, in Appendix B.IV, we show that the same results occur when demotivating beliefs are driven in a top-down manner by a cultural leader or institution that tunes the intensity of demotivation over time to maximize the spread of the demotivating belief.

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<sup>11</sup>This result helps us understand part (i). The (true) non-demotivating belief  $\theta = 0$  is driven to extinction whenever there is a demotivating belief that is closer than it to the relative fitness maximizing belief  $\theta^* = \sigma\alpha$ .

<sup>12</sup>In particular, the evolutionarily stable demotivating belief depends on the degree to which the environment is zero-sum. The evolutionarily stable degree of altruism does not. If survey responses such as “competition is not good” only reflect altruism, then they should not vary with zero-sumness, which contradicts our empirical results.

### C. The Effect of Demotivating Beliefs on Material Welfare and Subjective Well-Being

We have seen that demotivating beliefs have an ‘interactive effect’ at the individual level that enables them to spread through the population. We now turn to the social efficiency of such beliefs. Our efficiency criterion, which we refer to as material welfare, is a function of the objective payoffs, which serve as the cultural fitness of each belief. Specifically, material welfare at time  $t$  for a person holding belief  $\theta_i$  is the objective (or true) payoff given by (1) evaluated at the equilibrium effort levels  $(x_i^*)_{i=1}^n$  and averaged over all interactions:

$$W_i(t) = F_i(\mathbf{q}(t)) = \left[ \sigma U(x_i^*, x_i^*) + (1 - \sigma) \sum_{j=1}^n q_j(t) U(x_i^*, x_j^*) \right]. \quad (5)$$

**Proposition 2 . Demotivating Beliefs and Material Welfare.** *Material welfare at time  $t$  is highest for the holders of belief  $\theta^* = \sigma\alpha$  and strictly concave in  $\theta$ .*

The demotivating belief  $\theta^*$  improves welfare by internalizing the negative externalities from production in zero-sum environments. In addition, there is a hump-shaped relationship between material welfare and the intensity of demotivating beliefs. In other words, there is a demotivating belief that maximizes  $i$ ’s material welfare. This holds regardless of the initial condition  $\mathbf{q}(0)$ .

We can also examine the effect of demotivating beliefs on perceived welfare, which we refer to as “subjective well-being.” Let us define subjective well-being at time  $t$  for a person holding belief  $\theta_i$  as the subjective payoff given by (2) evaluated at the equilibrium effort levels  $(x_i^*)_{i=1}^n$  and averaged over all interactions:

$$\hat{W}_i(t) = \left[ \sigma \hat{U}_i(x_i^*, x_i^*) + (1 - \sigma) \sum_{j=1}^n q_j(t) \hat{U}_i(x_i^*, x_j^*) \right]. \quad (6)$$

**Proposition 3 . Demotivating Beliefs and Subjective Well-Being.** *Subjective well-being at time  $t$  is strictly decreasing in the intensity of demotivating beliefs  $\theta$  if  $\theta < 1 - \sigma\alpha$ . Otherwise, it is increasing in the intensity of demotivating beliefs. Subjective well-being is also strictly convex in  $\theta$ . Finally, for  $\sigma\alpha < 1/2$ , subjective well-being is highest for the true belief  $\theta = 0$ .*

Unlike material welfare, which is hump-shaped in the intensity of demotivating beliefs, subjective well-being is strictly decreasing in  $\theta$  if the most intense demotivating belief in the set of beliefs is not too intense, specifically if  $\max \Theta \leq 1 - \sigma\alpha$ . Otherwise, subjective well-being is

U-shaped in the intensity of demotivating beliefs, increasing for higher values of  $\theta$ . Even when  $\max \Theta > 1 - \sigma\alpha$ , numerical examples indicate that subjective well-being only rises slightly for higher values of  $\theta$ , even for high degrees of positive sorting (see Figure A1). Regardless of the shape of the function, subjective well-being is largest for the true non-demotivating belief  $\theta = 0$ . This is true as long as  $\sigma < \frac{1}{2}$ , a condition that we expect to hold. For example, in the case of genetic evolution,  $\sigma = \frac{1}{2}$  means that all interactions are with siblings, which is an extreme level of positive sorting. Thus, subjective well-being contrasts with material welfare, which we have shown is maximized at  $\theta^* > 0$  (for  $\sigma\alpha > 0$ ).

The reason why demotivating beliefs have a different effect on material welfare and subjective well-being is as follows. Material welfare is hump-shaped in  $\theta$  due to the tradeoff between the direct cost of a distorted belief system and the interactive benefit of being matched with a less motivated partner. There is no such tradeoff for subjective well-being since individuals choose effort to maximize their subjective payoff. Instead, there is an “affective cost” from discounting the material payoff by  $1 - \theta$ , i.e., making people feel they are doing worse than they actually are. This affective cost is hump-shaped in  $\theta$ , causing subjective well-being to be typically decreasing in  $\theta$ . Thus, Propositions 2 and 3 predict a divergence between material welfare and subjective well-being. These are key predictions that we will take to the data.

#### D. Comparative Dynamics across Populations

Thus far, we have considered a population interacting in an environment characterized by a degree of zero-sumness  $\alpha$ . In reality, even within a given society, there can be multiple socioeconomic and geographic niches with different degrees of zero-sumness. We now generate predictions for pooled populations of individuals interacting in environments with different degrees of zero-sumness, which we will also take to the data.

Consider a finite set of populations indexed by  $k \in \{1, 2, \dots, K\}$ . The degree to which the environment faced by population  $k$  is zero-sum is  $\alpha^k$ , and the populations are ordered such that  $k > k'$  implies  $\alpha^k > \alpha^{k'}$ . In order to focus on the degree of zero-sumness  $\alpha^k$ , we assume each population has the same index of assortativity  $\sigma > 0$  and set of beliefs  $\Theta$ .<sup>13</sup>

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<sup>13</sup>We assume unchanging  $\alpha^k$ . If we were to allow the environment to change, all results would apply regardless of the history of  $\alpha^k$  in each population, as long as enough time has passed since the last environmental change.



We begin by analyzing the relationship between zero-sumness, on the one hand, and demotivating beliefs, effort, material welfare, and subjective well-being, on the other, across populations  $k \in K$ . Define the population  $k$  share of belief  $i$  at time  $t$  by  $q_i^k(t)$  and the population  $k$  state by  $\mathbf{q}^k(t)$ . The mean demotivating belief, mean level of effort, mean material welfare, and mean subjective well-being in population  $k$  at time  $t$  are defined, respectively, as:

$$\theta^k(t) = \sum_{i=1}^n q_i^k(t) \theta_i, \quad X^k(t) = \sum_{i=1}^n q_i^k(t) x_i^*, \quad W^k(t) = \sum_{i=1}^n q_i^k(t) W_i(t), \quad \hat{W}^k(t) = \sum_{i=1}^n q_i^k(t) \hat{W}_i(t) \quad (7)$$

where  $x_i^*$  is given by (3),  $W_i(t)$  is given by (5), and  $\hat{W}_i(t)$  is given by (6). If we also assume a *regular environment* where the set of beliefs is the discrete grid  $\Theta = \{0, \frac{1}{\Delta}, \frac{2}{\Delta}, \dots, 1\}$  and the initial state  $\mathbf{q}(0)$  has full support on  $\Theta$ , we can then state the following proposition:

**Proposition 4 . Zero-Sum Environments, Demotivating Beliefs, and Economic Outcomes.** *Consider a regular environment with a sufficiently fine set of beliefs ( $\Delta$  large). If cultural evolution is allowed enough time to operate, the mean demotivating belief will be higher in populations with higher degrees of zero-sumness, and mean effort and material welfare will be lower. If, in addition,  $\sigma \leq \frac{1}{2}$  or  $\alpha^K \leq \frac{1}{\sigma} \frac{1+\sigma}{2+\sigma}$ , then mean subjective well-being will also be lower in populations with higher degrees of zero-sumness.*

*That is, under the conditions above, there exists a finite time  $T$  such that for all  $t \geq T$ ,  $\theta^k(t)$  is strictly increasing in  $\alpha^k$  and  $X^k(t)$ ,  $W^k(t)$  and  $\hat{W}^k(t)$  are strictly decreasing in  $\alpha^k$ .*

Therefore, where a population interacts in a more zero-sum environment, it will eventually hold more intense demotivating beliefs, exert less effort, and experience lower material welfare and subjective well-being. Hence, worse outcomes are produced in more zero-sum environments due to the evolution of demotivating beliefs. Again, this applies independently of the precise form of payoff monotone cultural dynamic or of the initial conditions for each population, as long as they are interior.

The reason behind the additional condition for subjective well-being is as follows. There are three effects of a more zero-sum environment on subjective well-being. The first is to increase negative externalities and thereby lower subjective well-being. The remaining two effects depend on the limiting demotivating belief,  $\theta^* = \sigma \alpha^k$ , being increasing in zero-sumness. Specifically, the second effect arises because increased demotivating beliefs discount the returns to effort by approximately  $1 - \theta^*$ , which reduces well-being by making an individual's situation seem worse than it is. The third effect raises well-being by producing demotivating beliefs that internalize

part of the negative externalities from zero-sum interactions. When positive assortativity  $\sigma$  and the degree of zero-sumness  $\alpha^k$  are large, the third effect dominates, and subjective well-being can rise with  $\alpha^k$ . Empirically, this is unlikely because  $\sigma = \frac{1}{2}$  is a very high degree of positive sorting. Moreover, numerical examples indicate that  $\hat{W}^k$  only increases slightly with  $\alpha^k$  and on a small part of the domain (see Figure A2). Essentially,  $\alpha^k$  becomes close to flat for high values of  $\alpha^k$ .

Taken together, these results also yield relationships between demotivating beliefs, economic outcomes, and subjective well-being across populations.

**Corollary 1 . *Demotivating Beliefs, Economic Outcomes, and Subjective Well-being.*** *Mean effort, material welfare, and subjective well-being are all strictly decreasing in a population's mean demotivating belief. Specifically, under the conditions of Proposition 4, there exists a finite time  $T$  such that, for all  $t \geq T$ ,  $\theta^k(t) > \theta^{k'}(t)$  implies  $X^k(t) < X^{k'}(t)$ ,  $W^k(t) < W^{k'}(t)$ , and  $\hat{W}^k(t) < \hat{W}^{k'}(t)$ .*

The theory thus generates a subtle but important point: within a society characterized by a given degree of zero-sumness, demotivating beliefs can increase material welfare (Proposition 2). However, across societies with varying degrees of zero-sumness, demotivating beliefs are associated with lower material welfare (Corollary 1). This is due to the variation in zero-sumness across populations, leading to more intense demotivating beliefs and lower material welfare.

#### *Summary of the Theoretical Predictions*

We now take the primary predictions from our theory to the data. Propositions 2 and 3 concern the effect of demotivating beliefs holding constant the zero-sumness of the environment. They predict a divergence between material welfare and subjective well-being: although an intermediate demotivating belief maximizes income, happiness is maximized by the true (non-demotivating) belief  $\theta = 0$ .

Proposition 4 examines variation across environments with varying degrees of zero-sumness. It predicts that demotivating beliefs are increasing in the underlying degree of zero-sumness of the environment. The proposition also connects zero-sumness to reduced effort, lower levels of material welfare, and worse subjective well-being. Corollary 1 shows that demotivating beliefs are also associated with lower levels of effort, material welfare, and subjective well-being.

Lastly, we can show that if an individual changes environment, their demotivating beliefs will reflect both the zero-sumness of their current and historical environment. The reason is that

cultural evolution is a relatively slow-moving process, often transpiring over generations. We return to this point in the implementation of the empirical analysis.

#### **4. Testing the Model in the Developing World: Evidence from the DRC**

##### ***A. Data Collection***

Our empirical analysis first studies two samples from Kananga in the Democratic Republic of the Congo (DRC). The city is the capital of the Kasai-Central province and has a population of roughly 1.8 million. The first sample, from 2015, includes about 200 individuals, while the second sample, from 2019, includes about 1,000 individuals. Respondents were chosen randomly, subject to inclusion criteria to ensure sufficient spread across ethnic groups. The surveys took place face-to-face at the respondent's residence. We use the first, smaller sample to develop and validate our measures of the zero-sumness of the environment and to provide exploratory evidence on the relationship with demotivating beliefs (Proposition 4). We then replicate the findings in the second, larger sample. Details on the surveys and sampling are provided in Appendix E.

##### ***B. Measuring a Zero-Sum World***

Central to our analysis is the extent to which the world is zero-sum,  $\alpha$ . Because we cannot directly measure the zero-sumness of each respondent's environment, we measure perceptions of its zero-sumness. Perceived  $\alpha$  is an imperfect measure. Conceptually, this is not a problem because our theoretical results remain unchanged if we allow individuals to form biased beliefs about the zero-sumness of their environment. Indeed, demotivating beliefs are shaped through a dynamic process operating on the true  $\alpha$ , and individuals' (mis)perceptions of  $\alpha$  do not influence this process. Thus, the only issue is empirical, namely, the extent to which perceptions of zero-sumness reflect reality. Fortunately, there is ample evidence confirming that zero-sum perceptions are shaped by how zero-sum the world truly is. For example, in the United States, zero-sum perceptions are strongly correlated with characteristics of the environment that shape its zero-sumness, including economic growth, intergenerational mobility, immigration, and enslavement (Chinoy et al., 2023). We also validate this relationship in our empirical setting in Section C.

We measure respondents' perceived  $\alpha$  using six survey questions that ask the extent to which they believe that the gains achieved by an individual or group come at the expense of others. Each question asks respondents how much they agree with one of two contrasting statements.

- Statement 1: *In Kananga, people only make money when others lose money.*  
Statement 2: *In Kananga, no one needs to lose money for others to make money.*
- Statement 1: *In Kananga, businesses only make money when others lose money.*  
Statement 2: *In Kananga, no one needs to lose money for businesses to make money.*
- Statement 1: *If one person in a village gets very wealthy, other people in the village will become poorer.*  
Statement 2: *If one person in a village gets very wealthy, other people in the village will not necessarily become poorer.*
- Statement 1: *In trade, if one party gains, the other party loses.*  
Statement 2: *In trade, it is possible for both parties to gain at the same time.*
- Statement 1: *A person can only gain power by taking it away from others.*  
Statement 2: *A person can gain power without taking it away from others.*
- Statement 1: *Gaining happiness requires taking it away from others.*  
Statement 2: *It is possible for everyone to be happy.*

The potential response options are: “agree strongly with statement 1,” “agree with statement 1,” “agree with statement 2,” or “agree strongly with statement 2.” For each survey question, we create a variable that takes on an integer value from 1–4, increasing in how zero-sum the choice of the respondent is. We then use principal component analysis (PCA) to create an index of zero-sumness based on the first principal component (capturing 34% of the variance in the 200-person sample and 36% in the 1,000-person sample).

Table 1 reports the estimated weights for the first principal component. In both samples, all six variables load positively and have estimates that are similar in magnitude (columns 1 and 2). These facts are informative. Ex ante, it is not clear whether there is a generalized perception – or “worldview” as Foster puts it – of zero-sumness that applies similarly to income, wealth, trade, power, and happiness, and to life in Kananga and in the village. The similar PCA weights suggest a shared zero-sum view of the world across different domains and settings.<sup>14</sup>

In the 200-person sample, we asked additional zero-sum questions, adding different scenarios (e.g., farming) and asking zero-sum relationships using more diverse language (e.g., “created” vs. “taking from others”; “exploiting others” vs. “without exploiting”; “helps people” vs. “hurts people”). The additional four questions are:

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<sup>14</sup>It might seem surprising that happiness is perceived as zero-sum since everyone can be happy. However, if happiness is derived from prestige, power, income, and wealth, which are also zero-sum, one might also view happiness as zero-sum. This finding accords with Foster’s notion of “limited good” in pre-industrial societies.

**Table 1: Principal Component Analysis for Zero-Sum indices**

Zero-sum survey questions	(1) 6 question index (200 sample)	(2) 6 question index (1,000 sample)	(3) 10 question index (200 sample)	(4) 12 question index (200 sample)
1. In Kananga, people only make money when others lose money 2. In Kananga, no one need lose money for others to make money	0.467	0.469	0.434	0.392
1. In Kananga, businesses only make money when others lose money 2. In Kananga, no one need lose money for businesses to make money	0.400	0.471	0.381	0.368
1. If one person in a village gets very wealthy, other people in the village will become poorer 2. If one person in a village gets very wealthy, other people in the village will not necessarily become poorer	0.320	0.378	0.306	0.240
1. In trade, if one party gains the other party loses 2. In trade, it is possible for both parties to gain at the same time	0.325	0.413	0.289	0.229
1. A person can only gain power by taking it away from others 2. A person can gain power without taking it away from others	0.453	0.362	0.451	0.434
1. Gaining happiness requires taking it away from others 2. It is possible for everyone to be happy	0.456	0.336	0.436	0.426
1. If one farmer has a very large crop, his neighbor is likely to also have a very large crop 2. If one farmer has a very large crop, his neighbor is likely to have a small crop			0.277	0.302
1. The success of the wealthy generally helps other people in the community 2. The success of the wealthy generally hurts other people in the community			0.127	0.216
1. Most wealth is created without exploiting others 2. Most wealth is obtained by exploiting others			0.049	0.135
1. Most of the wealth of the rich was created without taking it from others 2. Most of the wealth of the rich was obtained by taking it from others			-0.032	0.009
1. If God is looking out for my brother, He is less likely to be looking out for me 2. If God is looking out for my brother, He is more likely to also be looking out for me				0.258
1. If my ancestors' spirits are looking out for my brother, they are less likely to be looking out for me 2. If my ancestors' spirits are looking out for my brother, they are more likely to also be looking out for me				0.093
Eigenvalue	2.067	2.169	2.209	2.272
Proportion of variance explained	0.345	0.362	0.221	0.189
Observations	205	984	193	163

Notes: The table reports the estimated factor loadings from four principal component analyses. Each set of estimates is reported in one column, with the eigenvalue of the first principal component reported in the bottom panel. The questions used in the principal component analyses are respondents' self-reported perceptions of how zero-sum the world is, and respondents choose from one of four options: "agree strongly with statement 1," "agree with statement 1," "agree with statement 2," and "agree strongly with statement 2." Columns 1 and 2 report the factor loadings from the first principal component using the set of six survey questions with the 200-person person and 1,000-person samples, respectively. Columns 3 and 4 report the factor loadings of the first principal component using the set of 10 and 12 questions for the 200-person sample.

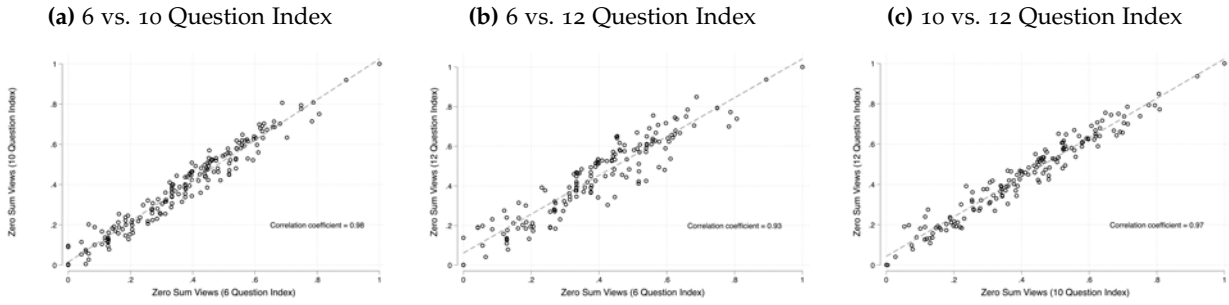
- Statement 1: *If one farmer has a very large crop, his neighbor is likely to also have a very large crop.*  
Statement 2: *If one farmer has a very large crop, his neighbor is likely to have a small crop.*
- Statement 1: *The success of the wealthy generally helps other people in the community.*  
Statement 2: *The success of the wealthy generally hurts other people in the community.*
- Statement 1: *Most wealth is created without exploiting others.*  
Statement 2: *Most wealth is obtained by exploiting others.*
- Statement 1: *Most of the wealth of the rich was created without taking it from others.*  
Statement 2: *Most of the wealth of the rich was obtained by taking it from others.*

We create another measure of zero-sum views that adds these four questions. The PCA estimates are reported in column 3 of Table 1. The variables mostly load in an expected manner.<sup>15</sup> Lastly, we also add two questions about specific but important domains in this setting; namely, benefits that arise due to blessings from God or from one's ancestors.

- Statement 1: *If God is looking out for my brother, he is less likely to be looking out for me.*  
Statement 2: *If God is looking out for my brother, he is more likely to also be looking out for me.*

<sup>15</sup>The factor loadings are very close to zero for the wealth question, which uses the phrase "created" versus "taking from others" and the question that uses the phrase "exploiting." This suggests that, consistent with Foster, people don't literally view a person's wealth as being stolen or exploited by others. Instead, the larger system creates a world with "limited good" that is zero-sum.

**Figure 1:** Correlation Plots of the Zero-Sum Indices based on 6, 10, and 12 Survey Questions



*Notes:* The figure reports the bivariate relationships between the zero-sum indices, constructed as the first principal component of 6, 10, or 12 survey questions, each normalized to lie between zero and one. panel (a) reports the correlation between the zero-sum indices based on 6 and 10 questions, panel (b) reports the correlation between the zero-sum indices based on 6 and 12 questions, and panel (c) reports the correlation between the zero-sum indices based on 10 and 12 questions. Each panel reports the correlation coefficient for the corresponding bivariate relationship between the zero-sum indices.

- **Statement 1:** *If my ancestors' spirits are looking out for my brother, they are less likely to look out for me.*
- **Statement 2:** *If my ancestors' spirits are looking out for my brother, they are more likely to look out for me.*

The factor loads positively onto both questions and most strongly on the question that asks about 'God' than on the question that asks about ancestors (Table 1, column 4).

Figure 1 shows the bivariate relationships between the three zero-sum measures based on six, ten, or twelve questions. As shown, they are very highly correlated with correlation coefficients that range from 0.93 to 0.98. All of the findings we report using our baseline 6-question zero-sum index are very similar if we use the 10- or 12-question indices.

### C. Validating the Zero-Sum Indices

Although it is reassuring that the zero-sum survey questions about different outcomes (happiness, power, gains from trade, income, wealth, crop yields) and different parties (individuals/people, trading parties, villagers, farmers, citizens in Kananga, and businesses in Kananga) are correlated with one another, we undertake several additional tests to validate the link between perceived zero-sumness and actual zero-sumness.

First, we compare our survey measures to a revealed measure of whether individuals view the world as zero-sum. In the 200-person sample, we presented respondents with several vignettes.<sup>16</sup> Each vignette uses an image to help explain the situation. In one scenario, shown in Figure D4a, the respondent is asked about two women, Kapinga and Tshilomba, who sell bananas. On

<sup>16</sup>See Appendix E.III for the full text.

day 1, Kapinga sells 10 bananas, and Tshilomba sells 20. On day 2, Kapinga sells 20 bananas. The respondents were then asked how many bananas they thought Tshilomba sold on day 2. They can choose either 10 or 40. If one perceived sales as zero-sum, then it would be natural to believe that Tshilomba sold 10 bananas. If one believed that sales were not zero-sum, then a logical assumption is that there was a demand shock, and everyone sold 100% more than the previous day, so Tshilomba would have sold 40 bananas. The second vignette, shown in Figure D4b, presents an analogous scenario where two farmers cultivate corn. Comparing responses to the vignette questions with the zero-sum indices described above confirms that individuals who chose the zero-sum vignette response have a significantly higher zero-sum index when using the 6-question index (Figures D4c and D4d) or the 10- or 12-question index (Figures D5a and D5b and Figures D6a and D6b).

The second check examines the relationship between zero-sum perceptions and factors that are expected to influence the zero-sumness of the environment. In the 200-person survey, we collected data on the employment history of the respondent and their family. Motivated by Foster's observation that pre-industrial economic occupations, namely farming, were more zero-sum than employment in modern sectors,<sup>17</sup> we check whether households with recent formal employment – relative to agriculture or unemployment – perceive the world as being less zero-sum. We create an index of employment that takes on the following values: (1) unemployed, (2) farmer, or (3) formal paid employment. The estimates,<sup>18</sup> which are reported in Table C1, confirm a negative association between employment, particularly in modern sectors, and zero-sum perceptions.<sup>19</sup> Thus, zero-sum perceptions appear to be associated with the zero-sumness of the environment. Given concerns about the endogeneity of memories of employment and a person's zero-sum perceptions, we also examine the relationship between rainfall in a person's origin village – a boon for farmers who would have faced a less zero-sum environment – during the first 20 (and 30 years) of their life. We again confirm that respondents with this rainier, less-zero-sum past view the world as less zero-sum (Table C2).

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<sup>17</sup>Foster writes "additional hard work in village productive enterprises simply does not produce a significant increment in income... It is not going too far to say that in agriculture there is no way really to get ahead... To become rich one must leave agriculture." (Foster, 1965, p. 307).

<sup>18</sup>The finer details of the estimates are reported in Appendix C.

<sup>19</sup>While respondents' own history of employment predicts zero-sum perceptions, the association is also very strong for the respondent's parents' employment or when we examine a combined measure.

#### D. Estimating Equations and Regression Estimates

We now explore Proposition 4 and examine the relationship between the zero-sum index and two demotivating beliefs: envy and beliefs in witchcraft.

In the model, we do not take a stand on the definition of a group. Since our samples are 200 or 1,000 people drawn from a total population of 1.8 million, our starting assumption is that each observation is drawn from a different “group” in the city. This assumption aligns with the rich variation we observe in individuals’ perceptions of the zero-sumness of the world. We therefore estimate the following individual-level equation:

$$y_i = \alpha_{e(i)} + \beta \text{ZeroSum}_i + \mathbf{X}_i \boldsymbol{\Omega} + \epsilon_i, \quad (8)$$

where  $i$  indexes individuals. The dependent variable  $y_i$  captures one of our demotivating beliefs of interest, either envy or indigenous religious beliefs.  $\alpha_{e(i)}$  denote ethnicity fixed effects. The vector  $\mathbf{X}_i$  includes demographic controls for age, age squared, a gender indicator, and its interaction with age and age squared. Our baseline estimates use robust standard errors, but to account for the possibility that multiple observations might be drawn from the same group  $k$ , we also report estimates that allow for various forms of non-independence of observations in Table D7. As hypothesized by Foster and predicted by our theory, we expect a more zero-sum view of the world to be associated with more envy and stronger indigenous witchcraft beliefs:  $\beta > 0$ .

Table 2 reports the estimates of equation (8) using the 200-person (panel A) and 1,000-person (panel B) samples.<sup>20</sup> Our first outcome is envy, which we measure as the first principal component of four survey questions.<sup>21</sup> The first three questions ask about experiencing frustration when people succeed in life easily, resentment when neighbors are successful, or feelings of injustice when some people seem highly talented. The fourth question asks if the respondent sometimes wishes that rich and powerful people lose their advantage.<sup>22</sup> We find a positive and statistically significant relationship between zero-sum and envy in both samples, and this relationship is robust to controlling for covariates (column 1) and ethnicity fixed effects (column 2). The

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<sup>20</sup>As we report in Tables D8 and D9, the relationship between zero-sum perceptions and envy, beliefs in witchcraft, and beliefs in Christianity are of similar magnitude and significance when we use the alternative zero-sum indices that are based on the ten or twelve survey questions available in the 200-person sample and introduced in Section 4.B.

<sup>21</sup>The precise wording of each question is provided in Appendix E.I, and the factor loadings for the first principal component are reported in Table D4.

<sup>22</sup>These variables measure respondents’ envy rather than their about the envy of others. We rely on the fact that a primary determinant of people’s belief about others’ behavior is their own behavior. Thus, we take a respondent’s own feelings of envy as a proxy for their perceived envy of others.



magnitude of the estimates is also meaningful. A one standard deviation increase in zero-sum perceptions is associated with a 0.41-0.20 standard deviation increase in envy (column 1).

We then turn to the relationship between zero-sum perceptions and traditional religious beliefs. The outcome in columns 3 and 4 is the intensity of witchcraft beliefs, measured as the first principal component of four questions about the strength of belief in traditional religion, frequency of prayer to ancestors, frequency of participation in rituals devoted to ancestors, and how close they feel to non-Christians who live in Kananga.<sup>23</sup> There is a strong positive relationship between zero-sum perceptions and witchcraft beliefs in the 200-person sample and a weaker one in the 1,000-person sample, again consistent with Proposition 4.

Another empirical implication of Proposition 4 is that belief systems that impose less of a psychological tax on effort and success (i.e., low  $\theta$ ) should have a weaker hold in more zero-sum (i.e., high  $\alpha$ ) environments. One such belief system is Christianity, which has boomed in recent decades across Africa, challenging and yet coexisting alongside traditional religious beliefs (White, Muthukrishna and Norenzayan, 2021). Unlike traditional religions, Christianity teaches that everyone with faith can receive blessings from God (Norenzayan, 2013).<sup>24</sup> Moreover, many Pentecostal denominations, now dominant in Kananga as elsewhere in urban Africa (Ranger and Ranger, 2008), promote versions of the prosperity gospel with explicit encouragement of hard work and economic ambition (Comaroff and Comaroff, 2000, Freeman, 2012). Interestingly, the link between zero-sum perceptions and Christianity is also found in Foster's account of Tzintzuntzan, where one of the accepted sources of income that did not generate envy and expectations of redistribution was a success due to favor from "saints" (see Foster, 1965, p. 307). We, therefore, expect a negative relationship between zero-sum perceptions and the strength of Christian beliefs. Our survey included questions about the strength of belief in the Christian God, the frequency of prayer, the frequency of attending church, and perceived closeness to Christians

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<sup>23</sup>The exact wording of the questions are provided in Appendix E.I and Table D5 reports the factor loadings of the principal component analysis.

<sup>24</sup>We empirically validate this using two survey questions about the extent to which blessings from "one's ancestors" and "God" are viewed as limited (see Appendix E.II for the exact wording of each question). When asked about "God" rather than "ancestors," respondents were twice as likely to choose that they "agree strongly" that blessings are not limited and that everyone can benefit from them (see Figure D7). The results are consistent with qualitative evidence from focus groups, where gains obtained through witchcraft were typically described as limited, coming at the expense of someone, and likely to induce jealousy. By contrast, blessings from God were understood as the result of individuals' devotion and due to God's grace, which is not scarce, does not come at the expense of others, and is less likely to induce jealousy.

**Table 2: Zero-Sum Index of Six Survey Questions, Envy, and Witchcraft in the DRC**

	Dependent Variable: Principal-Component Based Measures of:							
	Envy of Others' Success		Witchcraft Beliefs		Christianity Beliefs		Difference Between Witchcraft & Christianity	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: 200 Person Sample (2015)								
Zero-sum thinking, 0-1	0.421*** (0.114)	0.454*** (0.129)	0.545** (0.170)	0.550** (0.176)	-0.210** (0.104)	-0.260** (0.115)	0.755** (0.235)	0.810** (0.251)
Observations	204	204	197	197	197	197	197	197
R squared	0.575	0.615	0.455	0.501	0.417	0.476	0.430	0.484
Panel B: 1,000 Person Sample (2019)								
Zero-sum thinking, 0-1	0.157*** (0.027)	0.154*** (0.027)	0.028 (0.028)	0.028 (0.028)	-0.049** (0.017)	-0.049** (0.017)	0.077** (0.035)	0.077** (0.035)
Observations	984	984	984	984	984	984	984	984
R squared	0.164	0.170	0.166	0.171	0.132	0.141	0.148	0.157
Demographic Controls	Y	Y	Y	Y	Y	Y	Y	Y
Ethnicity FE	N	Y	N	Y	N	Y	N	Y

*Notes:* This table examines the relationship between zero-sum views and an individual's self-reported envy of others, beliefs in witchcraft, and beliefs in Christianity, for the sample of about 200 respondents collected in 2015 (panel A) and the sample of about 1,000 respondents collected in 2019 (panel B) in Kananga, DRC. It reports estimates of equation (8). In all columns, the explanatory variable is the first principal component of the six zero-sum statements. In columns 1 and 2, the dependent variables are the first principal component of the four survey questions measuring self-reported envy of others' success. The first three questions ask about experiencing frustration when people succeed in life easily, resentment when neighbors are successful, or feelings of injustice when some people seem to have all the talents. The fourth question asks if the respondent sometimes wishes that rich and powerful people lose their advantage. In columns 3 and 4, the dependent variables are the principal-component-based measure of beliefs in witchcraft using four survey questions that ask about the strength of belief in traditional religion, frequency of prayer to ancestors, frequency of participation in rituals devoted to ancestors, and how close they feel to non-Christians who live in Kananga. In columns 5 and 6, the dependent variables are the principal-component-based measure of beliefs in Christianity using four survey questions that ask about the strength of one's belief in the Christian God, frequency of prayer, frequency of attending church, and how close the respondent feels to Christians who live in Kananga. In columns 7 and 8, the dependent variables are the difference in the principal-component-based measure of beliefs in witchcraft and Christianity. We include controls for gender, age, and age squared and their interactions in all columns. Coefficients are reported with robust standard errors in parentheses. \*\*\*, \*\*, and \* indicate significance at the 1, 5, and 10 percent levels.

in Kananga.<sup>25</sup> In both samples, a more zero-sum view of the world is negatively associated with Christian beliefs (columns 5 and 6).<sup>26</sup>

As a robustness check, we calculate clustered standard errors assuming that the group  $k$  varies across the intersection of neighborhoods and ethnicities (i.e., different ethnic groups in different neighborhoods face a different zero-sumness of their environment); neighborhood and gender (i.e., different genders in different neighborhoods face different environments); and neighbor-

<sup>25</sup>The survey questions and variable construction mimic those about traditional religious beliefs (i.e., witchcraft) and are reported in Appendix E.I. The factor loadings are reported in Table D6.

<sup>26</sup>Given the divergent relationships between zero-sum perceptions and witchcraft versus Christianity and the fact that people tend to believe in both simultaneously, we also create a measure that captures the relative strength of one's belief in the two religions, constructed as one's witchcraft belief measure minus their Christianity measure. We find that zero-sum perceptions are associated with a stronger belief in witchcraft relative to Christianity (columns 7 and 8).

hoods only (i.e., different people in different neighborhoods face different environments) and report the results in Table D7 along with the randomization inference  $p$ -values, which do not make any assumptions about the error structure. Reassuringly, the standard errors are similar to the robust ones reported in Table 2.

As another sensitivity check, we test the assumption that  $\alpha$  and  $\sigma$  are uncorrelated. Although  $\sigma$  influences the evolutionarily stable belief  $\theta^*$ , most of our analysis concerns comparative statics for  $\alpha$  and thus relegates this effect to the regression residuals. Our estimates will be unbiased if  $\sigma$  and  $\alpha$  are uncorrelated. To measure the extent of assortativity ( $\sigma$ ) in this population, we elicit homophily in respondents' social networks. Questions in the 1,000-person survey ask respondents to list individuals they would go to (or who would come to them) in nine different situations, and we collect information about the respondents' links to these individuals. We calculate the fraction of those listed who belong to a respondent's: (1) nuclear family, (2) extended family, (3) church, (4) tribe, or (5) religion. Using principal components analysis, we then create an aggregate measure of homophily based on the first principal component.<sup>27</sup> Across respondents, our measure of  $\sigma$  is uncorrelated with our measure of zero-sum perceptions (Table D11) and controlling for  $\sigma$  does not influence our estimated coefficients for zero-sum perceptions (Table D12).

## 5. Global Evidence from the World Values Survey

The DRC samples allowed us to empirically validate Proposition 4 concerning the link between the zero-sumness of the environment and demotivating beliefs in a pre-industrial society comparable to the one Foster studied. However, these samples have limited cross-society variation and no information on material welfare and subjective well-being. As a result, we cannot test Proposition 4 concerning the link between zero-sum beliefs, material welfare, and subjective well-being across societies, or Propositions 2 and 3 concerning the relationship between the strength of demotivating beliefs and material welfare and subjective well-being when holding constant the zero-sumness of the environment. We now turn to a global analysis to test these predictions.

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<sup>27</sup>Details about the survey questions are provided in Appendix E.IV, and the factor loadings for the first principal component are reported in Table D10

## A. Data

We measure the zero-sumness of a person’s environment using a question from the World Values Survey (WVS), which has a similar structure to our zero-sum questions from the DRC. Respondents are given two opposing statements, one that is zero-sum – “People can only get rich at the expense of others” – and the other positive sum – “Wealth can grow so there’s enough for everyone.” The respondents are asked to report their views on a ten-point scale between the two extremes. We normalize the variable to lie between zero and one and increase in zero-sumness. Figure D8, which reports the distribution of the zero-sum measure, shows substantial variation in the extent to which individuals view wealth as zero-sum.

We begin by again validating that this measure reflects the true zero-sumness of individuals’ environments. We estimate the relationship between the level of economic growth in the respondent’s country in the first 20 or 30 years of their life and their perceived zero-sumness. The logic is that low economic growth should lead people to view the environment as zero-sum: output is not expanding over time but divided up year after year. Conversely, higher growth creates opportunities for everyone to become better off and should thus lead to lower perceived zero-sumness. Conditional on country-fixed effects, birth-year-fixed effects, and demographic controls, we find that lower economic growth is indeed associated with a more zero-sum view of the world (Table C3).<sup>28</sup> The results align with our findings from the DRC and evidence from the United States (Chinoy et al., 2023).

## B. Zero-sum perceptions and demotivating beliefs

We first examine the relationship between zero-sum views and demotivating beliefs that reduce effort, again motivated by Proposition 4 of the model. Demotivating beliefs differ across countries. In some, they might take the form of beliefs in witchcraft or the evil eye. In others, a dislike for greed and individual accumulation or a belief that hard work does not result in success. In industrialized countries, the best proxies for  $\theta$  are beliefs about the importance of hard work, economic success, and individual achievement, which are available in the WVS.

We use the WVS data to estimate the following equation:

$$Y_{i,c,t} = \alpha_{c,t} + \beta \text{Zero Sum}_{i,c,t} + \mathbf{X}_{i,c,t} \mathbf{\Gamma} + \varepsilon_{i,c,t}, \quad (9)$$

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<sup>28</sup>Details about the estimation and the results are reported in Appendix III

where  $i$  indices individuals,  $c$  country of residence, and  $t$  the year of the survey.  $\text{ZeroSum}_{i,c,t}$  is our measure of zero-sum for individual  $i$ .  $\alpha_{c,t}$  denote country by survey year fixed effects.  $Y_{i,c,t}$  denotes a measure of the strength in which person  $i$  holds a particular demotivating belief. The vector  $\mathbf{X}_{i,c,t}$  includes the following individual-level demographic controls: a gender indicator, age, age squared, and interactions between the gender and age measures.

We begin by considering the belief of whether hard work brings success. Respondents report their answers on a 1-10 integer scale. We reorder and normalize the variable such that zero equals full agreement with “in the long run, hard work usually brings a better life,” and one equals full agreement with “hard work doesn’t generally bring success.”<sup>29</sup> The measure, thus, increases in the belief that hard work does not pay off. Consistent with Proposition 4, zero-sum beliefs are associated with a stronger belief that hard work is unlikely to bring success (Table 3, column 1).

We next look at two related measures that capture respondents’ views of whether low effort explains why some people are poor. The first survey question is: “Why, in your opinion, are there people in this country who live in need?” We create a variable that takes on the value of zero if they choose the answer “because of laziness and lack of willpower,” and the value of one if they choose the answer “because of an unfair society.” The second measure captures views about whether the poor can escape poverty through effort: “In your opinion, do most poor people in this country have a chance of escaping from poverty, or is there very little chance of escaping?” We create a variable that takes on the value of zero if the respondent chooses the answer “They have a chance” and one if they choose “There is very little chance.” Thus, both questions measure the belief that effort and hard work fail to explain economic success. Zero-sum views again correlate with the belief that poverty does not arise from a lack of effort (columns 2 and 3).

We consider three additional demotivating beliefs. The first is the extent to which people get disutility from asking others for money. In a setting where it is shameful to be helped by others, individuals will try their hardest to provide for themselves. The survey question asks respondents if they agree with the statement: “It is humiliating to receive money without having to work for it” Respondents can choose “strongly agree,” “agree,” “neither,” “disagree,” or “strongly disagree.” We normalize the measure to lie between zero and one and to increase in the respondent’s disagreement with the statement. Again, the more zero-sum view of the world is associated with feeling less humiliation from receiving money (column 4). The last two

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<sup>29</sup>The exact wording of this and all other WVS variables used in the paper are reported in Appendix E.VII.

**Table 3: Zero-Sum and Demotivating Beliefs**

	Dependent Variable: Demotivating Belief:					
	Hard work brings success, 0 = fully agree to 1 = fully disagree	People are poor because of laziness, 0 = agree or 1 = disagree	People have a chance to escape poverty, 0 = agree or 1 = disagree	Humiliating to receive money without working for it, 0 = strongly agree to 1 = strongly disagree	Important to me to be successful, 0 = very much to 1 = not at all	How important is work, 0 = very important to 1 = not at all
	(1)	(2)	(3)	(4)	(5)	(6)
Zero-sum thinking, 0-1	0.112*** (0.002)	0.077*** (0.006)	0.121*** (0.006)	0.023*** (0.004)	0.024*** (0.002)	0.034*** (0.002)
Mean dependent variable	0.363	0.697	0.602	0.352	0.391	0.162
Std. dev. dependent variable	0.321	0.459	0.489	0.296	0.290	0.248
Mean independent variable	0.406	0.393	0.394	0.406	0.416	0.407
Std. dev. independent variable	0.309	0.317	0.315	0.297	0.305	0.309
Observations	246,408	55,871	59,052	60,856	151,270	242,255
R squared	0.121	0.125	0.178	0.096	0.171	0.111
Demographic Controls	Y	Y	Y	Y	Y	Y
Wave-country FE	Y	Y	Y	Y	Y	Y

Notes: The table reports OLS estimates in columns 1–6. An observation is an individual. All specifications include survey wave by country fixed effects. The independent variable is a scale variable ranging from zero to one, with one representing “People can only get rich at the expense of others” and zero representing “Wealth can grow so there’s enough for everyone.” The dependent variables are categorical variables appearing as column heads. Demographic controls include age, age squared, gender, and their interactions. Coefficients are reported with robust standard errors in parentheses. \*\*\*, \*\*, and \* indicate significance at the 1, 5, and 10 percent levels.

questions measure the perceived importance of achievement and work. The first question asks whether it is important to be “very successful... to have people recognize one’s achievement.” The second question asks respondents how important work is to them. Respondents choose responses ranging from “not at all important” to “very important.” Both measures are coded to be decreasing in the importance placed on achievement and work – i.e., increasing in the extent to which the beliefs are demotivating. The estimates, reported in columns 5 and 6, show that individuals with a more zero-sum worldview hold beliefs that place less importance on their success and on their work.

### C. Zero-sum perceptions, effort, and economic outcomes

We next consider the part of Proposition 4 arguing that zero-sum environments, by creating demotivating beliefs, will result in less effort and lower material welfare. We first test this prediction by examining respondents’ self-reported income on a 1-10 integer scale normalized to range from zero to one. We also examine a question about the net savings of the respondent’s family. We again normalize the variable to lie between zero and one and to increase in savings. Individuals with a more zero-sum view of the world report having lower incomes and less savings (Table 4, columns 1 and 2). Consistent with the model’s prediction, a more zero-sum environment

**Table 4: Zero-Sum Perceptions and Economic Welfare**

	Dependent Variable: Measures of Economic Welfare:					
	Income decile, 0 = bottom decile to 1 = top decile	Family savings, 0=borrowed to 1=saved	Educational attainment, 0 = primary school or less to 1 = university or more	Cognitive vs. manual work tasks, 0=manual to 1 = cognitive	Supervising someone at work, 0=no to 1=yes	Class, 0 = lower class to 1 = upper class
	(1)	(2)	(3)	(4)	(5)	(6)
Zero-sum thinking, 0-1	-0.039*** (0.002)	-0.032*** (0.002)	-0.030*** (0.002)	-0.049*** (0.004)	-0.046*** (0.004)	-0.045*** (0.002)
Mean dependent variable	0.407	0.625	0.522	0.446	0.327	0.421
Std. dev. dependent variable	0.257	0.309	0.337	0.346	0.469	0.245
Mean independent variable	0.404	0.406	0.406	0.416	0.415	0.409
Std. dev. independent variable	0.309	0.308	0.309	0.301	0.302	0.307
Observations	229,719	203,716	219,524	116,885	119,888	207,165
R-squared	0.159	0.090	0.173	0.087	0.106	0.111
Demographic Controls	Y	Y	Y	Y	Y	Y
Wave-country FE	Y	Y	Y	Y	Y	Y

Notes: The table reports OLS estimates. An observation is an individual. All specifications include survey wave by country fixed effects. The independent variable is a scale variable ranging from zero to one, with one representing "People can only get rich at the expense of others," and zero representing "Wealth can grow so there's enough for everyone." The dependent variables are categorical variables appearing as column heads. Demographic controls include age, age squared, gender, age interacted with gender, and age-squared interacted with gender. Coefficients are reported with robust standard errors in parentheses. \*\*\*, \*\*, and \* indicate significance at the 1, 5, and 10 percent levels.

is associated with lower material welfare.<sup>30</sup> Next, we examine education, an investment that requires effort but can enhance productivity. Again, consistent with the model's predictions, respondents who view the world as more zero-sum have lower levels of education (column 3). If this relationship is robust, we should also observe a similar negative association with jobs that require having made costly investments in human capital accumulation. Indeed, individuals with stronger zero-sum views are less likely to be employed in cognitively demanding occupations (column 4) and are less likely to supervise someone at work (column 5).

Finally, we explore the relationship between demotivating beliefs and material welfare. In particular, part (i) of Corollary 1 predicts that material welfare should be decreasing in demotivating beliefs. Consistent with this prediction, we find a negative relationship between each of the six measures of demotivating beliefs and most measures of material welfare (Table D13). More zero-sum environments are associated with lower material welfare and more demotivating beliefs, inducing a negative relationship between demotivating beliefs and material welfare.

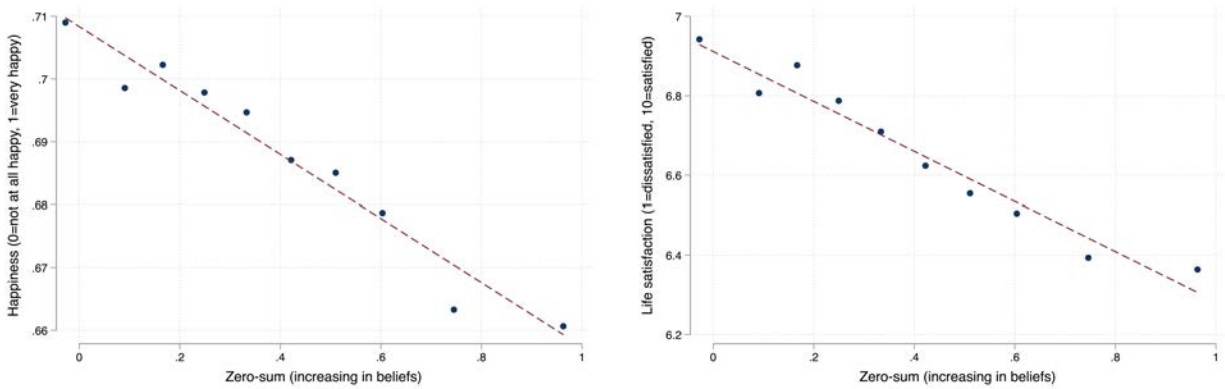
<sup>30</sup>We also examine socioeconomic status. Respondents report belonging to either: (1) Lower class; (2) Working class; (3) Lower middle class; (4) Upper middle class; and (5) Upper class. We use integer values reported for each category and normalize the index to lie between 0 and 1. Consistent with the model's prediction, zero-sum perceptions are associated with a lower self-reported socioeconomic class (column 6).

#### D. Zero-sum perceptions, demotivating beliefs, and happiness

Proposition 4 focuses on the relationship between a zero-sum environment and an individual's subjective well-being. We examine two measures of subjective well-being: "happiness" and "life satisfaction." The raw (binscatter) cross-individual relationship between zero-sum beliefs and happiness or life satisfaction, conditional on country-by-survey-wave fixed effects, is reported in Figure 2. There is a clear negative relationship between viewing the world as zero-sum and reported happiness and well-being, in line with Proposition 4. Estimates of equation (3) for both measures of well-being as the outcome confirm this negative and significant relationship between zero-sum perceptions and life satisfaction (Table 5, column 1).

We also explore the relationship between demotivating beliefs and subjective well-being. Part (ii) of Corollary 1 predicts that subjective well-being should decrease in demotivating beliefs. Consistent with this prediction, there is a negative relationship between each of the six measures of demotivating beliefs and both measures of subjective well-being (Table 5, columns 2–7). More zero-sum environments are associated with lower material welfare, subjective well-being, and more demotivating beliefs. This induces a negative relationship between demotivating beliefs and subjective well-being.

**Figure 2:** Relationship Between Zero-Sum Perceptions and Happiness or Life Satisfaction



Notes: This figure reports the relationship between zero-sum perceptions and happiness (left panel), and zero-sum perceptions and satisfaction (right panel) using a binscatter plot. Zero-sum thinking is measured using a scale variable ranging from zero to one, with one representing "People can only get rich at the expense of others" and zero representing "Wealth can grow so there's enough for everyone." Happiness is measured based on a scale variable reporting respondents' answers to the question "Taking all things together, would you say you are," with zero indicating "Not at all happy" and one indicating "Very happy." Life satisfaction is measured based on respondents' answers to the question "How satisfied are you with the financial situation of your household? If '1' means you are completely dissatisfied on this scale, and '10' means you are completely satisfied, where would you put your satisfaction with your household's financial situation?"



**Table 5: Zero-Sum Perceptions or Demotivating Beliefs and Happiness or Life Satisfaction**

	Measure of demotivating beliefs used:						
	Hard work brings success, 0 = fully agree to 1 = fully disagree	People are poor because of laziness, 0 = agree or 1 = disagree	People have a chance to escape poverty, 0 = agree or 1 = disagree	Humiliating to receive money without working for it, 0 = strongly agree to 1 = strongly disagree	Important to me to be successful, 0 = very much to 1 = not at all	How important is work, 0 = very important to 1 = not at all	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Self-Reported Happiness (0-1) as Dependent Variable							
Zero-sum thinking, 0-1	-0.051*** (0.002)						
Demotivating belief, $\theta$		-0.046*** (0.001)	-0.045*** (0.002)	-0.043*** (0.002)	-0.019*** (0.003)	-0.045*** (0.002)	-0.038*** (0.002)
Mean dependent variable	0.688	0.694	0.653	0.653	0.696	0.707	0.692
Std. dev. dependent variable	0.249	0.246	0.255	0.254	0.243	0.244	0.248
Mean independent variable	0.405	0.365	0.701	0.599	0.346	0.394	0.159
Std. dev. independent variable	0.309	0.323	0.458	0.490	0.296	0.292	0.247
Observations	246,094	329,899	62,055	64,833	103,517	156,835	398,525
R squared	0.145	0.136	0.187	0.181	0.105	0.123	0.134
Panel B: Subjective Life Satisfaction (1-10) as Dependent Variable							
Zero-sum thinking, 0-1	-0.628*** (0.016)						
Demotivating belief, $\theta$		-0.474*** (0.013)	-0.622*** (0.022)	-0.551*** (0.020)	-0.226*** (0.025)	-0.525*** (0.021)	-0.252*** (0.015)
Mean dependent variable	6.656	6.746	6.177	6.205	6.582	6.791	6.667
Std. dev. dependent variable	2.382	2.360	2.626	2.600	2.400	2.278	2.416
Mean independent variable	0.406	0.366	0.705	0.600	0.347	0.395	0.159
Std. dev. independent variable	0.310	0.323	0.456	0.490	0.296	0.292	0.247
Observations	245,792	329,770	60,594	64,415	103,372	157,059	400,198
R squared	0.173	0.164	0.246	0.242	0.167	0.132	0.172
Demographic Controls	Y	Y	Y	Y	Y	Y	Y
Wave-country FE	Y	Y	Y	Y	Y	Y	Y

Notes: The table reports the relationship between zero-sum perceptions or demotivating beliefs and happiness (panel A) or life satisfaction (panel B) using OLS estimates. An observation is an individual. In panel A, the dependent variable is happiness, which is measured based on a scale variable reporting respondents' answers to the question "Taking all things together, would you say you are," with zero indicating "Not at all happy" and one indicating "Very happy." In panel B, the dependent variable is life satisfaction, which is measured based on respondents' answers to the question "How satisfied are you with the financial situation of your household? '1' means you are completely dissatisfied on this scale, and '10' means you are completely satisfied, where would you put your satisfaction with your household's financial situation?" The independent variables are a scale ranging from zero to one, with one representing "People can only get rich at the expense of others," and zero representing "Wealth can grow so there's enough for everyone" (column 1), and categorical variables, ranging from 0, representing agreement, to 1, indicating disagreement with the sentence – except the sentence "How important is work," where 0 means "very important" and 1 means "not at all" – (columns 2–7). All specifications include wave-country fixed effects. Demographic controls include age, age squared, gender, and their interactions. Coefficients are reported with robust standard errors in parentheses. \*\*\*, \*\*, and \* indicate significance at the 1, 5, and 10 percent levels.

### E. Demotivating Beliefs and Economic Outcomes in a Fixed Zero-Sum Setting

While the preceding analysis focused on relationships across groups in environments of varying zero-sumness ( $\alpha$ ), we now explore the strength of demotivating beliefs, material welfare, and subjective well-being *within a group  $k$*  (with a fixed zero-sum environment).

Specifically, Proposition 2 predicts an optimal strength of demotivating beliefs  $\theta^*$  within a group  $k$  in an environment of zero-sumness  $\alpha$ . Material welfare should be hump-shaped in the strength of demotivating beliefs  $\theta$ . To test this, we divide the sample into deciles based on respondents' perceived zero-sumness. We interpret a decile as being analogous to a group  $k$ , with a fixed level of  $\alpha$ , in the model. To account for differences in language, gender, and

age, we first net out country-wave fixed effects and demographic controls before creating the zero-sum deciles. Within each decile, we examine the relationship between demotivating beliefs and income levels. We report estimates for the two measures of demotivating beliefs with the largest sample and multiple possible responses – i.e., not just agree/disagree – and thus allow us to test for the predicted hump-shaped relationship. The two questions are whether “hard work brings success” ( $N = 228,356$ ) and “how important is work” ( $N = 224,534$ ).<sup>31</sup> Figures 3 and 4 report the estimated relationships between demotivating beliefs and income. Consistent with Proposition 2, we see strong evidence of a hump-shaped relationship between demotivating beliefs and material welfare measured by income for virtually all zero-sum deciles.

We find similar results when we omit demographic controls or country-wave fixed effects (Figures D9 and D10), when using alternative measures of demotivating beliefs only available in smaller samples (Figures D13 and D14),<sup>32</sup> or if we measure material welfare using savings instead of income (Figures D17 and D18), education (Figures D19 and D20), employment in a cognitively demanding occupation (Figures D21 and D22), supervising someone at work (Figures D23 and D24), and socioeconomic status (Figures D25 and D26).

By contrast, Proposition 3 and the corresponding numerical results in Figure A1 predict that, within the group, subjective well-being is maximized by the true (non-demotivating) belief  $\theta = 0$ , is strictly convex, and (mostly) decreasing in demotivating beliefs for a given zero-sumness of the environment  $\alpha$ . Figures 5 and 6 confirm that subjective well-being, measured by happiness, is highest for the least demotivating belief and mostly decreasing in demotivating beliefs. Again, we find similar results when we omit demographic controls or country-wave fixed effects (Figures D11 and D12), when using alternative measures of demotivating beliefs (Figures D15 and D16), or when we measure subjective well-being using life satisfaction (Figures D27 and D28).

## 6. Long-Run Development: Beliefs and Innovation

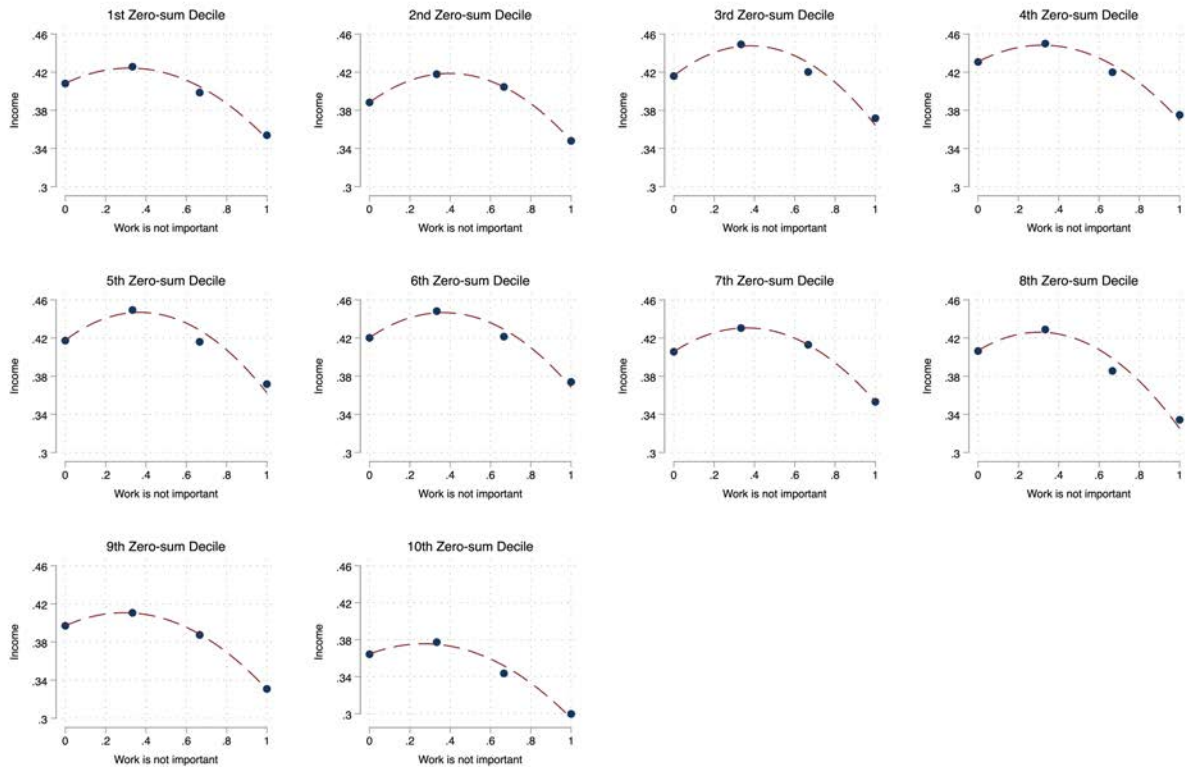
Finally, we examine the implications of our theory for long-term economic development, which was a component of Foster’s original argument. He hypothesized that the demotivating beliefs created by zero-sum environments adversely affected innovation and growth. To investigate this

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<sup>31</sup>We find similar patterns for other demotivating beliefs measures available for smaller samples (Figures D13–D16).

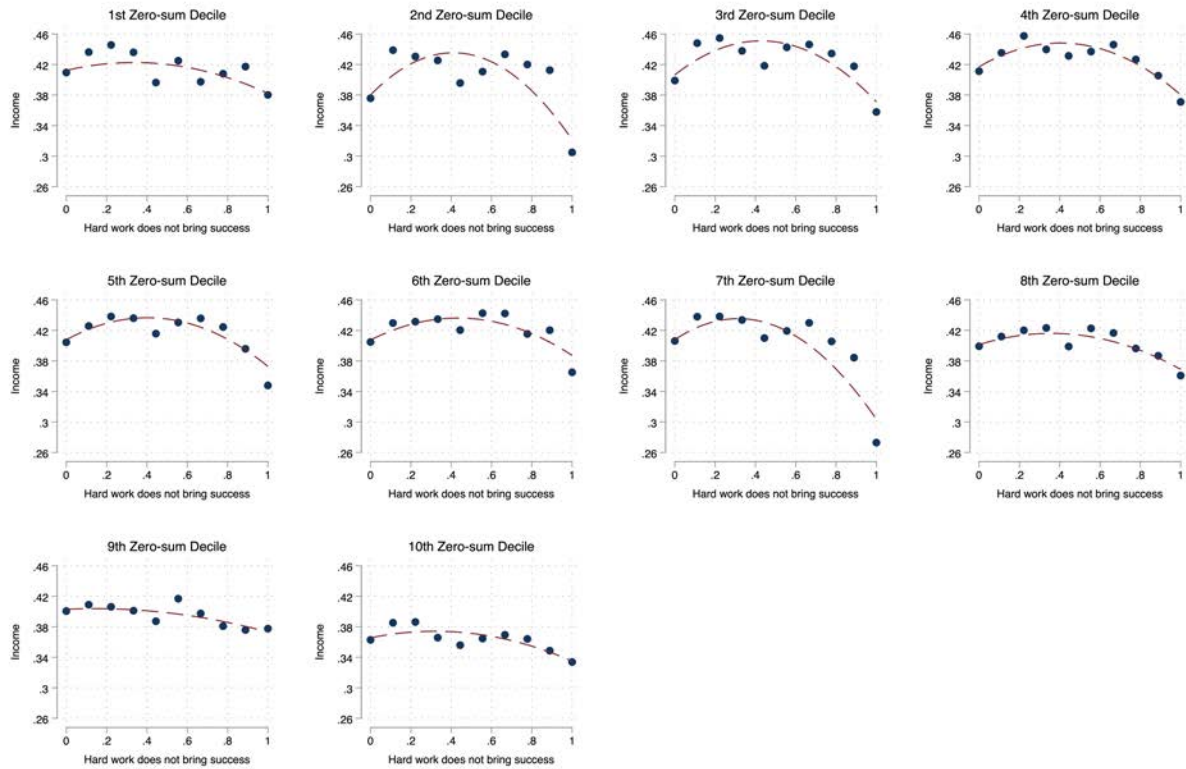
<sup>32</sup>We do not report the estimates for the two demotivating belief questions “People have a chance to escape poverty” and “People are poor because of laziness” because they only have two possible responses (agree or disagree), which prevents us from testing for a hump-shaped relationship.

**Figure 3:** Relationship Between Demotivating Beliefs (Work Unimportant) and Income – Holding Constant Zero-Sumness



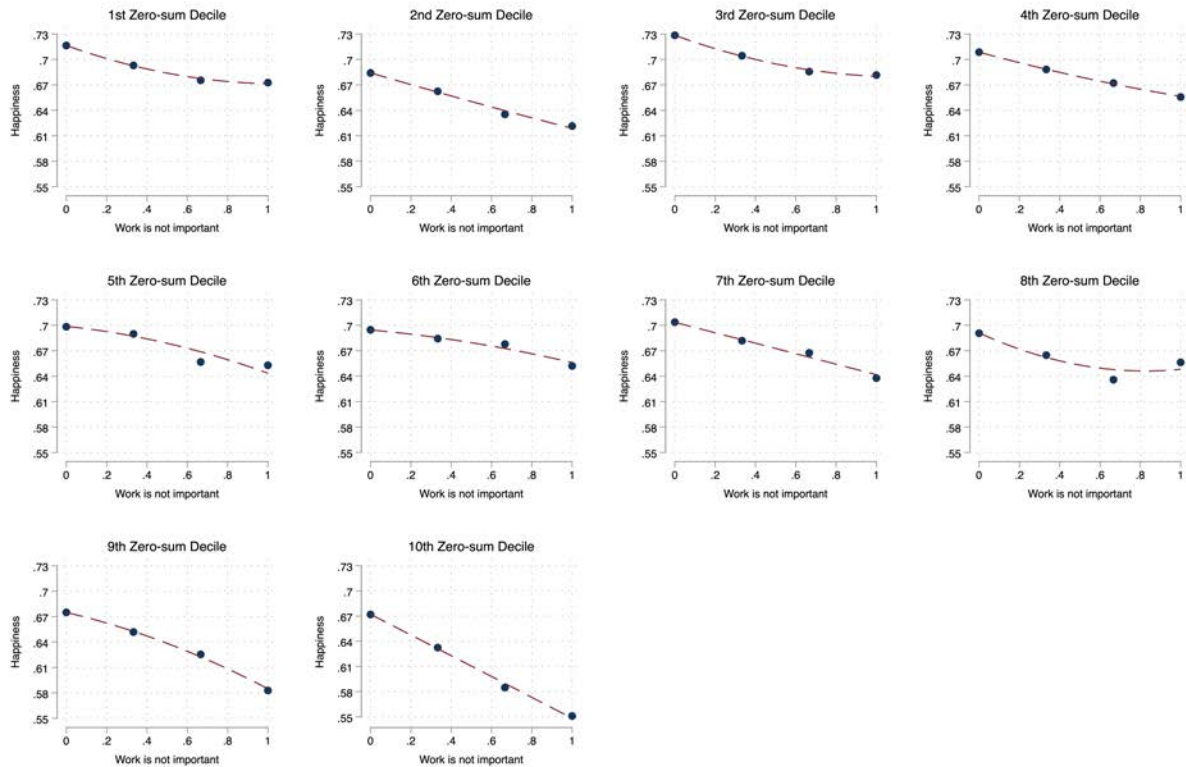
*Notes:* The figure reports the relationship between respondents' demotivating beliefs and level of income for each zero-sum decile. Country-wave fixed effects and demographic controls are netted out before creating the zero-sum deciles. The demotivating belief in this figure is reported based on respondents' answers to the version of the following question that asks about work: "For each of the following, indicate how important it is in your life. Would you say it is," with the options: "1 Very important, 2 Rather important, 3 Not very important, 4 Not at all important." These responses are reverse scored, so the variable is increasing in the demotivating belief "Work is not important at all." ( $N = 224,032$ ).

**Figure 4:** Relationship Between Demotivating Beliefs (Hard Work Does Not Bring Success) and Income – Holding Constant Zero-Sumness



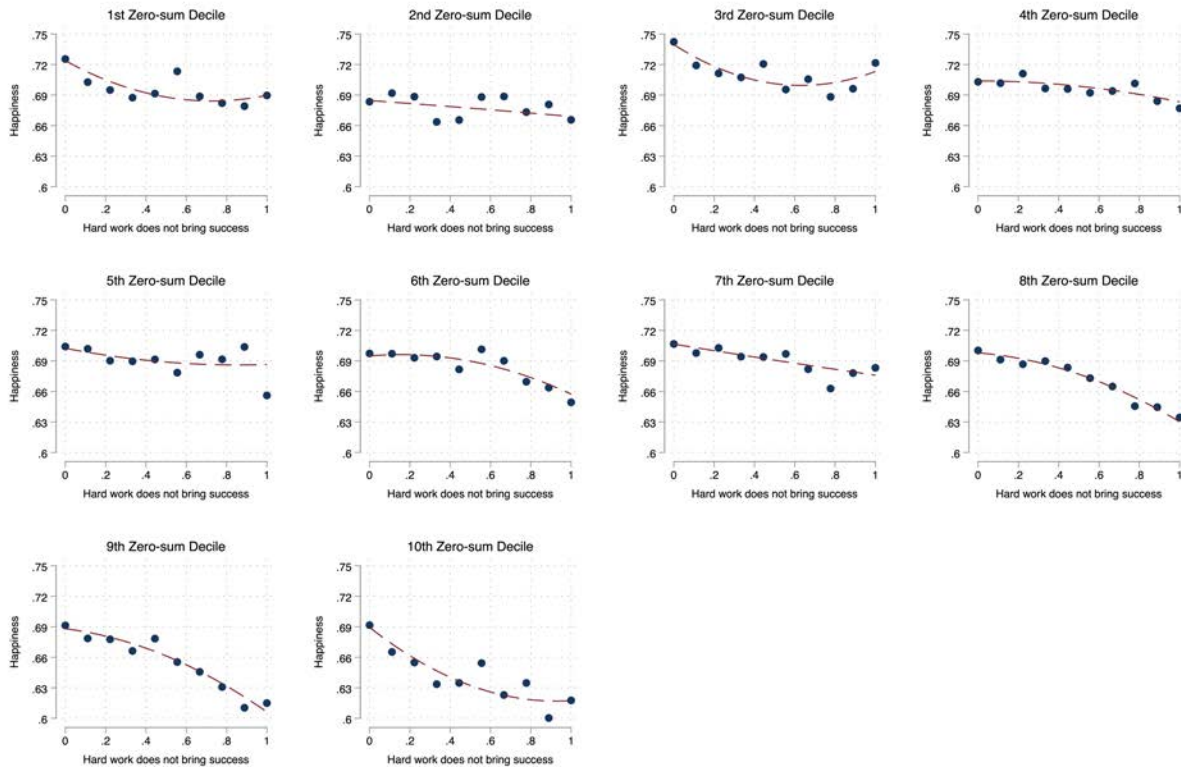
*Notes:* The figure reports the relationship between respondents' demotivating beliefs and level of income for each zero-sum decile. Country-wave fixed effects and demographic controls are netted out before creating the zero-sum deciles. The demotivating belief in this figure is reported based on how much respondents agreed with the statement "In the long run, hard work usually brings a better life" on a scale of one to ten, with one indicating complete agreement with the statement and ten indicating "Hard work doesn't generally bring success – it's more a matter of luck and connections." These responses are reverse scored, so the variable is increasing in the demotivating belief "Hard work does not bring success." ( $N = 227,851$ ).

**Figure 5:** Relationship Between Demotivating Beliefs (Work Unimportant) and Happiness – Holding Constant Zero-Sumness



*Notes:* The figure reports the relationship between respondents' demotivating beliefs and level of happiness for each zero-sum decile. Country-wave fixed effects and demographic controls are netted out before creating the zero-sum deciles. The demotivating belief in this figure is reported based on respondents' answers to the question (with work being the aspect respondents were asked the question about) "For each of the following, indicate how important it is in your life. Would you say it is," with options "1 Very important, 2 Rather important, 3 Not very important, 4 Not at all important." These responses are reverse scored to achieve the demotivating belief used in the figure "Work is not important at all." ( $N = 239,865$ ).

**Figure 6:** Relationship Between Demotivating Beliefs (Hard Work Does Not Bring Success) and Happiness – Holding Constant Zero-Sumness



*Notes:* The figure reports the relationship between respondents' demotivating beliefs and level of happiness for each zero-sum decile. Country-wave fixed effects and demographic controls are netted out before creating the zero-sum deciles. The demotivating belief in this figure is reported based on how much respondents agreed with the statement "In the long run, hard work usually brings a better life" on a scale of one to ten, with one indicating complete agreement with the statement and ten indicating "Hard work doesn't generally bring success—it's more a matter of luck and connections." These responses are reverse scored to achieve the demotivating belief used in the figure "Hard work does not bring success." ( $N = 243,927$ ).

possibility, we endogenize the technology level  $A(t)$  and examine its co-evolution with the distribution of beliefs  $\mathbf{q}$ . We find that while demotivating beliefs reduce a negative *contemporaneous* externality by limiting zero-sum competition, they also reduce a positive *intertemporal* externality from knowledge accumulation and can trap the economy in an underdeveloped state.

We need to specify a technology dynamic to say more about the expanded system  $(\mathbf{q}, A)$ . We assume technology cannot go below a subsistence level  $\underline{A} > 0$ . If  $A(t) \leq \underline{A}$  for some  $t = T$ , then  $A(t) = \underline{A}$  for all  $t > T$ . Otherwise, if  $A > \underline{A}$ , technological development is governed by the following equation of motion:

$$\frac{dA}{dt} = X(\mathbf{q}, A) - \delta A, \quad (10)$$

where  $\delta \in (0, 1)$  is the rate of technological depreciation and  $X(\mathbf{q}, A)$  is the mean level of effort in the population described in equation (7).<sup>33</sup> The positive effect of effort on the rate of innovation could arise from learning-by-doing and knowledge spillovers from productive activity, as in Aghion, Caroli and Garcia-Penalosa (1999) and Gershman (2014).<sup>34</sup>

To examine the long-term effect of demotivating beliefs on development, we substitute the expression for  $X(\mathbf{q}, A)$  from (7) into (10) to get:

$$\frac{dA}{dt} \begin{matrix} > \\ \equiv \\ < \end{matrix} 0 \iff A \begin{matrix} > \\ \equiv \\ < \end{matrix} \frac{\delta}{\sum_{i=1}^n q_i (1 - \theta_i)^2} \equiv D^*(\mathbf{q}, \Theta). \quad (11)$$

We call  $D^*(\mathbf{q}, \Theta)$  the development barrier. If  $A$  starts out above  $D^*(\mathbf{q}, \Theta)$ , there is perpetual growth. If, instead, it starts below  $D^*(\mathbf{q}, \Theta)$ , the level of technology  $A$  declines until it reaches the subsistence level  $\underline{A}$ .

There are two comparative static results regarding the development barrier  $D^*(\mathbf{q}, \Theta)$ . First, ruling out demotivating beliefs lowers the development barrier and expands the set of conditions that lead to perpetual growth. We formally establish this result in Proposition 5 in Appendix B.V. Hence, demotivating belief systems can be viewed as a kludge (Ely, 2011): they reduce wasteful zero-sum competition but they also create productive inefficiencies that can trap the economy in a low-technology state.

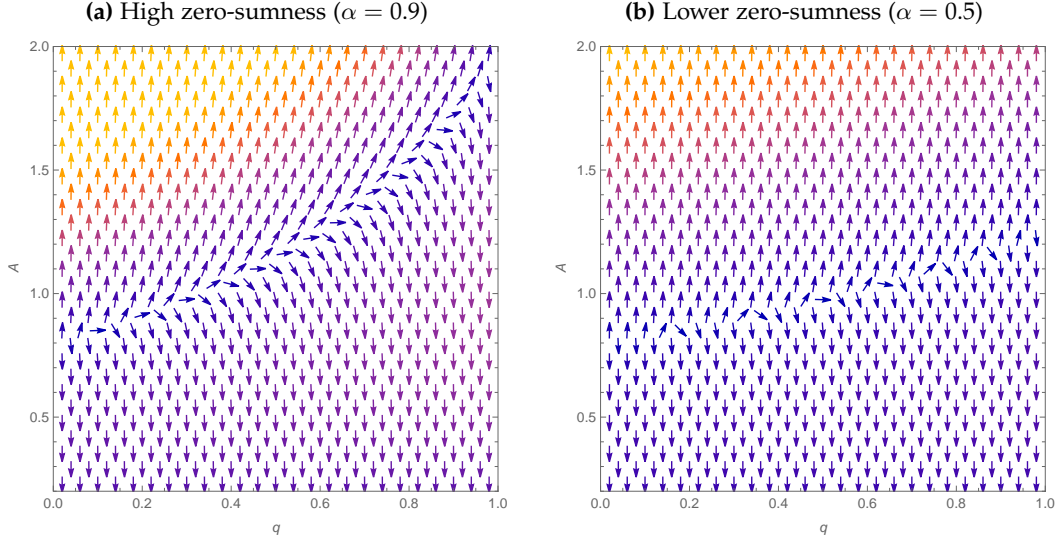
Second, there is a connection between zero-sumness and long-term development. Define  $\mathbf{q}^*(\alpha)$  as the state where the entire population holds belief  $\theta^* = \sigma\alpha$ , which it converges to when  $\theta^* \in$

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<sup>33</sup>The results do not change qualitatively if we assume  $\frac{dA}{dt} = (1 - \alpha)X(\mathbf{q}, A) - \delta A$ , so that effort in zero-sum interactions does not contribute to innovation.

<sup>34</sup>The effort choices characterized here continue to hold even with forward-looking agents because agents are non-atomic and thus do not individually affect mean effort.

**Figure 7:** The Development Barrier at Different Levels of Zero-Sumness of the Environment



*Notes:* The figure reports the vector plot of  $(q, A)$  under belief set  $\Theta = \{0, \theta^*\}$ , where  $q$  is the population share of the optimal demotivating belief  $\theta^*$ . The other parameter values are:  $\sigma = 0.4$ ,  $\delta = 0.8$ . Panel A considers a high level of zero-sumness,  $\alpha = 0.9$ , and the corresponding level of demotivating belief,  $\theta^* = 0.36$ . Panel B considers a lower level of zero-sumness,  $\alpha = 0.5$ , and the corresponding level of demotivating belief,  $\theta^* = 0.2$ .

$\Theta$ . The development barrier is then  $D^*(\mathbf{q}^*(\alpha), \Theta) = \frac{\delta}{1-\sigma\alpha}$ , which is strictly increasing in zero-sumness  $\alpha$  when there is positive sorting ( $\sigma > 0$ ). Hence, any shock to the economy that lowers its degree of zero-sumness makes it easier for the economy to transition to perpetual growth.

To illustrate this visually, consider the stylized case where the set of beliefs consists of the true (non-demotivating) belief 0 and the ‘optimal’ demotivating belief  $\theta^* = \sigma\alpha$ , i.e.,  $\Theta = \{0, \theta^*\}$ . Let  $q$  be the population share of  $\theta^*$  types and the cultural dynamic  $\frac{dq}{dt}$  be the standard replicator dynamic. Vector plots are presented in Figure 7. Panel (a) depicts a case of high zero-sumness,  $\alpha = 0.9$ . Assuming  $\sigma = 0.4$ , the demotivating belief  $\theta^*$  equals 0.36. The development barrier is the separatrix, which rises from 0.8 when  $q = 0$  to around 2 when  $q = 1$ . Panel (b) depicts a reduction in zero-sumness to 0.5 and a corresponding shift to the less demotivating belief  $\theta^* = 0.2$ . We see that the reduction in zero-sumness  $\alpha$  and the corresponding belief  $\theta^*$  speeds up growth and lowers the development barrier. Even if the drop in  $\alpha$  is temporary, it can produce perpetual growth from states that would otherwise lead to technological regress.

This insight may inform the long-standing historical question of why the economic take-off of the late 18th and 19th centuries Industrial Revolution began in Western Europe in the second half of the second millennium CE (Mokyr, 2016). Consistent with the explanation provided by Henrich (2020), our model suggests that Europe’s global expansion and colonialism after 1500



CE may have reduced the zero-sumness of the environment through the emergence of new trading opportunities (Acemoglu, Johnson and Robinson, 2005), an inflow of new technologies and resources, like new crops (Nunn and Qian, 2010, 2011), fertilizers/guano (Mann, 2012), stimulants like sugar, coffee, and tea (Hersch and Voth, 2022), and a perception of land abundance. Unleashed by colonialism and aided by the devastating impact of Eurasian diseases, this shock may have opened an exit ramp from a zero-sum trap. According to our theory, such effects could have triggered a cultural shift to a less demotivating belief system accompanied by higher effort exertion and more learning-by-doing. This cultural shift could have ushered in technological breakthroughs and a transition to modern, intensive economic growth.

Several lines of historical evidence suggest a shift away from traits that curbed ambition and effort after 1500 CE. First, European populations appear to be working longer and harder after 1600 CE (Voth, 1998, Clark, 1987, Henrich, 2020), which has been coined the “industrious revolution” (Vries, 2008). Second, consistent with such behavior, McCloskey (2006, 2010, 2016) has argued that new *bourgeois virtues* that placed value on hard work, thrift, and consumption, were a necessary pre-condition for the Industrial Revolution. Max Weber (1930) and David McClelland (1961) also stress the importance of similar values – what they call *the spirit of capitalism* and *need for achievement*, respectively – for sustained economic development. Third, more importance was given to intellectual, economic, and moral *progress* after 1500 (Wootton, 2016, Howes, 2016).<sup>35</sup>

In our terminology, the emergence of these values constituted a shift to a less demotivating belief system, which promoted economic activity. Our theory suggests that this cultural shift might have been driven by colonialism, the expansion of international trade, the influx of new tools and techniques, and the sudden “availability” of vast tracts of land and other resources on the eve of the Industrial Revolution. We, therefore, posit a cultural relationship between colonialism, trade, psychology, and the Great Divergence.<sup>36</sup> While a complete empirical examination is beyond the scope of this paper, we provide suggestive evidence for the plausibility of this interpretation. We use Google N-grams to look at the frequency of the mention of progress in

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<sup>35</sup>At the same time that such beliefs were spreading in pre-industrial revolution Europe, witchcraft beliefs, accusations, and prosecutions were in decline and would eventually vanish (Macfarlane, 1999, Bever, 2009).

<sup>36</sup>In our model, a reduction in  $\sigma$  and the corresponding belief  $\theta^*$  would also contribute to speeding up growth and lowering the development barriers. This prediction relates to work by Alger and Weibull (2010), who use an evolutionary analysis to shed light on how family ties affect incentives and economic development. Indeed, historians have argued that the onset of the Industrial Revolution was associated with weaker family ties due to migration from rural to urban areas (Laslett and Wall, 1972), changes in gender roles (Horrell and Humphries, 1995), and in the prevalence of child labor (Humphries, 2013). Thus, changes at the onset of the Early Modern period, which affected both  $\alpha$  and  $\sigma$  would have had reinforcing and complementary effects.

books published between 1600 and 1900 (Michel et al., 2010). While acknowledging the caveats associated with historical counts from N-grams (Pechenick, Danforth and Dodds, 2015, Younes and Reips, 2019), we see that the use of the word “progress” increased and the use of “jealousy” and “envy” declined right around the time of the take-off of the Industrial Revolution (Figure D29). While these patterns do not prove that a change in the zero-sumness of the environment and demotivating beliefs caused the Industrial Revolution (nor does our theory imply it), they do suggest a possible self-reinforcing confluence of factors. Changes in the zero-sumness of the environment possibly shaped cultural beliefs and economic behavior and boosted technological innovation, which in turn altered the economic environment, continuing the process.

## 7. Conclusions

This paper studied the evolution of demotivating belief systems and their effect on economic development. In an evolutionary model inspired by Foster’s “image of limited good,” we showed that demotivating beliefs can spread in environments where economic interactions are zero-sum. We also showed that the effects of zero-sum production are very different within or across populations. Within a population, an intermediate demotivating belief can improve material welfare by reducing excessive competition, but well-being decreases monotonically with demotivating beliefs. Across populations, there is a positive relationship between zero-sumness of the environment and demotivating beliefs, and both negatively affect material welfare and subjective well-being.

We tested these theoretical predictions in the data. In two samples from the Democratic Republic of the Congo, we found robust evidence that respondents with a more zero-sum view of the world hold stronger demotivating beliefs, including envy about the success of others and witchcraft beliefs that cast success as suspicious. In the global World Value Survey sample, we again documented a robust positive relationship between perceived zero-sumness and demotivating beliefs, including skepticism about the return to effort and the value of hard work. Also consistent with the model, we found that zero-sum perceptions and the resulting demotivating beliefs are associated with less happiness and lower life satisfaction. Lastly, we showed evidence of the divergence between material welfare and subjective well-being predicted by the model. When holding the degree of zero-sumness in the environment constant, income is hump-shaped in demotivating beliefs, while happiness decreases with the strength of demotivating beliefs.

Finally, we turned to the models' implications for innovation. When adding technology to the model, we showed that demotivating beliefs, by discouraging effort, could introduce a long-run dynamic inefficiency and trap a society in a low technology state. However, a short-lived decrease in the zero-sumness of the environment could induce sufficient cultural change away from demotivating belief systems to promote effort, innovation, and a shift toward a high-growth regime. We discussed how these predictions provide insights into our understanding of the cultural roots of the rise of Western Europe.

The paper leaves many important questions unanswered regarding the evolution of demotivating belief systems and their interactions with economic development. To what extent was the Great Divergence partly triggered by a cultural shift in Western Europe away from demotivating belief systems that suppressed effort? Has the intensification of economic rivalry and scarcity in the past decade increased the effective zero-sumness of the environment in many countries? If so, does this increase help explain the global increase in populism, nativism, and anti-elite sentiment (Guriev and Papaioannou, 2022), the turn away from meritocracy in the United States (Sandel, 2020), or the rise of incels in dating markets (Brooks, Russo-Batterham and Blake, 2022)? We view these questions as fertile ground for future work.

## References

- Acemoglu, Daron, Simon Johnson, and James Robinson**, "The Rise of Europe: Atlantic Trade, Institutional Change, and Economic Growth," *American Economic Review*, 2005, 95 (3), 546–579.
- Aghion, Philippe, Eve Caroli, and Cecilia Garcia-Penalosa**, "Inequality and Economic Growth: The Perspective of the New Growth Theories," *Journal of Economic Literature*, 1999, 37 (4), 1615–1660.
- Akerlof, Robert, Niko Matouschek, and Luis Rayo**, "Stories at Work," *AEA Papers and Proceedings*, 2020, 110, 199–204.
- Alesina, Alberto, Sebastian Hohmann, Stelios Michalopoulos, and Elias Papaioannou**, "Religion and Social Mobility in Africa," *Nature*, 2023, 618, 134–143.
- Algan, Yann and Pierre Cahuc**, "Inherited Trust and Growth," *American Economic Review*, 2010, 100 (5), 2060–2092.
- Alger, Ingela and Jörgen W. Weibull**, "Kinship, Incentives, and Evolution," *American Economic Review*, 2010, 100 (4), 1725–58.
- and **Jörgen W. Weibull**, "A generalization of Hamilton's rule—Love others how much?," *Journal of Theoretical Biology*, 2012, 299, 42–54.
- and **Jörgen W. Weibull**, "Homo Moralis—Preference Evolution under Incomplete Information and Assortative Matching," *Econometrica*, 2013, 81 (6), 2269–2302.
- and —, "Evolution and Kantian Morality," *Games and Economic Behavior*, 2016, 98, 56–67.
- Becker, Gary S.**, "Altruism, Egoism, and Genetic Fitness: Economics and Sociobiology," *Journal of Economic Literature*, 1976, 14 (3), 817–826.
- Becker, Sascha O. and Ludger Woessmann**, "Was Weber Wrong? A Human Capital Theory of Protestant Economic History," *Quarterly Journal of Economics*, 2009, 124 (2), 531–596.
- Bénabou, Roland and Jean Tirole**, "Belief in a Just World and Redistributive Politics," *Quarterly Journal of Economics*, 2006, 121 (2), 699–746.
- Bever, Edward**, "Witchcraft Prosecutions and the Decline of Magic," *Journal of Interdisciplinary History*, 2009, 40 (2), 263–293.

- Bisin, Alberto and Thierry Verdier**, ““Beyond the melting pot”: Cultural Transmission, Marriage, and the Evolution of Ethnic and Religious Traits,” *Quarterly Journal of Economics*, 2000, 115 (3), 955–988.
- and —, “On the Joint Dynamics of Culture and Institutions,” 2017. NBER Working paper No. 23375.
- Bowles, Samuel S.**, “Group Competition, Reproductive Leveling, and the Evolution of Human Altruism,” *Science*, 2006, 314 (5805), 1569–1572.
- Boyd, Robert and Peter J. Richerson**, *Culture and the Evolutionary Process*, University of Chicago Press, 1988.
- and **Peter J Richerson**, *The Origin and Evolution of Cultures*, Oxford University Press, 2005.
- Breza, Emily, Arun Chandrasekhar, Tyler McCormack, and Mengjie Pan**, “Using Aggregated Relational Data to Feasibly Identify Network Structure without Network Data,” *American Economic Review*, 2020, 110 (8), 2454–2484.
- Brooks, Robert C., Daniel Russo-Batterham, and Khandis R. Blake**, “Incel Activity on Social Media Linked to Local Mating Ecology,” *Psychological Science*, 2022, 33 (2), 249–258.
- Buggle, Johannes C. and Ruben Durante**, “Climate Risk, Cooperation and the Co-Evolution of Culture and Institutions,” *Economic Journal*, 01 2021, 131 (637), 1947–1987.
- Carvalho, Jean-Paul**, “Veiling,” *Quarterly Journal of Economics*, 2013, 128 (1), 337–370.
- and **Michael Sacks**, “The Economics of Religious Communities,” *Journal of Public Economics*, 2021, 201, 104481.
- and —, “Radicalization,” 2021. Working paper.
- Cavalli-Sforza, Luigi Luca and Marcus W. Feldman**, *Cultural Transmission and Evolution: A Quantitative Approach*, Princeton: Princeton University Press, 1981.
- Chinoy, Sahil, Nathan Nunn, Sandra Sequeira, and Stefanie Stantcheva**, “Zero-Sum Thinking and the Roots of U.S. Political Divides,” 2023. Working paper.
- Clark, Gregory**, “Productivity Growth without Technical Change in European-Agriculture before 1850,” *Journal of Economic History*, 1987, 47 (2), 419–432.
- Comaroff, Jean and John Comaroff**, “Privatizing the Millennium: New Protestant Ethics and the Spirits of Capitalism in Africa, and Elsewhere,” *Africa Spectrum*, 2000, pp. 293–312.
- Cooper, Ben and Chris Wallace**, “Group selection and the Evolution of Altruism,” *Oxford Economic Papers*, 2004, 56 (2), 307–330.
- Ely, Jeffrey C.**, “Kludged,” *American Economic Journal: Microeconomics*, 2011, 3 (3), 210–231.
- and **Okan Yilankaya**, “Nash Equilibrium and the Evolution of Preferences,” *Journal of Economic Theory*, 2001, 97 (2), 255–272.
- Enke, Benjamin**, “Kinship, Cooperation, and the Evolution of Moral Systems,” *Quarterly Journal of Economics*, 2019, 134 (2), 953–1019.
- Esponda, Ignacio and Demian Pouzo**, “Berk–Nash Equilibrium: A Framework for Modeling Agents with Misspecified Models,” *Econometrica*, 2016, 84 (3), 1093–1130.
- Fernandez, Raquel**, “Women, Work and Culture,” *Journal of the European Economic Association*, 2007, 5 (2–3), 305–332.
- Fernández, Raquel and Alessandra Fogli**, “Culture: An empirical investigation of beliefs, work, and fertility,” *American Economic Journal: Macroeconomics*, 2009, 1 (1), 146–177.
- Flouri, Eirini**, “An Integrated Model of Consumer Materialism: Can Economic Socialization and Maternal Values Predict Materialistic Attitudes in Adolescents?,” *Journal of Socio-Economics*, 1999, 28 (6), 707–724.
- Foster, George M.**, *Traditional Cultures, and the Impact of Technological Change*, New York: Harper, 1962.
- , “Peasant Society and the Image of Limited Good,” *American Anthropologist*, 1965, 67 (2), 293–315.
- , *Tzintzuntzan; Mexican Peasants in a Changing World*, New York: Little Brown & Company, 1967.
- , “A Second Look at Limited Good,” *Anthropological Quarterly*, 1972, 45 (2), 57–64.
- Frank, Robert H.**, “If Homo Economicus Could Choose his Own Utility Function, Would he Want One with a Conscience?,” *American Economic Review*, 1987, pp. 593–604.
- , *Passions Within Reason: The Strategic Role of the Emotions*, New York and London: WW Norton & Co, 1988.
- Freeman, Dena**, *Pentecostalism and Development: Churches, NGOs and Social Change in Africa*, Palgrave Macmillan, 2012.
- Gershman, Boris**, “The Two Sides of Envy,” *Journal of Economic Growth*, 2014, 19 (4), 407–438.
- , “The Economic Origins of the Evil Eye Belief,” *Journal of Economic Behavior & Organization*, 2015, 110, 119–144.
- , “Witchcraft Beliefs and the Erosion of Social Capital: Evidence from Sub-Saharan Africa and beyond,”

- Journal of Development Economics*, 2016, 120, 182–208.
- , “Witchcraft Beliefs as a Cultural Legacy of the Atlantic Slave Trade: Evidence from Two Continents,” *European Economic Review*, 2020, 122 (3), 103362.
- , “Witchcraft Beliefs Around the World: An Exploratory Analysis,” *PLoS ONE*, November 2022, 17 (11), e0276872.
- , “Witchcraft Beliefs, Social Relations, and Development,” *Handbook of Labor, Human Resources and Population Economics*, 2022, pp. 1–30.
- , “Witchcraft Beliefs and Subjective Well-Being,” 2023. Working paper, American University.
- Giuliano, Paola**, “Living Arrangements in Western Europe: Does Cultural Origin Matter?,” *Journal of the European Economic Association*, 2007, 5 (5), 927–952.
- and **Nathan Nunn**, “Understanding Cultural Persistence and Change,” *Review of Economic Studies*, 2021, 88 (4), 1541–1581.
- Grosjean, Pauline and Rishabh Khattar**, “It’s Raining Men! Hallelujah? The Long-Run Consequences of Male-Biased Sex Ratios,” *Review of Economic Studies*, 2018, 86 (2), 723–754.
- Guiso, Luigi, Paola Sapienza, and Luigi Zingales**, “Cultural Biases in Economic Exchange,” *Quarterly Journal of Economics*, 2009, 124 (3), 1095–1131.
- , —, and —, “Long-Term Persistence,” *Journal of the European Economic Association*, 2016, 14 (6), 1401–1436.
- Guriev, Sergei and Elias Papaioannou**, “The Political Economy of Populism,” *Journal of Economic Literature*, September 2022, 60 (3), 753–832.
- Güth, W. and M. Yaari**, “An Evolutionary Approach to Explain Reciprocal Behavior in a Simple Strategic Game,” in U. Witt, ed., *Explaining Process and Change—Approaches to Evolutionary Economics*, University of Michigan Press, 1992.
- Hamilton, William D.**, “The Genetical Evolution of Social Behaviour II,” *Journal of Theoretical Biology*, 1964, 7 (1), 17–52.
- Heifetz, Aviad, Chris Shannon, and Yossi Spiegel**, “What to Maximize if You Must,” *Journal of Economic Theory*, 2007, 133 (1), 31–57.
- Henrich, Joseph**, “Cultural Group Selection, Coevolutionary Processes and Large-Scale Cooperation,” *Journal of Economic Behavior & Organization*, 2004, 53 (1), 3–35.
- , “The Evolution of Innovation-Enhancing Institutions,” in Stephen J. Shennan and Michael J. O’Brien, eds., *Innovation in Cultural Systems: Contributions in Evolutionary Anthropology*, MIT Press, 2009, pp. 99–120.
- , *The WEIRD People in the World: How the West became psychologically peculiar and particularly prosperous*, New York: Farrar, Straus and Giroux, 2020.
- , **Maciej Chudek, and Robert Boyd**, “The Big Man Mechanism: How Prestige Fosters Cooperation and Creates Prosocial leaders,” *Philosophical Transactions of the Royal Society B: Biological Sciences*, 2015, 370 (1683).
- Hersch, Jonathan and Hans-Joachim Voth**, “Sweet Diversity: Colonial Goods and the Welfare Gains from Global Trade,” *Explorations in Economic History*, 2022, 86 (2), 101468.
- Horrell, Sara and Jane Humphries**, “Women’s Labour Force Participation and the Transition to the Male Breadwinner Family, 1790–1865,” *Economic History Review*, 1995, 48 (1), 89–117.
- Howes, Anton**, “The Spread of Improvement: Why Innovation Accelerated in Britain 1547–1851,” 2016. Working paper.
- Humphries, Jane**, “Childhood and Child Labour in the British Industrial Revolution,” *Economic History Review*, 2013, 66 (2), 395–418.
- Iannaccone, Laurence R.**, “Sacrifice and Stigma: Reducing Free-Riding in Cults, Communes, and other Collectives,” *Journal of Political Economy*, 1992, 100 (2), 271–291.
- Laslett, Peter and Richard Wall**, *Household and Family in Past Time*, Cambridge University Press, 1972.
- Macfarlane, Alan**, *Witchcraft in Tudor and Stuart England*, London: Routledge, 1999.
- Mann, Charles C.**, 1493, New York: Knopf, 2012.
- Massari, Filippo and Jonathan Newton**, “Learning and Equilibrium in Misspecified Models,” 2020. Working paper.
- McClelland, David C.**, *The Achieving Society*, New York: D. Van Nostrand Company, 1961.
- McCloskey, Deirdre Nansen**, *Bourgeois Virtues: Ethics for Age of Commerce*, Chicago: University of Chicago Press, 2006.
- , *Bourgeois Dignity: Why Economics Can’t Explain the Modern World*, Chicago: University of Chicago Press,

- 2010.
- , *Bourgeois Equality: How Ideas, Not Capital or Institutions, Enriched the World*, Chicago: University of Chicago Press, 2016.
- Michel, Jean Baptiste, Yuan Kui Shen, Aviva Presser Aiden, Adrian Veres, Matthew K. Gray, The Google Books Team, Joseph P. Pickett, Dale Hoiberg, Dan Clancy, Peter Norvig, Jon Orwant, Steven Pinker, Martin A. Nowak, and Erez Liberman Aiden**, “Quantitative Analysis of Culture Using Millions of Digitized Books,” *Science*, 2010, 331 (6014), 176–182.
- Mokyr, Joel**, *A Culture of Growth: The Origins of the Modern Economy*, Princeton: Princeton University Press, 2016.
- Norenzayan, Ara**, *Big Gods: How Religion Transformed Cooperation and Conflict*, Princeton University Press, 2013.
- Nunn, Nathan and Leonard Wantchekon**, “The Slave Trade and the Origins of Mistrust in Africa,” *American Economic Review*, 2011, 101 (7), 3221–3252.
- and **Nancy Qian**, “The Columbian Exchange: A History of Disease, Food, and Ideas,” *Journal of Economic Perspectives*, 2010, 24 (2), 163–188.
- and —, “The Potato’s Contribution to Population and Urbanization: Evidence from a Historical Experiment,” *Quarterly Journal of Economics*, 2011, 126 (2), 593–650.
- and **Raul Sanchez de la Sierra**, “Why Being Wrong Can Be Right: Magical Warfare Technologies and the Persistence of False Beliefs,” *American Economic Review Papers & Proceedings*, 2017, 107 (5), 582–687.
- Ok, Efe A. and Fernando Vega-Redondo**, “On the Evolution of Individualistic Preferences: An Incomplete Information Scenario,” *Journal of Economic Theory*, 2001, 97 (2), 231–254.
- Pechenick, Eitan Adam, Christopher M. Danforth, and Peter Sheridan Dodds**, “Characterizing the Google Books Corpus: Strong Limits to Inferences of Socio-Cultural and Linguistic Evolution,” *PLoS ONE*, 2015, 10 (10), e0137041.
- Platteau, Jean-Philippe**, *Institutions, Social Norms, and Economic Development*, Vol. 1, Psychology Press, 2000.
- Ranger, Terence O. and T. O. Ranger**, *Evangelical Christianity and Democracy in Africa*, Oxford University Press, 2008.
- Sandel, Michael J.**, *The Tyranny of Merit: What’s Become of the Common Good?*, Penguin UK, 2020.
- Sandholm, William H.**, *Population Games and Evolutionary Dynamics*, Cambridge: MIT press, 2010.
- Schelling, Thomas C.**, *The Strategy of Conflict*, Cambridge: Harvard University Press, 1960.
- Schulz, Jonathan F., Duman Bahrami-Rad, Jonathan P. Beauchamp, and Joseph Henrich**, “The Church, Intensive Kinship, and Global Psychological Variation,” *Science*, 2019, 366 (6466), eaau5141.
- Spolaore, Enrico and Romain Wacziarg**, “The Diffusion of Development,” *Quarterly Journal of Economics*, 2009, 124 (2), 469–529.
- Tabellini, Guido**, “Institutions and culture,” *Journal of the European Economic Association*, 2008, 6 (2-3), 255–294.
- Verdier, Thierry and Yves Zenou**, “Cultural Leaders and the Dynamics of Assimilation,” *Journal of Economic Theory*, 2018, 175, 374–414.
- Voigtländer, Nico and Hans-Joachim Voth**, “Persecution perpetuated: The Medieval Origins of Anti-Semitic Violence in Nazi Germany,” *Quarterly Journal of Economics*, 2012, 127 (3), 1339–1392.
- Voth, Hans-Joachim**, “Time and Work in Eighteenth-Century London,” *Journal of Economic History*, 1998, 58 (1), 29–58.
- Vries, Jan De**, *The Industrious Revolution: Consumer Behavior and The Household Economy, 1650 to the present*, New York: Cambridge University Press, 2008.
- Weber, Max**, *The Protestant Ethic and the Spirit of Capitalism*, London: Unwin Hyman Limited, 1930.
- West, Stuart A., Ashleigh S. Griffin, and Andy Gardner**, “Evolutionary Explanations for Cooperation,” *Current biology*, 2007, 17 (16), R661–R672.
- Whelan, Christopher T.**, “Marginalization, Deprivation, and Fatalism in the Republic of Ireland: Class and Underclass Perspectives,” *European Sociological Review*, 1996, 12 (1), 33–51.
- White, Cindel J. M., Michael Muthukrishna, and Ara Norenzayan**, “Cultural Similarity among Coreligionists within and between Countries,” *Proceedings of the National Academy of Sciences*, 2021, 118 (37), e2109650118.
- Wootton, David**, *Invention of Science*, Penguin, 2016.
- Younes, Nadja and Ulf-Dietrich Reips**, “Guideline for Improving the Reliability of Google Ngram Studies: Evidence from Religious Terms,” *PLoS ONE*, 2019, 14 (3), e0213554.

## Appendix (For Online Publication Only)

### Appendix A. Mathematical Proofs

**Proof of Proposition 1.** Under a payoff monotone dynamic for two traits  $i$  and  $j$  that are present in the population,  $\frac{d}{dt} \left[ \frac{q_i}{q_j} \right] > 0$  if and only if  $F_i(\mathbf{q}) > F_j(\mathbf{q})$ .

The cultural fitness of trait  $i$  is given by (4). Thus,

$$\begin{aligned} F_i(\mathbf{q}) &> F_j(\mathbf{q}) \\ \iff (1 - \theta_i) \left( 1 - \frac{1}{2}(1 - \theta_i) \right) A^2 - \sigma\alpha(1 - \theta_i)A^2 &> (1 - \theta_j) \left( 1 - \frac{1}{2}(1 - \theta_j) \right) A^2 - \sigma\alpha(1 - \theta_j)A^2. \end{aligned} \tag{A1}$$

Recall that  $A > 0$ . Hence:

(i) Setting  $\theta_j = 0$ , (A1) becomes  $\theta_i < 2\sigma\alpha$ . Since this is independent of the state, part (i) follows immediately.

(ii) If  $\theta_i$  is chosen to maximize the left-hand side of (A1), then the growth rate of trait  $i$  will be higher than any other trait. The unique maximizer is  $\theta^* = \sigma\alpha$ . Since this is independent of the state, the share of such types will converge monotonically to one as long as  $q^*(0) > 0$ .  $\square$

**Corollary 2 . Evolution of Approximately Optimal Demotivating Beliefs.** Consider a regular environment in which the set of beliefs is the discrete grid  $\Theta = \{0, \frac{1}{\Delta}, \frac{2}{\Delta}, \dots, 1\}$  and where the initial state  $\mathbf{q}(0)$  has full support on  $\Theta$ .

If the set of beliefs is sufficiently fine ( $\Delta$  large), cultural evolution selects a belief that is approximately  $\theta^* = \sigma\alpha$ . That is,  $q_i(t)$  converges monotonically to one for some  $\theta_i \in (\theta^* - \frac{1}{\Delta}, \theta^* + \frac{1}{\Delta})$ .

This follows from  $\theta^*$  being the relative cultural fitness maximizing belief and the strict concavity of  $F_i(\mathbf{q}) - F_j(\mathbf{q})$  with respect to  $\theta_i$  for all  $j \neq i$ .

**Proof of Proposition 2.** Suppose  $\theta_i > \theta_j$ . Rearranging (A1),  $F_i(\mathbf{q}) > F_j(\mathbf{q})$  if and only if

$$\begin{aligned} -\frac{1}{2}(\theta_i - \theta_j) + \frac{1}{2}\theta_i(1 - \theta_i) - \frac{1}{2}\theta_j(1 - \theta_j) + \sigma\alpha(\theta_i - \theta_j) &> 0 \\ \iff -\frac{1}{2}(\theta_i - \theta_j)(\theta_i + \theta_j) + \sigma\alpha(\theta_i - \theta_j) &> 0 \\ \iff \sigma\alpha &> \frac{1}{2}(\theta_i + \theta_j). \end{aligned}$$

Consider  $\theta_i = \theta_j + \Delta$ . For  $\Delta$  sufficiently small, the last condition becomes  $\theta_i < \sigma\alpha$ . Therefore, material welfare is strictly increasing in  $\theta$  up to  $\theta^* = \sigma\alpha$  and strictly decreasing thereafter.

In addition, because  $F_i(\mathbf{q}) - F_j(\mathbf{q})$  is proportional to approximately  $\sigma\alpha - \theta_i$  for  $\Delta$  small, material welfare is also strictly concave in  $\theta$ .  $\square$

**Proof of Proposition 3.** Suppose  $\theta_i > \theta_j$ . Then

$$\begin{aligned}
& \hat{W}_i < \hat{W}_j \\
& \iff \frac{1}{2}(1 - \theta_i)^2 - \sigma\alpha(1 - \theta_i) < \frac{1}{2}(1 - \theta_j)^2 - \sigma\alpha(1 - \theta_j) \\
& \iff \frac{1}{2}[(1 - \theta_j)^2 - (1 - \theta_i)^2] > \sigma\alpha[(1 - \theta_j) - (1 - \theta_i)] \\
& \iff \frac{1}{2}[(1 - \theta_j) - (1 - \theta_i)][(1 - \theta_j) + (1 - \theta_i)] > \sigma\alpha[(1 - \theta_j) - (1 - \theta_i)] \\
& \iff \frac{1}{2}[(1 - \theta_j) + (1 - \theta_i)] > \sigma\alpha \\
& \iff 1 - \sigma\alpha > \frac{1}{2}(\theta_i + \theta_j). \tag{A2}
\end{aligned}$$

Consider  $\theta_i = \theta_j + \Delta$ . For  $\Delta$  sufficiently small, the last condition becomes  $\theta_i < 1 - \sigma\alpha$ . Therefore, subjective well-being is strictly decreasing in  $\theta$  for  $\theta < 1 - \sigma\alpha$  and increasing otherwise.

In addition, because  $\hat{W}_i - \hat{W}_j$  is proportional to approximately  $\theta_i - 1 + \sigma\alpha$  for  $\Delta$  small, subjective well-being is also strictly convex in  $\theta$ .

Finally, if  $\theta_j = 0$ , then (A2) becomes  $1 - \sigma\alpha > \frac{1}{2}\theta_i$ , which is satisfied for all  $\theta_i \in [0, 1]$  if  $\sigma\alpha < \frac{1}{2}$ .

$\square$

**Numerical results accompanying Proposition 3.** To illustrate the relationship between subjective well-being and the intensity of demotivating beliefs, we report the limiting value of subjective well-being as a function of  $\theta$  for the case where the zero-sumness of the environment is  $\alpha = 1/2$ . This is shown in Figure A1. The two panels, each which assumes a different value of  $\sigma$  that are fairly high (0.25 or 0.50), show that even when  $\max \Theta > 1 - \sigma\alpha$ , subjective well-being only rises slightly for higher values of  $\theta$ . This theoretical prediction matches the empirical results shown in Figures 5 and 6.

**Proof of Proposition 4.** By Corollary 2, for any interior initial state and  $\Delta$  sufficiently large,  $q_i^k(t)$  converges monotonically to one, where  $\theta_i$  is approximately  $\sigma\alpha^k$ .

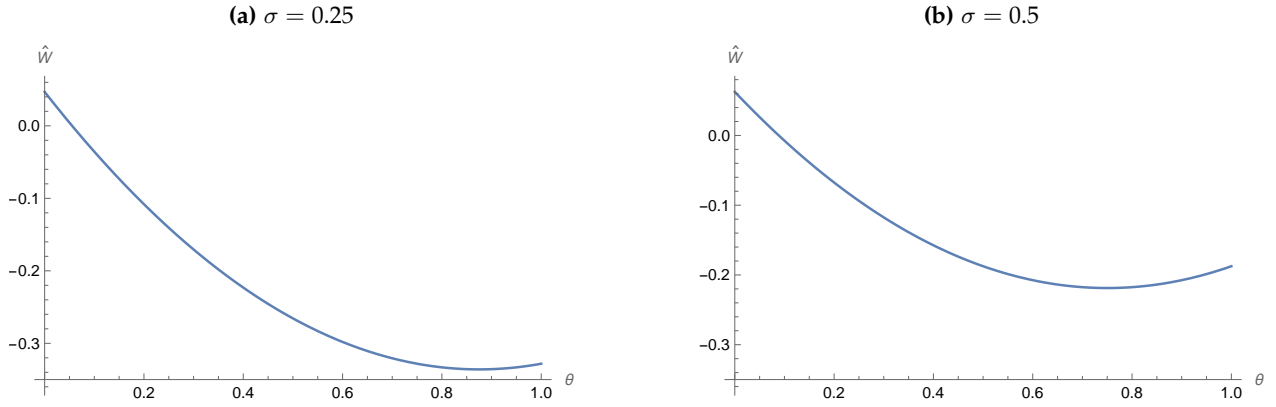
First, this implies  $\theta^k(t)$  converges to approximately  $\sigma\alpha^k$ . The first result follows immediately.

Second,  $X^k(t)$  converges to approximately  $(1 - \sigma\alpha^k)^2 A^2$  and mean material welfare  $W^k(t)$  converges to approximately

$$(1 - \sigma\alpha^k) \left[ \frac{1}{2} - \alpha^k \left( 1 - \frac{1}{2}\sigma \right) \right] A^2.$$



**Figure A1:** Plot of subjective well-being  $\hat{W}$  on the intensity of demotivating beliefs  $\theta$ , for  $\alpha = 1/2$ ,  $A = 1$ , and a population-average belief  $\sum_{k=1}^n q_k \theta_k = 0.5$ .



Differentiating with respect to  $\alpha^k$  yields

$$- \left[ 1 - 2\sigma\alpha^k \left( 1 - \frac{1}{2}\sigma \right) \right] A^2,$$

which is negative for all  $\alpha^k \in [0,1)$ .

Hence, each limit point is strictly decreasing in  $\alpha^k$ , thus establishing the results regarding  $X^k(t)$  and  $W^k(t)$  for  $\Delta$  sufficiently large, as hypothesized.

Third, note that  $\hat{W}^k(t)$  converges to approximately  $(1 - \sigma\alpha^k) \left[ \frac{1}{2} (1 - \sigma\alpha^k) - \alpha^k \right] A^2$ . Differentiating with respect to  $\alpha^k$  and dividing by  $A^2$  yields

$$-\sigma \left[ \frac{1}{2} (1 - \sigma\alpha^k) - \alpha^k \right] - \frac{1}{2}\sigma(1 - \sigma\alpha^k) - (1 - \sigma\alpha^k).$$

Rearranging, this is negative if

$$\alpha^k < \frac{1}{\sigma} \frac{1+\sigma}{2+\sigma},$$

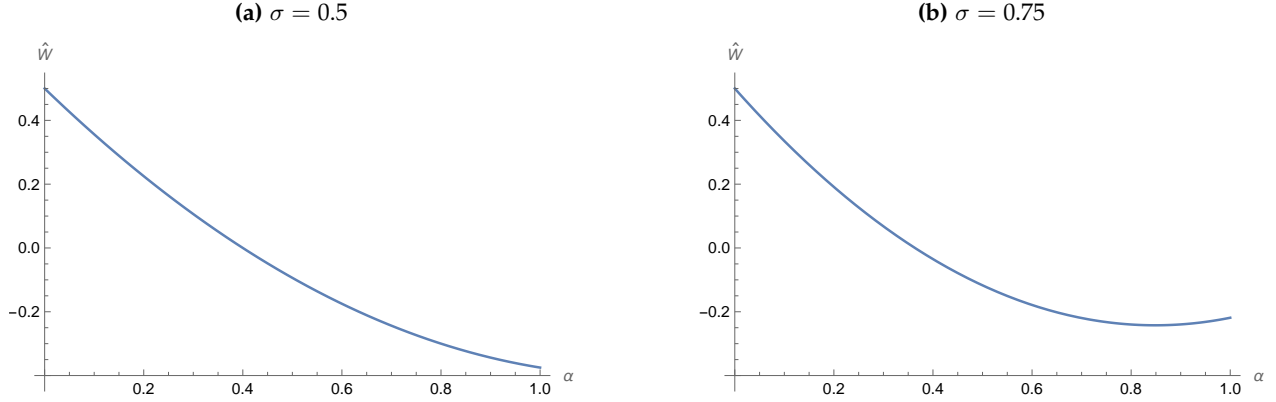
which holds for all  $\alpha^k \in [0,1]$  if  $\sigma \leq \frac{1}{2}$ .

Again, the limit point is strictly decreasing in  $\alpha^k$  for  $\sigma \leq \frac{1}{2}$  or  $\alpha^k < \frac{1}{\sigma} \frac{1+\sigma}{2+\sigma}$ , thus establishing the result regarding  $\hat{W}^k(t)$  for  $\Delta$  and  $T$  sufficiently large, as hypothesized.  $\square$

**Numerical results accompanying Proposition 4.** To illustrate the relationship between subjective well-being and the degree of zero-sumness, we plot the limiting value of subjective well-being when all individuals hold the belief  $\theta^* = \sigma\alpha^k$ , as a function of  $\alpha^k$ . This is shown in Figure A2. Panel (a) depicts a case in which subjective well-being  $\hat{W}^k$  is strictly decreasing in  $\alpha^k$  on  $[0,1]$ .

Panel (b) shows that even when  $\hat{W}^k$  is increasing in  $\alpha^k$  over part of the domain, the curve does not change dramatically. In both cases, the subjective well-being curve becomes relatively flat for high degrees of zero-sumness,  $\alpha^k$ . This matches the empirical results reported in Figure 2.

**Figure A2:** Plot of subjective well-being  $\hat{W}^k$  on the degree to which the environment is zero-sum  $\alpha^k$ , when  $A = 1$  and all individuals hold the limiting belief  $\theta^* = \sigma\alpha^k$ .



## Appendix B. Robustness of Theoretical Predictions to Alternative Formulations

### I. Alternative Forms of Demotivation

We consider our predictions for alternative assumptions for how demotivating beliefs affect payoffs.

First, suppose that demotivating beliefs enter the subjective payoff function as follows, discounting the entire benefit:

$$\hat{U}_i(x_i, x_j) = (1 - \theta_i)A [\sqrt{x_i} - \alpha\sqrt{x_j}] - \frac{1}{2}x_i. \quad (\text{B3})$$

The optimal effort remains the same at  $x_i^* = (1 - \theta_i)^2 A^2$ . Hence, material payoffs are unchanged and cultural evolution, which operates on material payoffs, is also unchanged. The only differences are minor changes to the conditions for the comparative dynamics involving subjective payoffs in Propositions 3 and 4. The results are qualitatively unchanged.

Second, suppose instead that demotivating beliefs raise the cost of effort as follows:

$$\hat{U}_i(x_i, x_j) = A [\sqrt{x_i} - \alpha\sqrt{x_j}] - \frac{1}{2} \frac{x_i}{1 - \theta_i}. \quad (\text{B4})$$

Again, the optimal effort remains the same at  $x_i^* = (1 - \theta_i)^2 A^2$ . Hence material payoffs and cultural evolution are unchanged.

## II. Nonequivalence of Altruism

In this section, we show that our model of demotivating beliefs is not mathematically equivalent to a model of the evolution of altruism.

Consider the following model of altruism where, again, fraction  $\alpha$  of interactions are zero-sum. As in (1), material payoffs in an  $i, j$  match are

$$\begin{aligned} U(x_i, x_j) &= A [\alpha (\sqrt{x_i} - \sqrt{x_j}) + (1 - \alpha) \sqrt{x_i}] - \frac{1}{2} x_i \\ &= A [\sqrt{x_i} - \alpha \sqrt{x_j}] - \frac{1}{2} x_i. \end{aligned} \quad (\text{B5})$$

Subjective (other-regarding) payoffs are

$$\begin{aligned} \hat{U}_i(x_i, x_j) &= U(x_i, x_j) + \theta_i U(x_j, x_i) \\ &= A [\sqrt{x_i} - \alpha \sqrt{x_j}] - \frac{1}{2} x_i + \theta_i \{ A [\sqrt{x_j} - \alpha \sqrt{x_i}] - \frac{1}{2} x_j \}, \end{aligned} \quad (\text{B6})$$

where now  $\theta_i \in \Theta$  is a level of altruism (or spite if negative).

Maximizing (B6) with respect to  $x_i$  yields:

$$x_i^* = \arg \max_{x_i \in \mathbb{R}_+} \hat{U}_i(x_i, x_j) = (1 - \alpha \theta_i)^2 A^2.$$

The fitness of trait  $i$

$$\begin{aligned} F_i(\mathbf{q}) &= \sigma U_{ii} + (1 - \sigma) \sum_{j=1}^n q_j U_{ij} \\ &= (1 - \alpha \theta_i) \left( 1 - \frac{1}{2} (1 - \alpha \theta_i) \right) A^2 - \sigma \alpha (1 - \alpha \theta_i) A^2 - (1 - \sigma) \alpha A^2 \sum_{j=1}^n q_j (1 - \alpha \theta_j). \end{aligned} \quad (\text{B7})$$

Hence:

$$\begin{aligned} F_i(\mathbf{q}) &> F_j(\mathbf{q}) \\ \iff (1 - \alpha \theta_i) \left( 1 - \frac{1}{2} (1 - \alpha \theta_i) \right) A^2 - \sigma \alpha (1 - \alpha \theta_i) A^2 &> (1 - \alpha \theta_j) \left( 1 - \frac{1}{2} (1 - \alpha \theta_j) \right) A^2 - \sigma \alpha (1 - \alpha \theta_j) A^2. \end{aligned} \quad (\text{B8})$$

Maximizing the LHS of (B8) yields the relative fitness-maximizing trait  $i$ . The first-order condition is

$$-\alpha + \frac{1}{2} \alpha - \frac{1}{2} \alpha^2 \theta_i + \frac{1}{2} \alpha - \frac{1}{2} \alpha^2 \theta_i - \sigma \alpha^2 = 0.$$

Hence, the unique maximizer is  $\theta^* = \sigma$ , which is independent of the degree of zero-sumness  $\alpha$ .

This is not supported by the empirical evidence we present in this paper.

### III. Competitive versus Prosocial Effort

In this section, we show that our results are robust to another formulation that disentangles effort in different domains. Specifically, there are two types of effort, competitive effort  $x$  in private (partially zero-sum) interactions and prosocial effort  $y$  in interactions with positive spillovers. Again, suppose the fraction  $\alpha$  of private interactions is zero-sum.

Material payoffs in an  $i, j$  match are

$$U(x_i, x_j, y_i, y_j) = A_1 [\sqrt{x_i} - \alpha\sqrt{x_j}] - \frac{1}{2}x_i + (1 - \alpha)A_2 \underbrace{[\sqrt{y_i} + \sqrt{y_j}]}_{\text{positive spillovers}} - \frac{1}{2}y_i, \quad (\text{B9})$$

where  $A_1$  is the technology in zero-sum interactions and  $A_2$  is the technology in interactions with positive spillovers.

Subjective (other-regarding) payoffs are

$$\hat{U}_i(x_i, x_j, y_i, y_j) = (1 - \theta_i)A_1 [\sqrt{x_i} - \alpha\sqrt{x_j}] - \frac{1}{2}x_i + (1 - \alpha)A_2[\sqrt{y_i} + \sqrt{y_j}] - \frac{1}{2}y_i, \quad (\text{B10})$$

where  $\theta_i$  is the intensity of demotivation in private (partially zero-sum) interactions only. In this way, belief systems such as the laws of Jante and the ‘tall poppy’ syndrome can disincentivize anti-social effort without reducing prosocial effort.

Then the main results, including  $\theta^* = \sigma\alpha$ , are the same as in our baseline model. The only difference is that societies with high  $A_2$  can be highly productive while having beliefs that are demotivating in zero-sum domains (e.g., Scandinavian societies).

### IV. Cultural Leaders and Institutions

Rather than being determined by cultural evolution, it could be that the distribution of demotivating beliefs is directed by a community leader or cultural institution in a top-down way. To examine this alternative formulation, suppose the set of beliefs is binary,  $\Theta = \{\theta_1, \theta_2\}$ , with  $\theta_1 = 0$  the correct belief and  $\theta_2 = \theta(t)$  a demotivating belief. We assume that community leaders or some impersonal institutions dynamically tune  $\theta(t)$  in a way that maximizes the spread of the demotivating belief. This is meant to capture the influence that political or religious leaders can have on beliefs  $\theta(t)$  (e.g., Verdier and Zenou, 2018, Carvalho and Sacks, 2021b). For religious beliefs, examples would be the church doctrine, such as the Marriage and Family Program of the Catholic Church dating back to the medieval period (Schulz et al., 2019). When considering supernatural beliefs, such as beliefs in the evil eye or witchcraft, they can be influenced by

prestigious individuals such as chiefs, shamans, and witchdoctors (Henrich, Chudek and Boyd, 2015).

Because the demotivating belief  $\theta^* = \sigma\alpha$  maximizes relative cultural fitness regardless of the state, it is chosen by the leader for all time without having to be dynamically tuned. In addition, the demotivating belief spreads from all interior initial states and achieves fixation. Thus, we expect the belief system produced by community leaders or cultural institutions to be the same as that selected by cultural evolution. In both cases, a population in which interactions are more zero-sum (larger  $\alpha$ ) will have more intense demotivating beliefs.

## V. Endogenous Technological Change

Recall that the technology dynamic is given by (11). As a benchmark, consider a degenerate set of beliefs labeled  $\Theta^0$  where  $\theta_i = 0$  for all  $i$ . In this case, all beliefs are true and not demotivating. The development barrier is  $D^*(\mathbf{q}, \Theta^0) = \delta$ . Starting from  $A(0) > \delta$ , there is perpetual technological progress and growth. Starting from  $A(0) < \delta$ , there is technological regress and contraction of the economy until  $A(t) = \underline{A}$ , the subsistence level. Hence, a technological shock of size greater than  $\delta - \underline{A}$  is required to transition the economy from the  $A = \underline{A}$  steady state to perpetual growth. Now consider a non-degenerate belief system  $\Theta$ . In this case, the development barrier  $D^*(\mathbf{q}, \Theta)$  depends on  $\mathbf{q}$ . In particular,  $D^*(\mathbf{q}, \Theta) > D^*(\mathbf{q}, \Theta^0)$  whenever there exists a belief such that  $\theta_i > 0$  and  $q_i > 0$ .

Now write  $(\mathbf{q}, A) \in \Omega(\Theta)$  if starting from  $(\mathbf{q}, A)$  and given the set of beliefs  $\Theta$ ,  $dA/dt > 0$  for all  $t > 0$  under a payoff monotone cultural dynamic and the technology dynamic given by (10). That is,  $\Omega(\Theta)$  is the set of states from which the *co-evolution* of beliefs  $\mathbf{q}$  and technology  $A$  leads to perpetual growth.

By Proposition 1(i), for demotivating beliefs to spread under a payoff monotone dynamic from an interior state, there must exist  $\theta_i \in \Theta$  such that  $\theta_i < 2\sigma\alpha$  (which requires  $\sigma\alpha > 0$ ). When  $\Theta$  has this property, we refer to the environment as one that supports demotivating beliefs.

To assess the impact of beliefs on long-run economic development, we can compare technological progress in an environment that supports demotivating beliefs to technological progress under the degenerate set of beliefs  $\Theta^0$ .

**Proposition 5 . Demotivating Beliefs Undermine Technological Progress.** Suppose  $\underline{A} < \delta$ .<sup>B1</sup> For any environment  $\Theta$  that supports demotivating beliefs, the set of conditions from which there is perpetual growth is a strict subset of the set of conditions from which there is perpetual growth under the degenerate (non-demotivating) set of beliefs  $\Theta^0$ :

$$\Omega(\Theta) \subsetneq \Omega(\Theta^0).$$

*Proof.* By (11), for  $\Theta^0$ , i.e.,  $\theta_i = 0$  for all  $i$ , the development barrier is  $D^*(\mathbf{q}, \Theta^0) = \delta$ . As this is independent of  $\mathbf{q}$ ,

$$\Omega(\Theta^0) = \{(\mathbf{q}, A) \in [0,1] \times \mathbb{R}_+ : A > \delta\}. \quad (\text{B11})$$

More generally, by (11),  $\frac{dA}{dt} < 0$  in all states  $(\mathbf{q}, A)$  such that  $A < D^*(\mathbf{q}, \Theta)$ . We have established  $D^*(\mathbf{q}, \Theta) \geq D^*(\mathbf{q}, \Theta^0) = \delta$ , and strictly so if there exists  $i$  such that  $\theta_i > 0$  and  $q_i > 0$ .

Hence, as with  $\Theta^0$ , if  $A(0) < \delta$ , then  $\frac{dA}{dt}|_{t=0} < 0$ . By induction then,  $\frac{dA}{dt}|_{t=\tau} < 0$  for all  $\tau$  until the lower bound  $\underline{A}$  is reached.

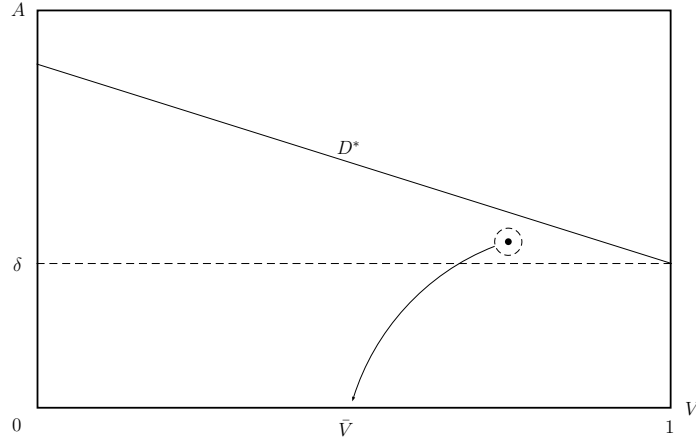
In addition, we claim that there is perpetual technological regress from an open set of initial conditions  $(\mathbf{q}, A(0))$  such that  $A(0) > \delta$  for any  $\Theta$  that supports demotivating beliefs. This would imply  $\Omega(\Theta) \subsetneq \Omega(\Theta^0)$ .

To establish the claim, plot the development barrier  $D^*$  as a function of  $V \equiv \sum_{i=1}^n q_i(1 - \theta_i)^2$  as in Figure B3. By (11),  $D^*$  is strictly decreasing in  $V$  on  $[0,1]$ . At  $V = 1$ ,  $D^* = \delta$ , as in the degenerate set of beliefs. We know from Proposition 1(i) that  $\mathbf{q}(t)$  converges to a state in which  $\lim_{t \rightarrow \infty} q_i(t) > 0$  for some  $\theta_i > 0$  as long as  $\theta_i < 2\sigma\alpha$ , i.e., in an environment that supports demotivating beliefs. Therefore,  $V(t)$  converges to some value denoted by  $\bar{V} < 1$  in an environment that supports demotivating beliefs.

Hence for  $A(0)$  close to but larger than  $\delta$  and  $V(0)$  close to but less than 1 (as shown in the figure),  $\frac{dA}{dt}|_{t=0} < 0$  and  $\frac{dV}{dt}|_{t=0} < 0$ , and the solution path never crosses the development barrier  $D^*$ . As shown in the figure, there exists an open set of such initial states. This establishes the claim and the proposition.  $\square$

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<sup>B1</sup>Note that  $\underline{A} > \delta$  is a trivial case, in which there is perpetual technological progress from every initial condition regardless of  $\theta$ .



**Figure B3:** Notional plot of two-dimensional system  $(V, A)$ , where  $D^*$  is the development barrier,  $\delta$  is the technology depreciation rate, and  $\bar{V}$  is the value of  $V$  under the limiting distribution of beliefs  $\lim_{t \rightarrow \infty} q(t)$ .

## Appendix C. Validation of the Zero-Sum Measures

### I. DRC Sample: Using Employment

As an additional test of the validity of survey-based perceptions of the zero-sumness of a person's world as a measure of  $\alpha$ , we examine the relationship between zero-sum perceptions and current and past employment history of a person and their family in the 200 person sample in the DRC. We check for this relationship by estimating the following equation:

$$\text{ZeroSum}_i = \alpha_{e(i)} + \beta \text{Employment}_i + \mathbf{X}_i \Gamma + \varepsilon_i \quad (\text{C12})$$

where  $i$  indexes individuals.  $\alpha_{e(i)}$  denotes ethnicity fixed effects. The vector  $\mathbf{X}_i$  includes demographic controls for age, age squared, a gender indicator, and its interaction with age and age squared.  $\text{Employment}_i$  is a categorical variable that takes on the following integer values for the employment status of individual  $i$  and/or his family: (1) fully unemployed, (2) farmer, or (3) formal paid employment.

Estimates of equation (C12) are reported in Table C1. Odd numbered columns report specifications without ethnicity fixed effects and even numbered columns include them. Columns 1–2 use the respondent's employment status, columns 3–4 use the respondent's mother's employment status, columns 5–6 use the respondent's father's employment status, columns 7–8 use a variable indicating whether the respondent had a job in the last five years and columns 9–10 use a variable indicating whether a member of the respondent's nuclear family had a job in the past 5 years.

**Table C1: Do Zero-Sum Perceptions Reflect Reality? The Influence of Economic Conditions**

	Dependent Variable: Zero-Sum Thinking, 0-1									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Respondent's employment status	-0.016 (0.014)	-0.014 (0.014)								
Mother's employment status			-0.033* (0.017)	-0.035** (0.018)						
Father's employment status					-0.052** (0.023)	-0.050** (0.023)				
Respondent had job in the last 5 years							-0.117** (0.039)	-0.095** (0.041)		
Member of nuclear family had job in last 5 years									-0.093** (0.032)	-0.073** (0.033)
Mean dependent variable	0.372	0.372	0.372	0.372	0.379	0.379	0.372	0.372	0.371	0.371
Std. dev. dependent variable	0.191	0.191	0.191	0.191	0.192	0.192	0.191	0.191	0.189	0.189
Mean independent variable	1.790	1.790	2.302	2.302	2.693	2.693	0.127	0.127	0.213	0.213
Std. dev. independent variable	0.970	0.970	0.771	0.771	0.602	0.602	0.334	0.334	0.410	0.410
Observations	205	205	205	205	176	176	205	205	202	202
R squared	0.013	0.104	0.023	0.118	0.028	0.131	0.046	0.125	0.046	0.121
Demographic Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Ethnicity FE	N	Y	N	Y	N	Y	N	Y	N	Y

*Notes:* This table examines the relationship between an individual's zero-sum setting in terms of their own and their nuclear family's employment indicators and their zero-sum perceptions, for the sample of about 200 respondents collected in 2015 in Kananga, DRC. In all columns, the dependent variable is the first principal component of the six zero-sum statements. All columns include demographic controls for age, age squared, and gender. In columns 1–2, the explanatory variable is a categorical variable indicating the respondent's employment status where 1= no form of employment, 2 = farmer, and 3 = formal employment. In columns 3–4, the explanatory variable is a categorical variable indicating the mother's employment status where 1= no form of employment, 2 = farmer, and 3 = formal employment. In columns 5–6, the explanatory variable is a categorical variable indicating the father's employment status where 1= no form of employment, 2 = farmer, and 3 = formal employment. In columns 7–8, the explanatory variable is a dummy indicating whether the respondent had a job in the past 5 years. In columns 9–10, the explanatory variable is a dummy indicating whether any member of the respondent's nuclear family had a job in the past 5 years. We include controls for gender, age, and age squared in all columns. Coefficients are reported with robust standard errors in parentheses. \*\*\*, \*\*, and \* indicate significance at the 1, 5, and 10 percent levels.

We find a consistent negative relationship between the economic conditions an individual faces in the first 20 or 30 years of their life and the extent to which they view the world as zero-sum today. Thus, consistent with expectations, worse economic conditions are associated with a more zero-sum view in adulthood.

## II. DRC Sample: Using Rainfall

As an additional test of the validity of survey-based perceptions of the zero-sumness of a person's world as a measure of  $\alpha$ , we examine the relationship between zero-sum perceptions and rainfall during the respondent's life in the 200-person sample in the DRC. We check for this relationship by estimating the following equation:

$$\text{Zero Sum}_{i,t} = \alpha_{t,g} + \alpha_t + \beta \text{Rainfall}_t + \mathbf{X}_{i,t}\boldsymbol{\Gamma} + \varepsilon_{i,t} \quad (\text{C13})$$

where  $i$  indexes individuals,  $g$  indexes gender, and  $t$  indexes person  $i$ 's year of birth. The variable  $\text{Rainfall}_t$  is the average annual rainfall (in mm) during the first 20 or 30 years of person  $i$ 's life given. If the measure of zero-sum captures reality, we expect to find a negative estimate of  $\beta$ : less rainfall should be associated with a more zero-sum view of the world.



**Table C2: Rainfall and Zero-Sum Perceptions**

	Dependent Variable: Zero-Sum Thinking, 0-1					
	(1)	(2)	(3)	(4)	(5)	(6)
Rainfall: First 20 years of life	-0.00525* (0.00295)		-0.00364* (0.00205)		-0.00273* (0.00164)	
Rainfall: First 30 years of life		-0.00569* (0.00289)		-0.00392* (0.00204)		-0.00400** (0.00173)
Mean dependent variable	0.377	0.377	0.377	0.377	0.377	0.377
Std. dev. dependent variable	0.192	0.192	0.192	0.192	0.192	0.192
Mean independent variable	122.542	121.907	122.542	121.907	122.542	121.907
Std. dev independent variable	10.16839	9.219	10.16839	9.219	10.16839	9.219
Observations	183	183	183	183	183	183
R squared	0.525	0.529	0.346	0.349	0.022	0.034
Number of clusters	169	169	169	169	169	169
Age	N	N	N	N	Y	Y
Gender	Y	Y	Y	Y	Y	Y
Birth year FE	Y	Y	Y	Y	N	N
Birth year FE and gender interaction	Y	Y	N	N	N	N

*Notes:* This table examines the relationship between an individual's zero-sum setting in terms of the mean rainfall in the first 20 and 30 years of their life and zero-sum perceptions, for the sample of about 200 respondents collected in 2015 in Kananga, DRC. In all columns, the dependent variable is the first principal component of the six zero-sum statements. Columns include birth-year fixed effects and its interaction with gender, demographic controls for age, age squared, and gender, and their interactions as indicated. In columns 1, 3, and 6, the explanatory variable is the mean rainfall in the respondent's village of origin in the first 20 years of their life. In columns 2, 4, and 6, the explanatory variable is the mean rainfall in the respondent's village of origin in the first 30 years of their life. Coefficients are reported with robust standard errors in parentheses. \*\*\*, \*\*, and \* indicate significance at the 1, 5, and 10 percent levels.

The vector  $\mathbf{X}_{i,t}$  includes the following controls: individual  $i$ 's age, age squared, an indicator for their gender, and this interacted with both age and age squared. All estimates are clustered at level of the interaction of the person's year of birth and geographic location (in terms of the 0.5x0.5 degree resolution grid cell they are located in).

Estimates of equation (C13) are reported in Table C2. Columns 1–2 use report estimates that control for birth-year fixed effects, birth-year fixed effects interacted with gender and gender fixed effects, columns 3–4 report estimates that control for birth-year fixed effects and gender. Columns 5–6 report estimates that control for the respondent's age, age squared, and gender.

### III. WVS Sample: Using Economic Growth

As an additional test of the validity of survey-based perceptions of the zero-sumness of a person's world as a measure of  $\alpha$ , we examine the relationship between zero-sum perceptions and recent economic growth among respondents in the WVS. We check for this relationship by estimating

the following equation:

$$\text{ZeroSum}_{i,c,v,t} = \alpha_{c,v} + \alpha_t + \beta \text{Growth}_{c,t} + \mathbf{X}_{i,c,v,t} \mathbf{\Gamma} + \varepsilon_{i,c,t} \quad (\text{C14})$$

where  $i$  indexes individuals,  $c$  indexes countries,  $v$  indexes survey waves, and  $t$  indexes person  $i$ 's year of birth. The variable  $\text{Growth}_{c,t}$  is the average annual growth rate of economic growth in country  $c$  during the first 20 or 30 years of person  $i$ 's life given. If the measure of zero-sum captures reality, we expect to find a negative estimate of  $\beta$ : weaker economic growth should be associated with a more zero-sum view of the world. The vector  $\mathbf{X}_{i,c,t}$  includes the following controls: individual  $i$ 's age, age squared, an indicator for their gender, and this interacted with both age and age squared. All estimates are clustered at the country level.

Estimates of equation (C14) are reported in Table C3. Columns 1–2 use total real GDP growth rates, while columns 3–4 use per capita real GDP growth rates. Columns 5–8 report estimates that control for subnational region fixed effects rather than country fixed effects.

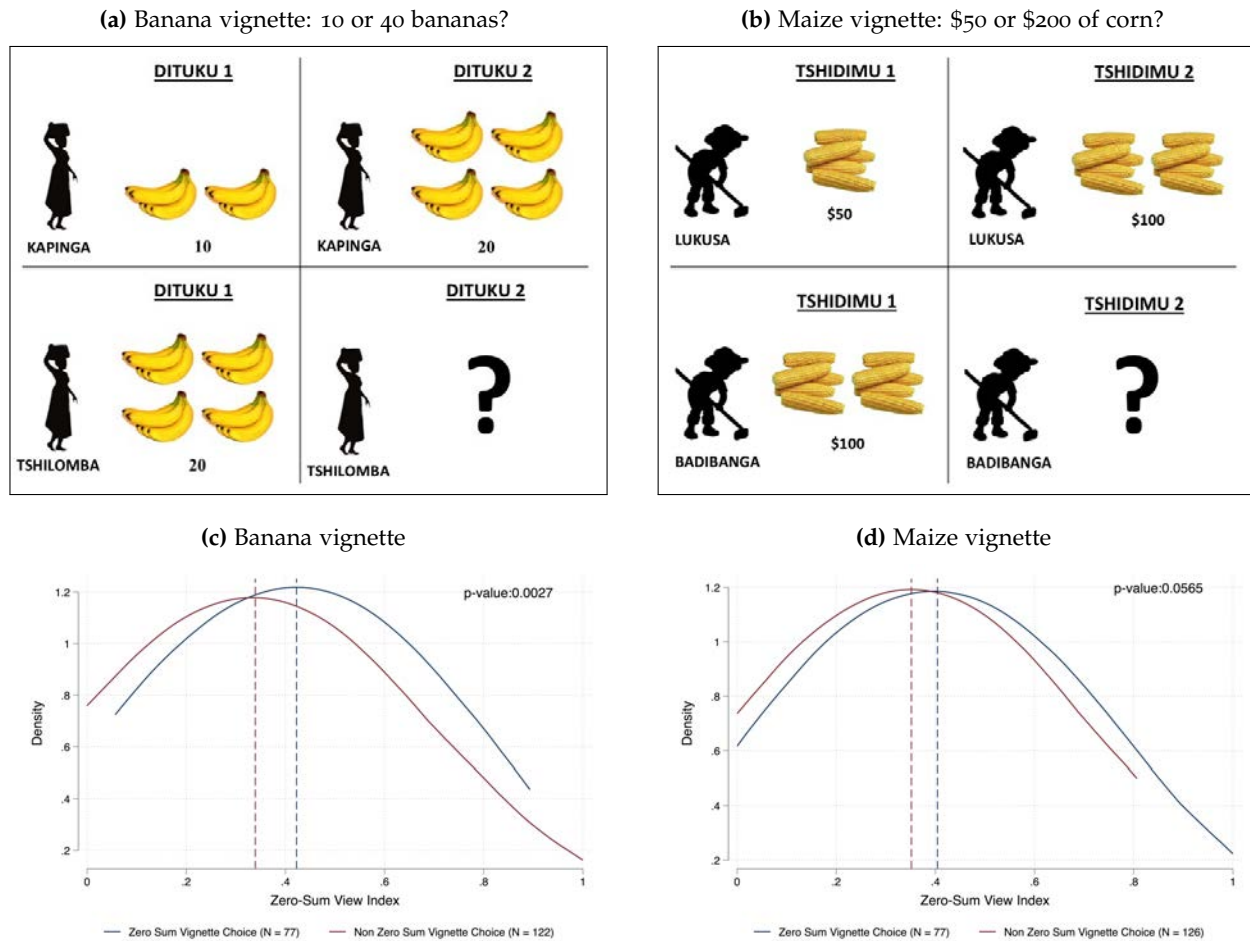
**Table C3: Economic Growth and Zero-Sum Perceptions**

Dependent Variable: Zero-Sum Thinking, 0-1				
	(1)	(2)	(3)	(4)
GDP 20 year growth	-0.383*** (0.106)			
GDP 30 year growth		-0.538** (0.241)		
GDP per capita 20 year growth			-0.429*** (0.105)	
GDP per capita 30 year growth				-0.611** (0.235)
Mean dependent variable	0.406	0.406	0.406	0.406
Std. dev. dependent variable	0.305	0.305	0.305	0.305
Mean independent variable	0.038	0.038	0.020	0.021
Std. dev. independent variable	0.022	0.019	0.021	0.018
Observations	102,234	95,368	102,175	95,368
R squared	0.084	0.085	0.084	0.085
Number of clusters/countries	74	70	74	70
Demographic Controls	Y	Y	Y	Y
Wave-country FE	Y	Y	Y	Y
Birth-year FE	Y	Y	Y	Y

*Notes:* The table reports OLS estimates. An observation is an individual, weighted to make the sample nationally representative. All specifications include demographic controls (age, age squared, and their interactions with a gender indicator), wave-country fixed effects, and birth-year fixed effects. The dependent variable is our measure of zero-sum perceptions based on the question that asks respondents to choose a point on a scale between "People can only get rich at the expense of others" and zero representing "Wealth can grow so there's enough for everyone." GDP growth rates are the GDP growth for the first 20 (or 30 years) of a respondent's life. Coefficients are reported with standard errors clustered at the country-level in parentheses. \*\*\*, \*\*, and \* indicate significance at the 1, 5, and 10 percent levels.

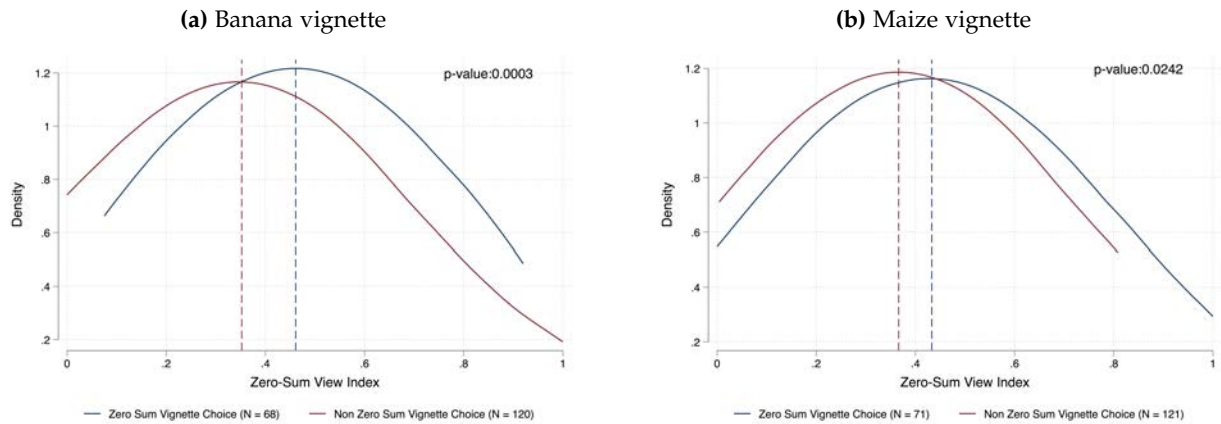
## Appendix D. Additional Figures and Tables

**Figure D4:** Zero-Sum Index of Six Survey Questions and Zero-Sum Choice in the Banana and Maize Vignettes



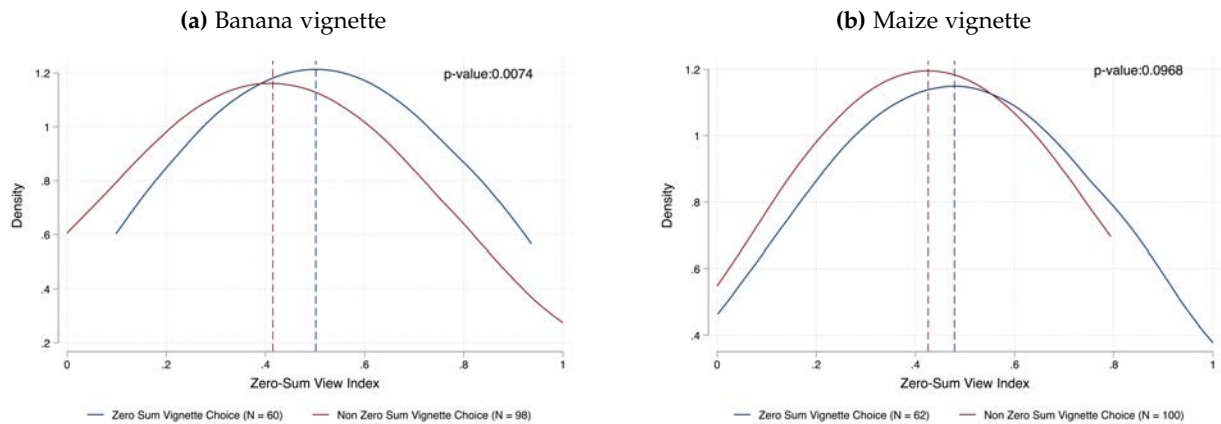
*Notes:* This figure reports the images provided to the respondents to illustrate the banana (in panel (a)) and maize (in panel (b)) vignette questions. It reports the distribution of the zero-sum view index, constructed as the first principal component of the six zero-sum statements, by respondents' choice in the vignette questions (in panels (c) and (d)). Specifically, it reports the Kernel Density of the zero-sum view index when the zero-sum answer is chosen in the vignette question (in blue) and when the non-zero-sum answer is chosen in the vignette question (in dark red). Panel (c) reports results for the banana vignette, and panel (d) for the maize vignette. The Kernel densities use the default Epanechnikov kernel and bandwidth. Both panels report the  $p$ -value associated with the t-test of equality of the zero-sum view index for respondents who chose the zero-sum response and those who chose the non-zero-sum response.

**Figure D5:** Zero-Sum Index of Ten Survey Questions and Zero-Sum Choice in the Banana and Maize Vignettes



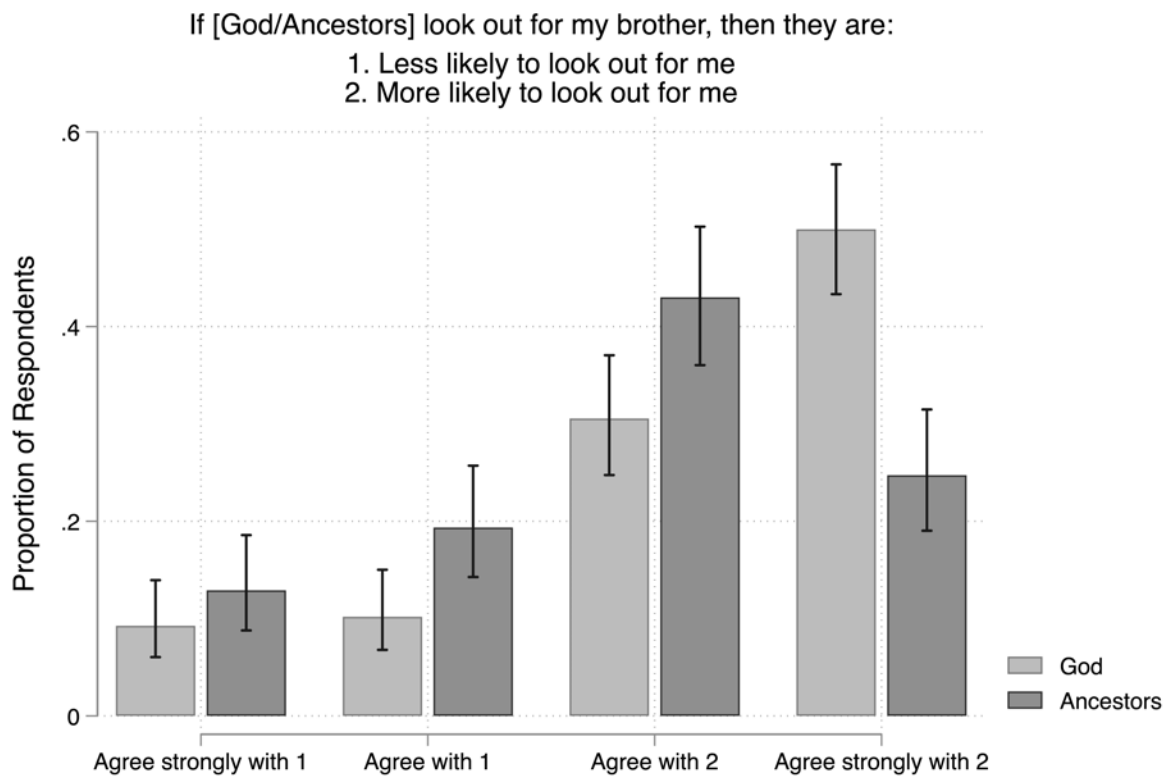
*Notes:* This figure reports the distribution of the zero-sum view index constructed as the first principal component of the ten zero-sum statements described in Section 4.B, by respondents' choice in the vignette questions. Specifically, it reports the Kernel Density of this zero-sum view index when the zero-sum answer is chosen in the vignette question (in blue) and when the non-zero-sum answer is chosen in the vignette question (in dark red). Panel (a) reports results for the banana vignette, and panel (b) for the maize vignette. The Kernel densities use the default Epanechnikov kernel and bandwidth. Both panels report the  $p$ -value associated with the  $t$ -test of equality of the zero-sum view index for respondents who chose the zero-sum response and those who chose the non-zero-sum response.

**Figure D6:** Zero-Sum Index of Twelve Survey Questions and Zero-Sum Choice in the Banana and Maize Vignettes



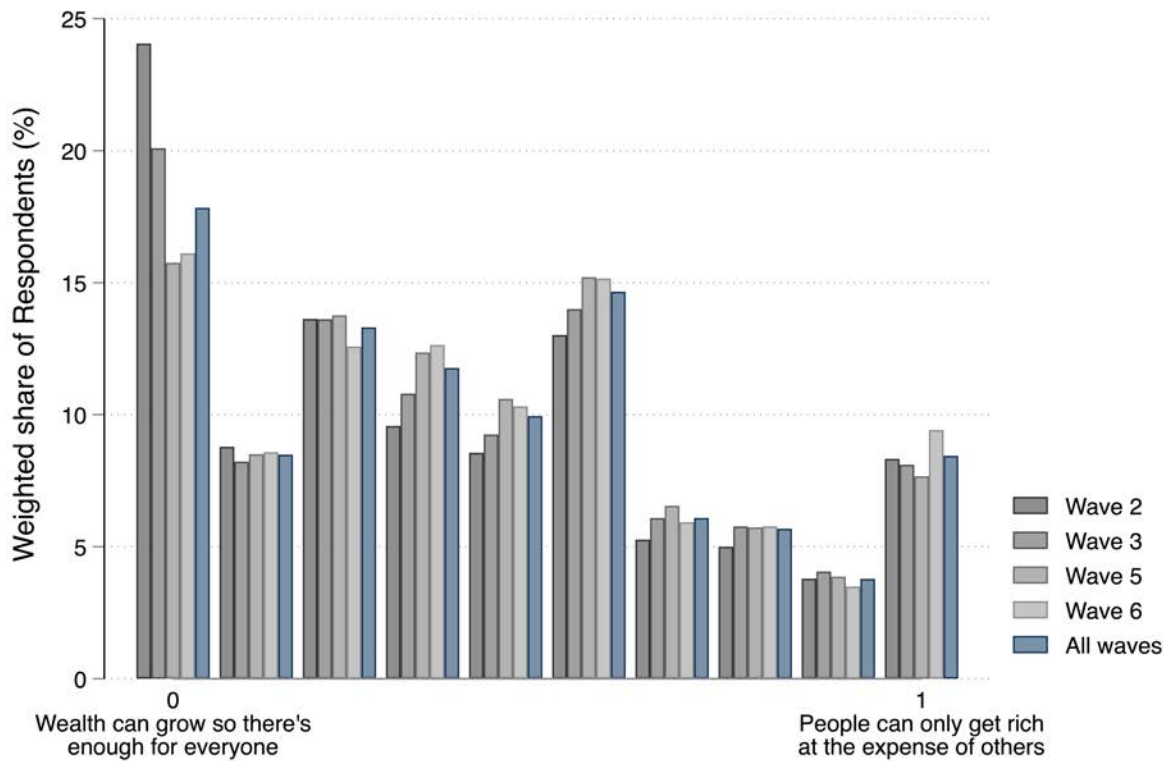
*Notes:* This figure reports the distribution of the zero-sum view index constructed as the first principal component of the twelve zero-sum statements described in Section 4.B, by respondents' choice in the vignette questions. Specifically, it reports the Kernel Density of this zero-sum view index when the zero-sum answer is chosen in the vignette question (in blue) and when the non-zero-sum answer is chosen in the vignette question (in dark red). Panel (a) reports results for the banana vignette, and panel (b) for the maize vignette. The Kernel densities use the default Epanechnikov kernel and bandwidth. Both panels report the  $p$ -value associated with the  $t$ -test of equality of the zero-sum view index for respondents who chose the zero-sum response and those who chose the non-zero-sum response.

**Figure D7:** Traditional Religion, Christianity, and Zero-Sum: 200 Person Sample



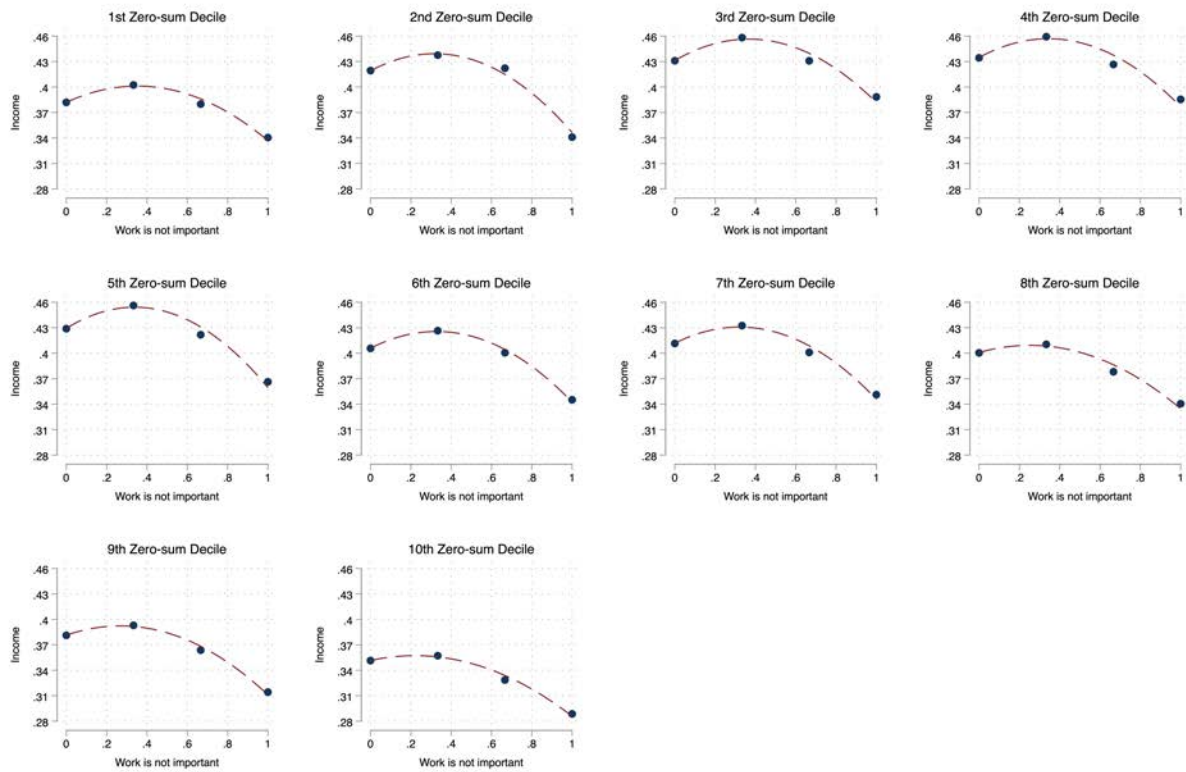
*Notes:* The figure reports the proportion of the responses to two questions which have the same structure. The questions ask “If [God/Ancestors] look out for me brother, then: they are less likely to look out for me (Statement 1), or they are more likely to look out for me (Statement 2).” Individuals could choose which statement they agreed with most and how strongly they agreed with that statement. The light gray bars correspond to the version of the question that asks about the Christian God, and the dark gray bars to the version of the question that asks about ancestors. The black lines show the 95% confidence intervals for each of the responses.

**Figure D8: Distribution of the Zero-Sum Measure in the WVS**



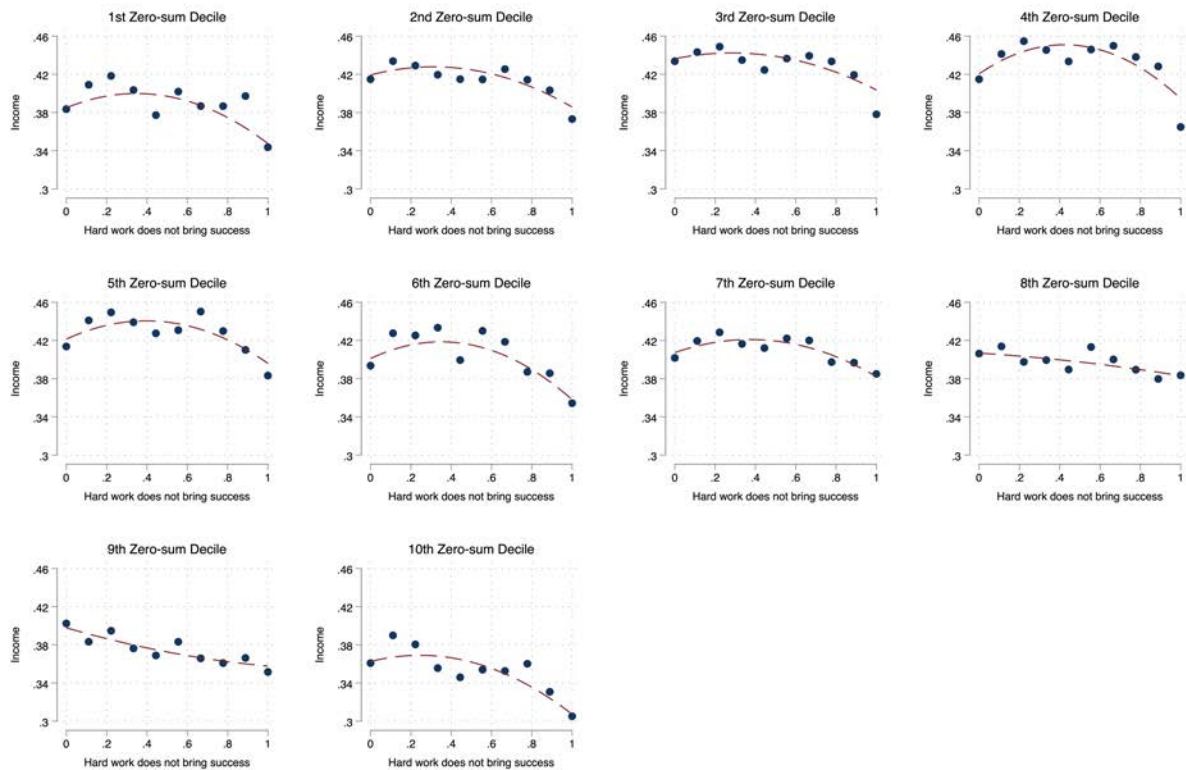
*Notes:* The figure reports the distribution of respondent answers for each of the four waves of the WVS, and for the aggregate sample. The figures reports a weighted share of respondent answers across waves 2, 3, 5, and 6 of the WVS for a zero-sum measure where zero indicates respondents fully agreed with the statement “Wealth can grow so there’s enough for everyone” and one indicates respondents fully agreed with the statement “People can only get rich at the expense of others.”

**Figure D9:** Relationship Between Demotivating Beliefs and Income – Holding Constant Zero-Sumness and Without Demographic Controls and Country-Wave Fixed Effects



*Notes:* The figure reports the relationship between respondents' demotivating beliefs and level of income for each zero-sum decile. The demotivating belief in this figure is reported based on respondents' answers to the question (with work being the aspect respondents were asked the question about) "For each of the following, indicate how important it is in your life. Would you say it is," with options "1 Very important, 2 Rather important, 3 Not very important, 4 Not at all important." These responses are reverse scored to achieve the demotivating belief used in the figure "Work is not important at all." (N = 224,534)

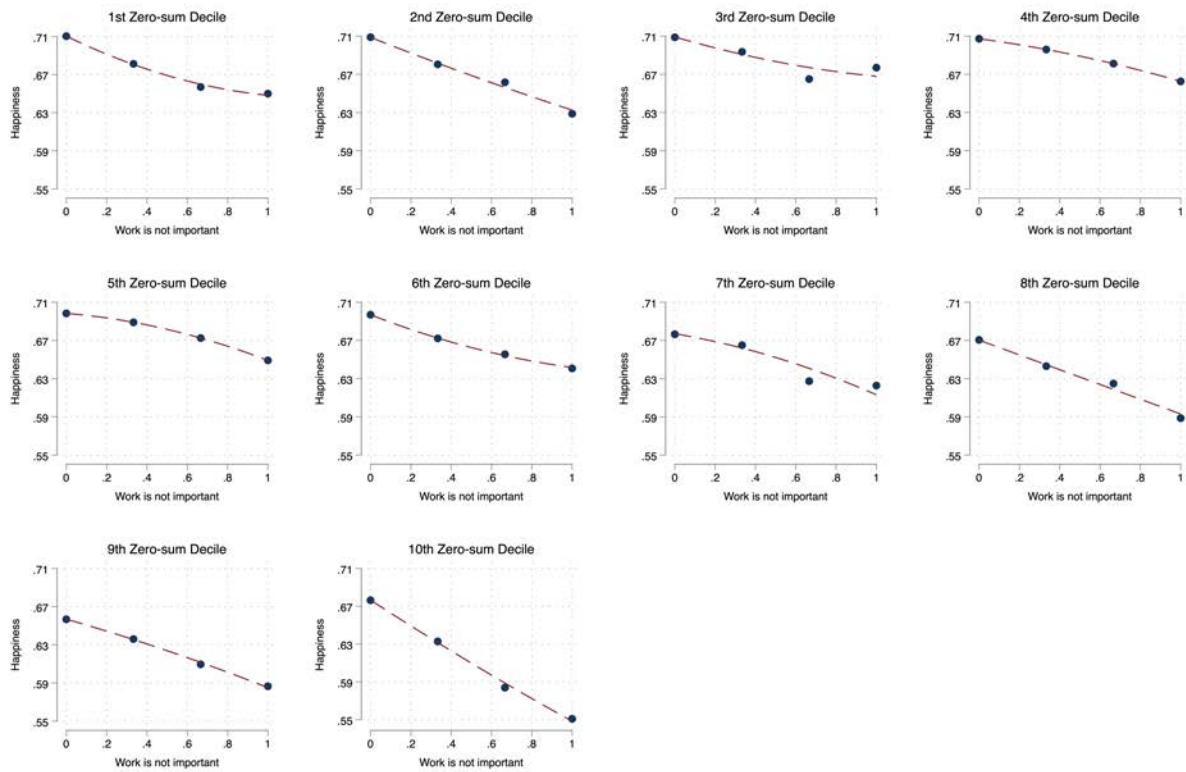
**Figure D10:** Relationship Between Demotivating Beliefs and Income – Holding Constant Zero-Sumness and Without Demographic Controls and Country-Wave Fixed Effects



*Notes:* The figure reports the relationship between respondents' demotivating beliefs and level of income for each zero-sum decile. The demotivating belief in this figure is reported based on how much respondents agreed with the statement "In the long run, hard work usually brings a better life" on a scale of one to ten, with one indicating complete agreement with the statement and ten indicating "Hard work doesn't generally bring success—it's more a matter of luck and connections." These responses are reverse scored to achieve the demotivating belief used in the figure "Hard work does not bring success." (N = 228,356)

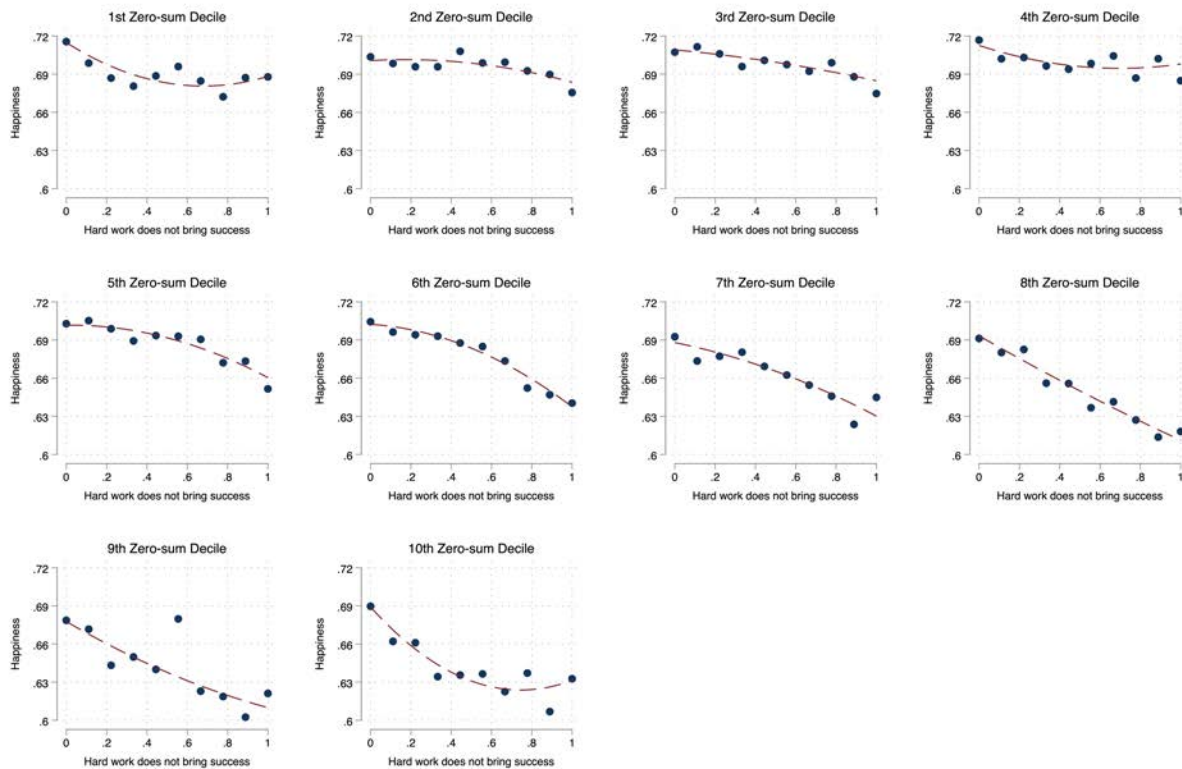


**Figure D11:** Relationship Between Demotivating Beliefs and Happiness – Holding Constant Zero-Sumness and Without Demographic Controls and Country-Wave Fixed Effects



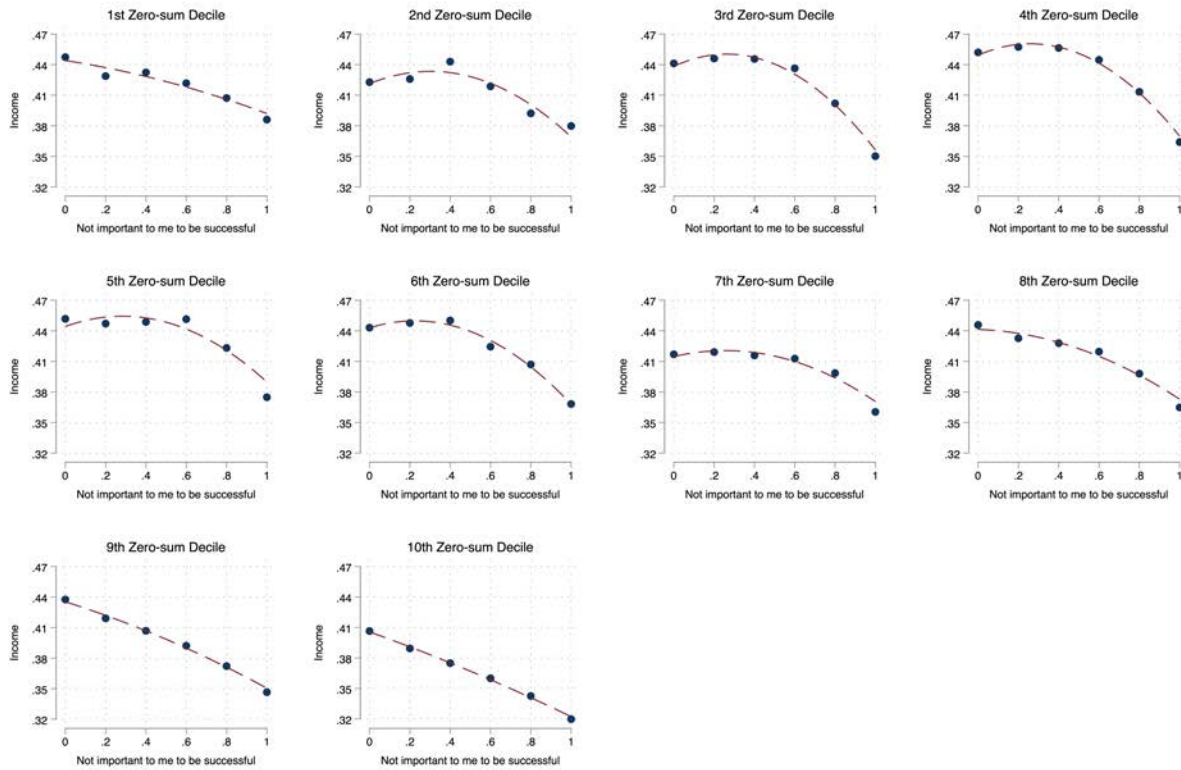
*Notes:* The figure reports the relationship between respondents' demotivating beliefs and level of happiness for each zero-sum decile. The demotivating belief in this figure is reported based on respondents' answers to the question (with work being the aspect respondents were asked the question about) "For each of the following, indicate how important it is in your life. Would you say it is," with options "1 Very important, 2 Rather important, 3 Not very important, 4 Not at all important." These responses are reverse scored to achieve the demotivating belief used in the figure "Work is not important at all." (N = 240,544)

**Figure D12:** Relationship Between Demotivating Beliefs and Happiness – Holding Constant Zero-Sumness and Without Demographic Controls and Country-Wave Fixed Effects



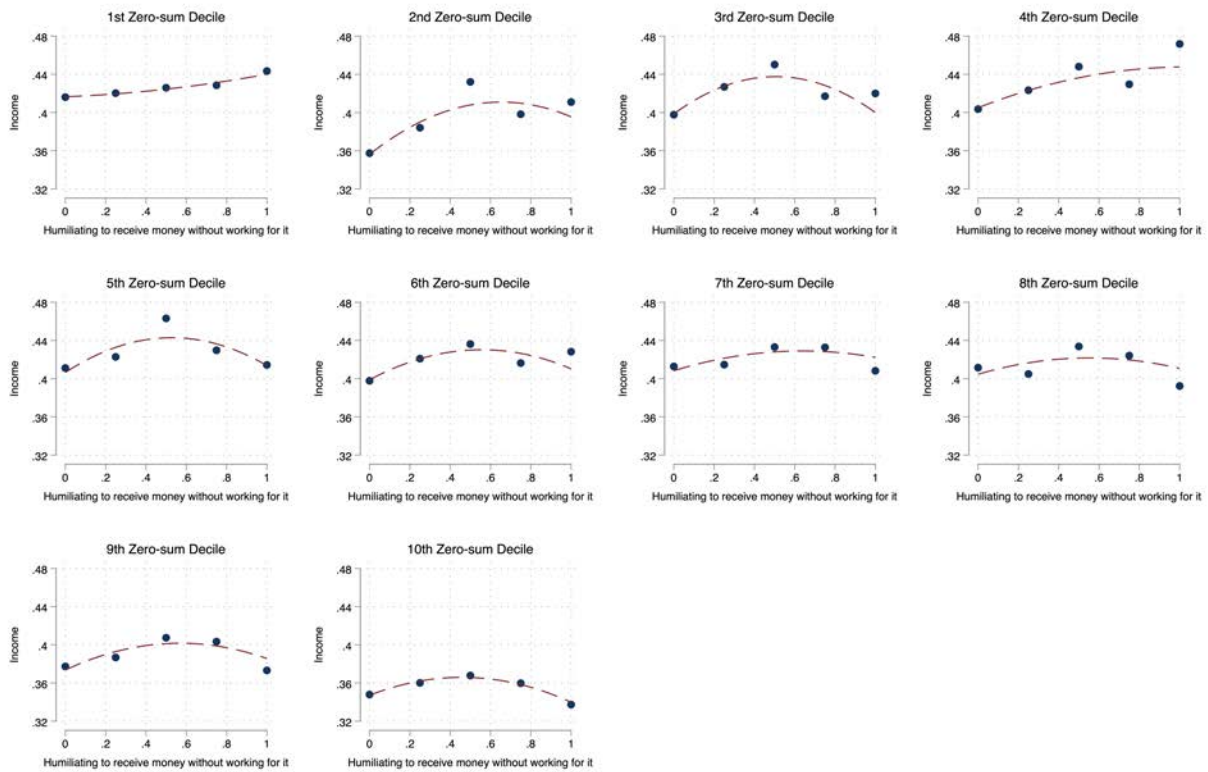
*Notes:* The figure reports the relationship between respondents' demotivating beliefs and level of happiness for each zero-sum decile. Country-wave fixed effects and demographic controls are netted out before creating the zero-sum deciles. The demotivating belief in this figure is reported based on how much respondents agreed with the statement "In the long run, hard work usually brings a better life" on a scale of one to ten, with one indicating complete agreement with the statement and ten indicating "Hard work doesn't generally bring success – it's more a matter of luck and connections." These responses are reverse scored to achieve the demotivating belief used in the figure "Hard work does not bring success." (N = 244,611)

**Figure D13:** Relationship Between Demotivating Beliefs and Income – Holding Constant Zero-Sumness



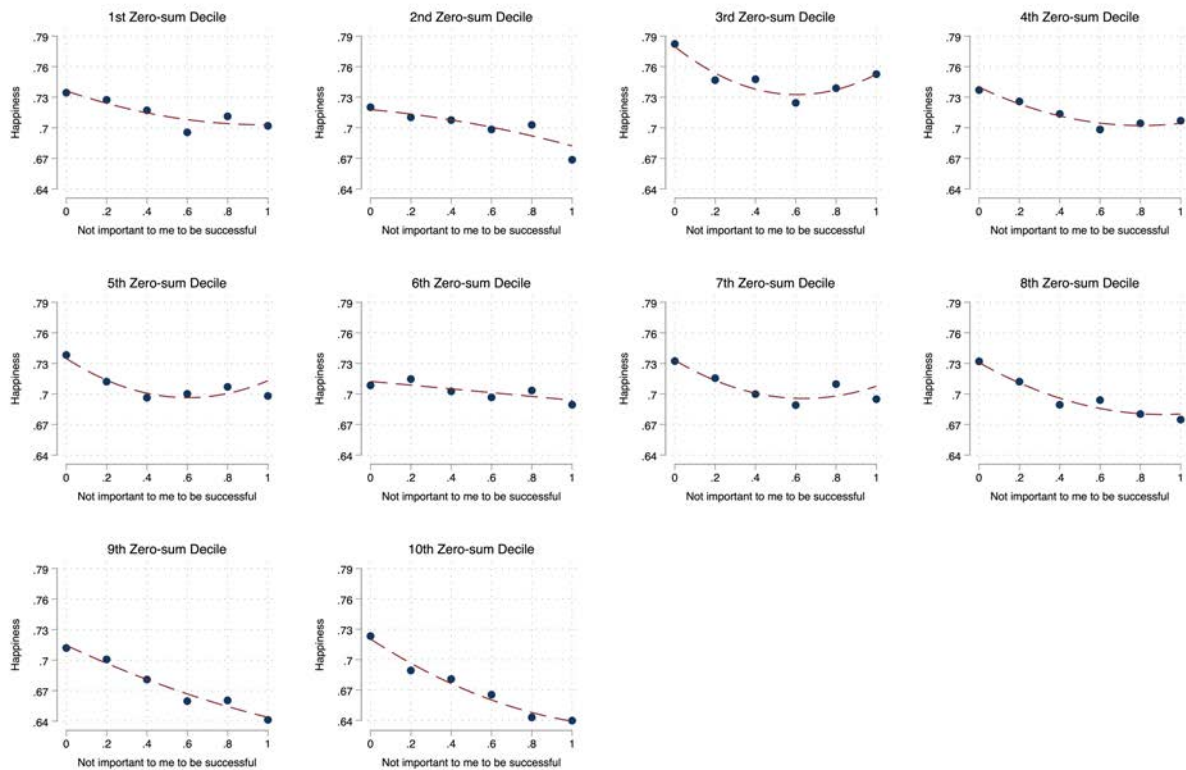
*Notes:* The figure reports the relationship between respondents' demotivating beliefs and level of income for each zero-sum decile. Country-wave fixed effects and demographic controls are netted out before creating the zero-sum deciles. The demotivating belief in this figure is reported based on respondents' answers to how they would describe themselves in relation to the statement "Being very successful is important to this person; to have people recognize one's achievements." on a scale of "1 Very much like me" to "6 Not at all like me." These responses are reverse scored to achieve the demotivating belief used in the figure "Not at all important to me to be successful." (N =144,233)

**Figure D14:** Relationship Between Demotivating Beliefs and Income – Holding Constant Zero-Sumness



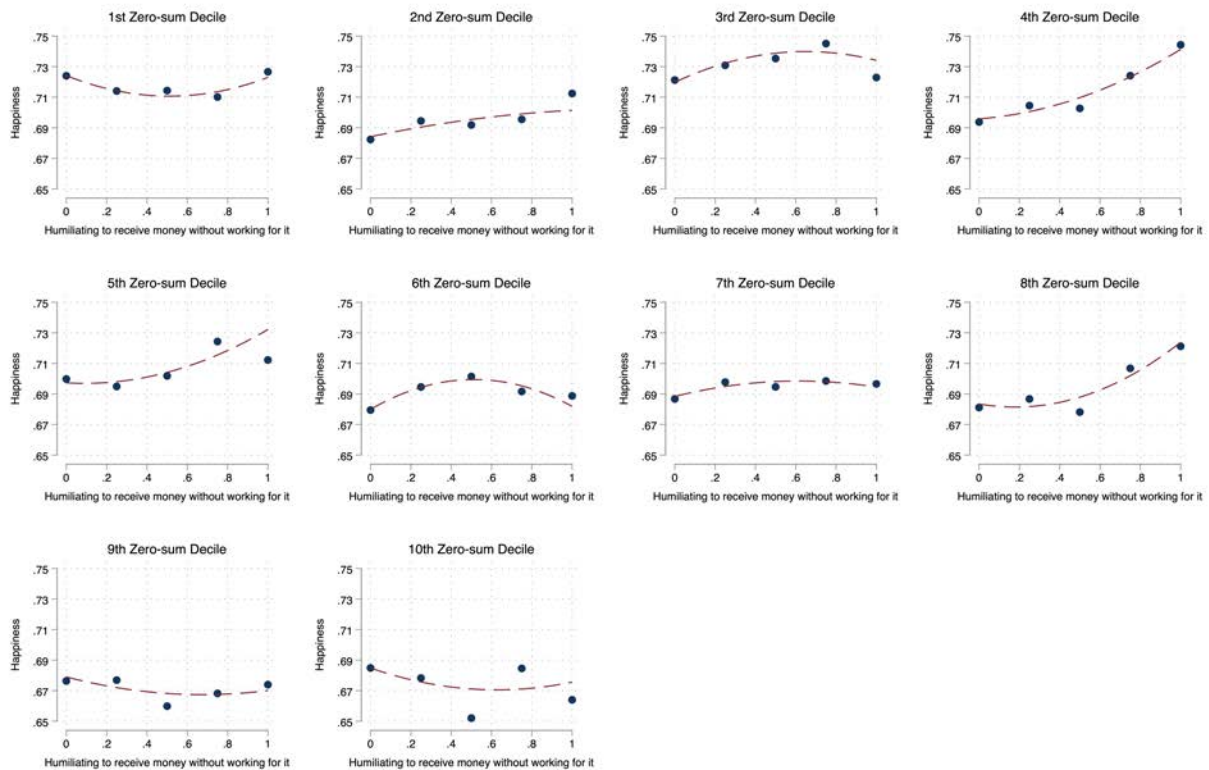
*Notes:* The figure reports the relationship between respondents' demotivating beliefs and level of income for each zero-sum decile. Country-wave fixed effects and demographic controls are netted out before creating the zero-sum deciles. The demotivating belief in this figure is reported based on how much respondents agree with the statement "It is humiliating to receive money without working for it" with one indicating "Strongly agree" and five indicating "Strongly disagree." These responses are reverse scored to achieve the demotivating belief used in the figure "Humiliating to receive money without working for it." (N = 56,467)

**Figure D15:** Relationship Between Demotivating Beliefs and Happiness – Holding Constant Zero-Sumness



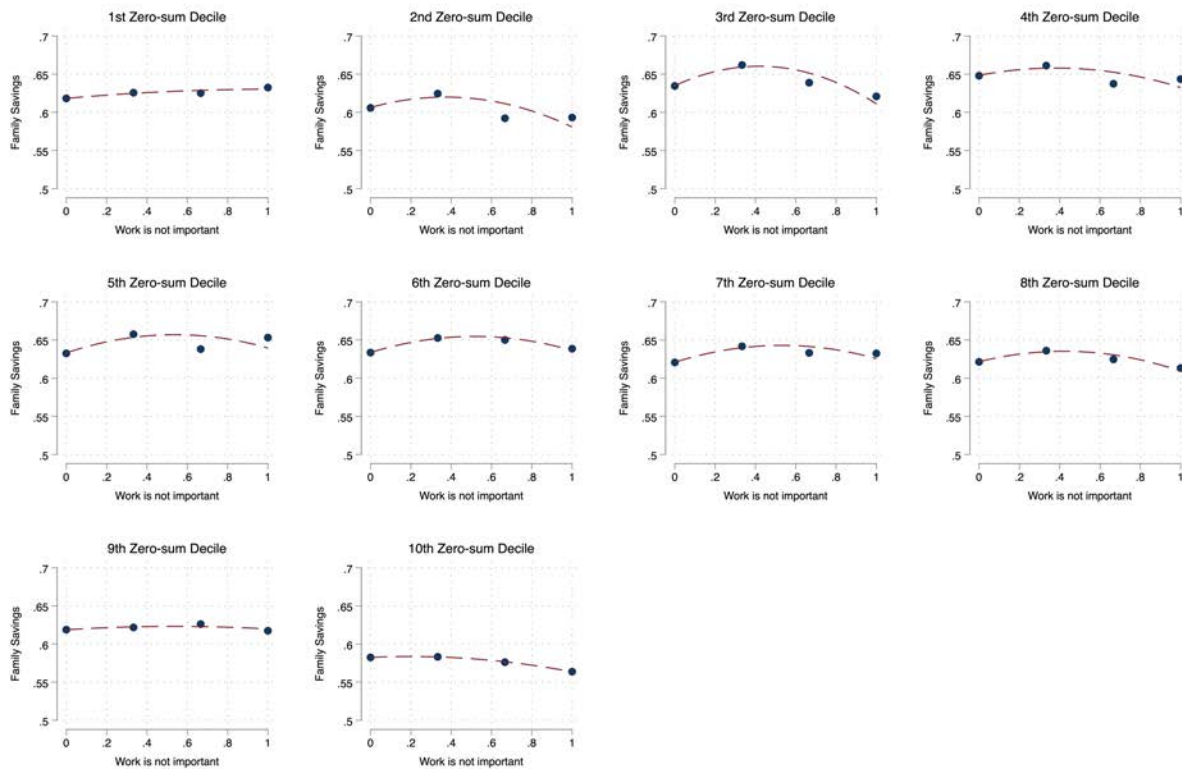
*Notes:* The figure reports the relationship between respondents' demotivating beliefs and level of happiness for each zero-sum decile. Country-wave fixed effects and demographic controls are netted out before creating the zero-sum deciles. The demotivating belief in this figure is reported based on respondents' answers to how they would describe themselves in relation to the statement "Being very successful is important to this person; to have people recognize one's achievements." on a scale of "1 Very much like me" to "6 Not at all like me." These responses are reverse scored to achieve the demotivating belief used in the figure "Not at all important to me to be successful." (N = 150,538)

**Figure D16:** Relationship Between Demotivating Beliefs and Happiness – Holding Constant Zero-Sumness



*Notes:* The figure reports the relationship between respondents' demotivating beliefs and level of happiness for each zero-sum decile. Country-wave fixed effects and demographic controls are netted out before creating the zero-sum deciles. The demotivating belief in this figure is reported based on how much respondents agree with the statement "It is humiliating to receive money without working for it" with one indicating "Strongly agree" and five indicating "Strongly disagree." These responses are reverse scored to achieve the demotivating belief used in the figure "Humiliating to receive money without working for it." (N = 60,553)

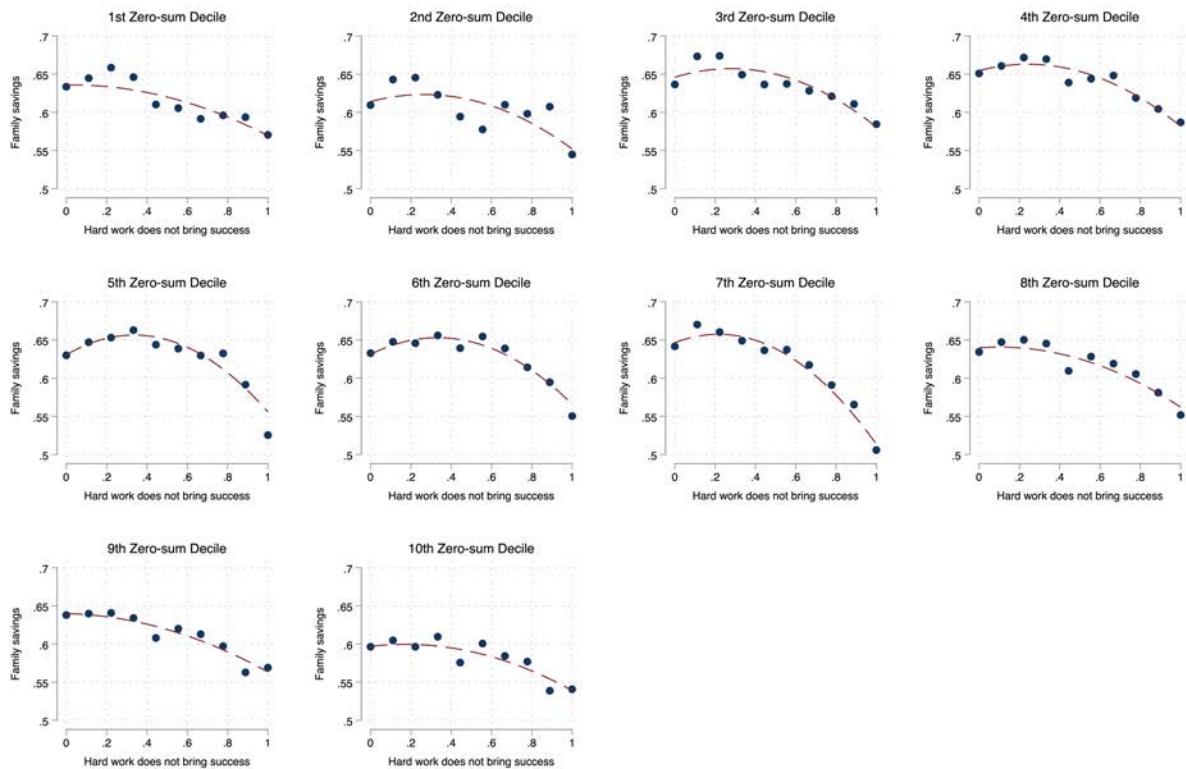
**Figure D17:** Relationship Between Demotivating Beliefs and Family Savings – Holding Constant Zero-Sum Perceptions



*Notes:* The figure reports the relationship between respondents' demotivating beliefs and family savings for each zero-sum decile. Country-wave fixed effects and demographic controls are netted out before creating the zero-sum deciles. The demotivating belief in this figure is reported based on respondents' answers to the question (with work being the aspect respondents were asked the question about) "For each of the following, indicate how important it is in your life. Would you say it is," with options "1 Very important, 2 Rather important, 3 Not very important, 4 Not at all important." These responses are reversed so the variable is increasing in the demotivating belief "Work is not important at all." ( $N = 198,261$ )



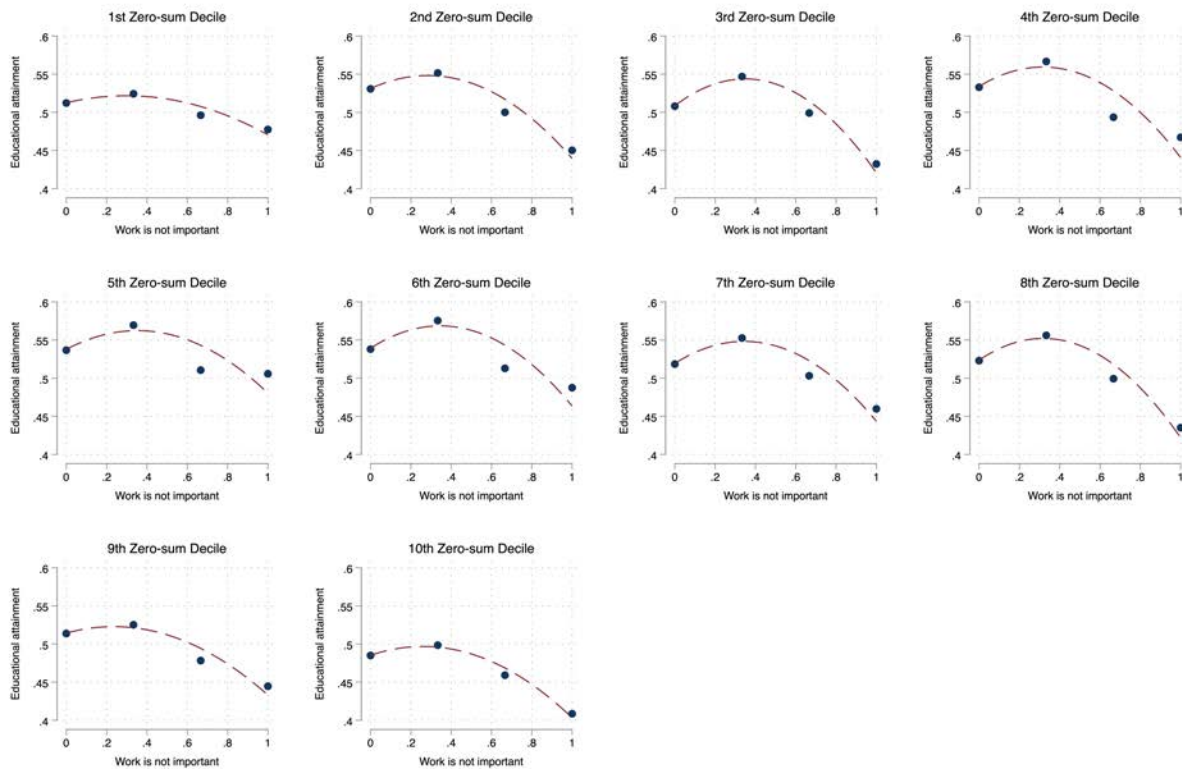
**Figure D18:** Relationship Between Demotivating Beliefs and Family Savings – Holding Constant Zero-Sum Perceptions



*Notes:* The figure reports the relationship between respondents' demotivating beliefs and family savings for each zero-sum decile. Country-wave fixed effects and demographic controls are netted out before creating the zero-sum deciles. The demotivating belief in this figure is reported based on how much respondents agreed with the statement "In the long run, hard work usually brings a better life" on a scale of one to ten, with one indicating complete agreement with the statement and ten indicating "Hard work doesn't generally bring success—it's more a matter of luck and connections." These responses are reversed so the variable is increasing in the demotivating belief "Hard work does not bring success." ( $N = 202,014$ )

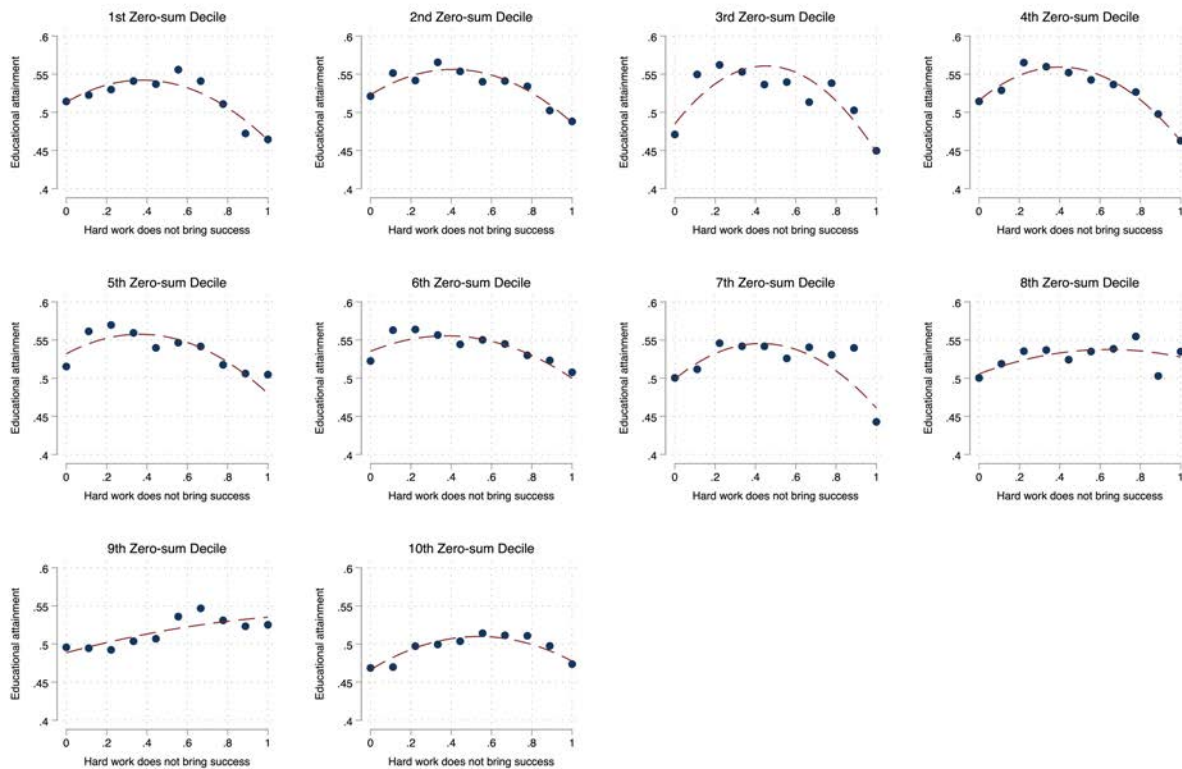


**Figure D19:** Relationship Between Demotivating Beliefs and Educational Attainment – Holding Constant Zero-Sum Perceptions



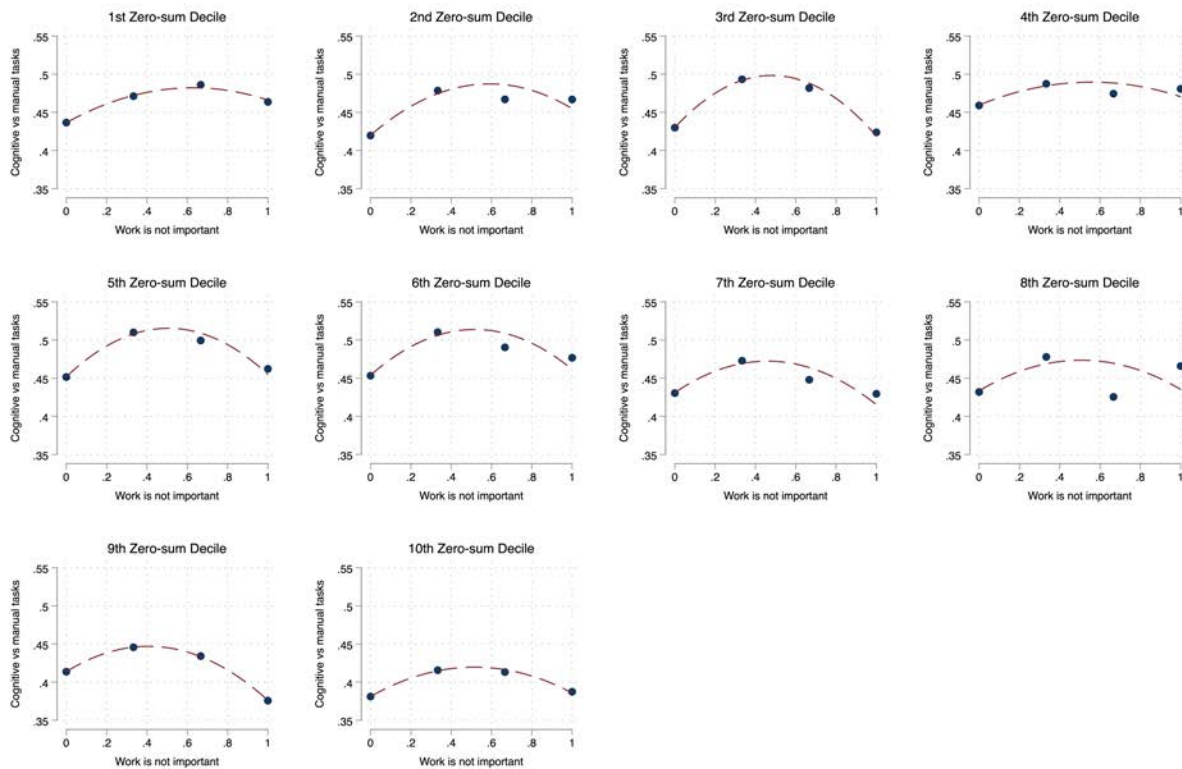
*Notes:* The figure reports the relationship between respondents' demotivating beliefs and educational attainment for each zero-sum decile. Country-wave fixed effects and demographic controls are netted out before creating the zero-sum deciles. The demotivating belief in this figure is reported based on respondents' answers to the question (with work being the aspect respondents were asked the question about) "For each of the following, indicate how important it is in your life. Would you say it is," with options "1 Very important, 2 Rather important, 3 Not very important, 4 Not at all important." These responses are reversed so the variable is increasing in the demotivating belief "Work is not important at all." ( $N = 213,755$ )

**Figure D20:** Relationship Between Demotivating Beliefs and Educational Attainment – Holding Constant Zero-Sum Perceptions



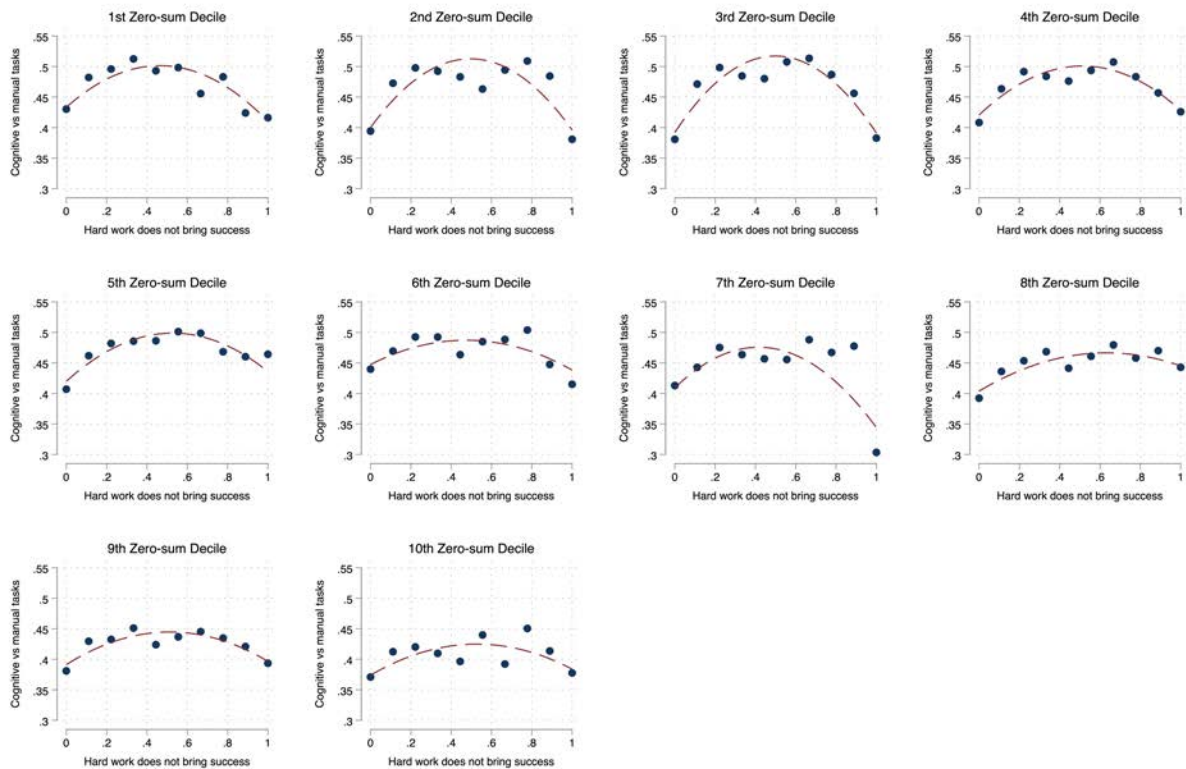
*Notes:* The figure reports the relationship between respondents' demotivating beliefs and educational attainment for each zero-sum decile. Country-wave fixed effects and demographic controls are netted out before creating the zero-sum deciles. The demotivating belief in this figure is reported based on how much respondents agreed with the statement "In the long run, hard work usually brings a better life" on a scale of one to ten, with one indicating complete agreement with the statement and ten indicating "Hard work doesn't generally bring success—it's more a matter of luck and connections." These responses are reversed so the variable is increasing in the demotivating belief "Hard work does not bring success." ( $N = 217,682$ )

**Figure D21:** Relationship Between Demotivating Beliefs and Manual vs. Cognitive Tasks – Holding Constant Zero-Sum Perceptions



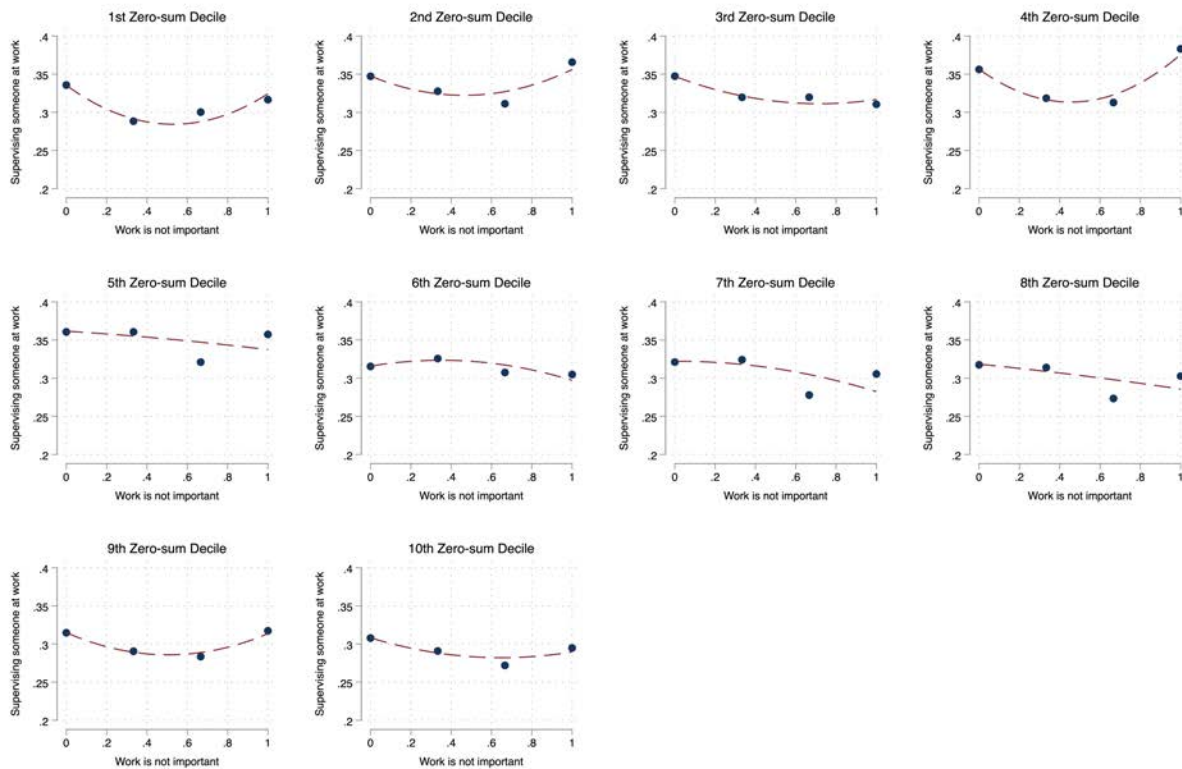
*Notes:* The figure reports the relationship between respondents' demotivating beliefs and manual vs. cognitive tasks for each zero-sum decile. Country-wave fixed effects and demographic controls are netted out before creating the zero-sum deciles. The demotivating belief in this figure is reported based on respondents' answer to the question (with work being the aspect respondents were asked the question about) "For each of the following, indicate how important it is in your life. Would you say it is," with options "1 Very important, 2 Rather important, 3 Not very important, 4 Not at all important." These responses are reversed so the variable is increasing in the demotivating belief "Work is not important at all." ( $N = 115,441$ )

**Figure D22:** Relationship Between Demotivating Beliefs and Manual vs. Cognitive Tasks – Holding Constant Zero-Sum Perceptions



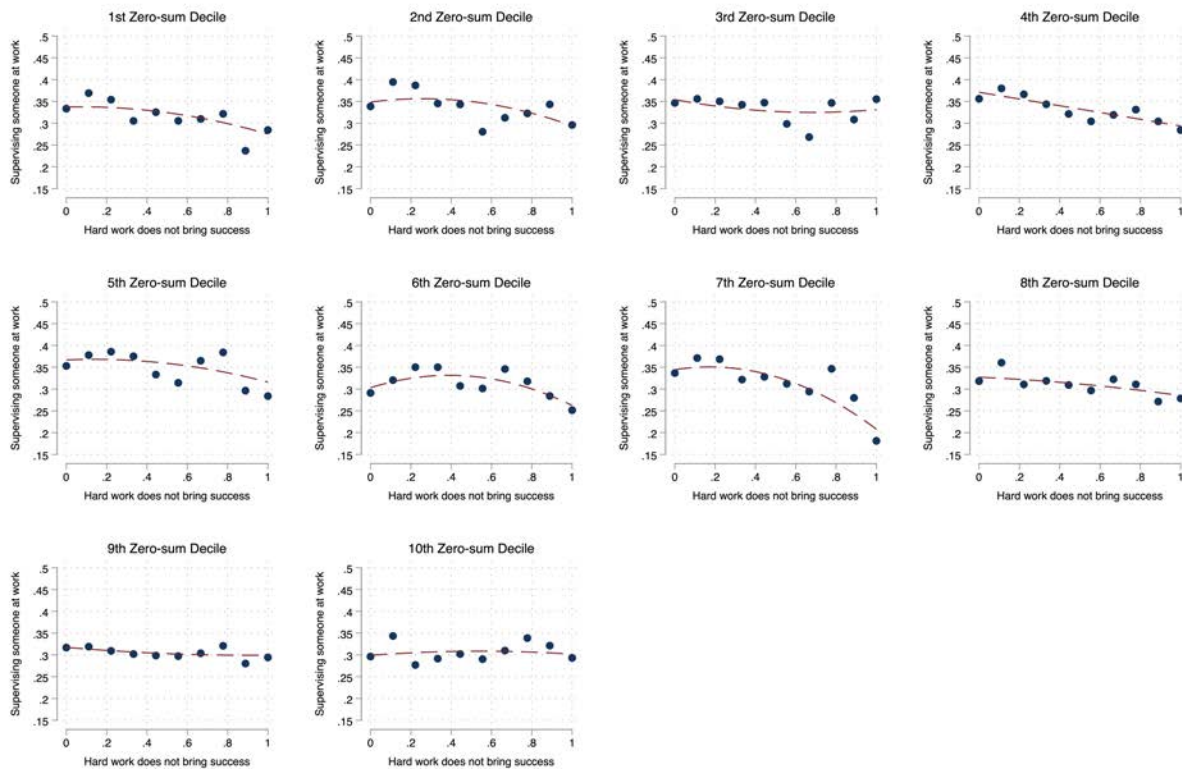
*Notes:* The figure reports the relationship between respondents' demotivating beliefs and manual vs. cognitive tasks for each zero-sum decile. Country-wave fixed effects and demographic controls are netted out before creating the zero-sum deciles. The demotivating belief in this figure is reported based on how much respondents agreed with the statement "In the long run, hard work usually brings a better life" on a scale of one to ten, with one indicating complete agreement with the statement and ten indicating "Hard work doesn't generally bring success—it's more a matter of luck and connections." These responses are reversed so the variable is increasing in the demotivating belief "Hard work does not bring success." ( $N = 116,120$ )

**Figure D23:** Relationship Between Demotivating Beliefs and Supervising Someone at Work – Holding Constant Zero-Sum Perceptions



*Notes:* The figure reports the relationship between respondents' demotivating beliefs and supervising someone at work for each zero-sum decile. Country-wave fixed effects and demographic controls are netted out before creating the zero-sum deciles. The demotivating belief in this figure is reported based on respondents' answers to the question (with work being the aspect respondents were asked the question about) "For each of the following, indicate how important it is in your life. Would you say it is," with options "1 Very important, 2 Rather important, 3 Not very important, 4 Not at all important." These responses are reversed so the variable is increasing in the demotivating belief "Work is not important at all." ( $N = 118,320$ )

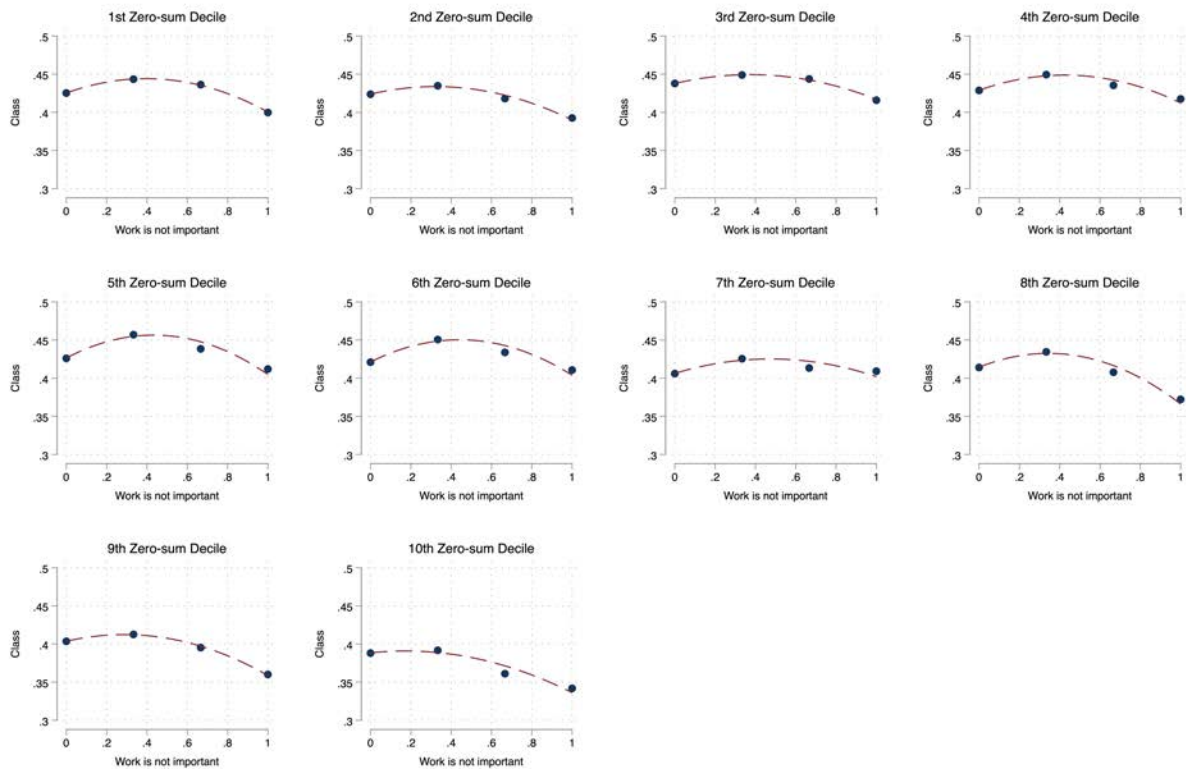
**Figure D24:** Relationship Between Demotivating Beliefs and Supervising Someone at Work – Holding Constant Zero-Sum Perceptions



*Notes:* The figure reports the relationship between respondents' demotivating beliefs and supervising someone at work for each zero-sum decile. Country-wave fixed effects and demographic controls are netted out before creating the zero-sum deciles. The demotivating belief in this figure is reported based on how much respondents agreed with the statement "In the long run, hard work usually brings a better life" on a scale of one to ten, with one indicating complete agreement with the statement and ten indicating "Hard work doesn't generally bring success—it's more a matter of luck and connections." These responses are reversed so the variable is increasing in the demotivating belief "Hard work does not bring success." ( $N = 119,068$ )

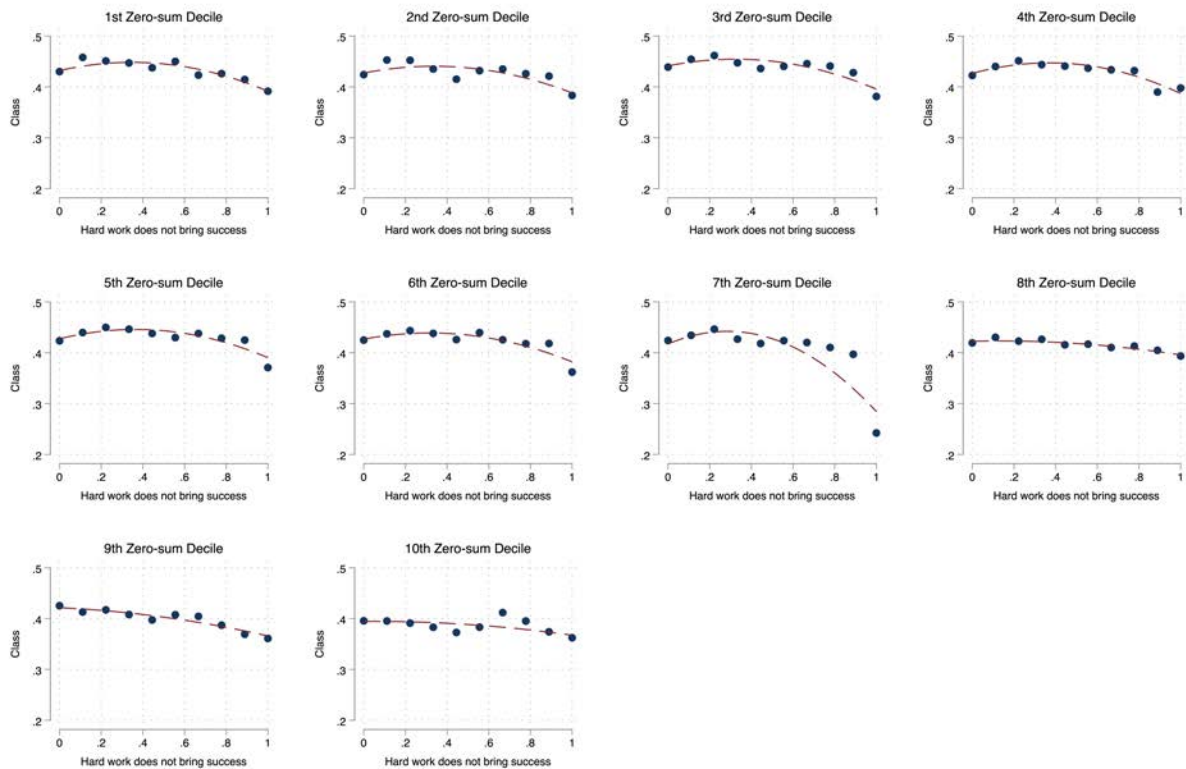


**Figure D25:** Relationship Between Demotivating Beliefs and Socioeconomic Class – Holding Constant Zero-Sum Perceptions



*Notes:* The figure reports the relationship between respondents' demotivating beliefs and their socioeconomic class for each zero-sum decile. Country-wave fixed effects and demographic controls are netted out before creating the zero-sum deciles. The demotivating belief in this figure is reported based on respondents' answers to the question (with work being the aspect respondents were asked the question about) "For each of the following, indicate how important it is in your life. Would you say it is," with options "1 Very important, 2 Rather important, 3 Not very important, 4 Not at all important." These responses are reversed so the variable is increasing in the demotivating belief "Work is not important at all." ( $N = 204,577$ )

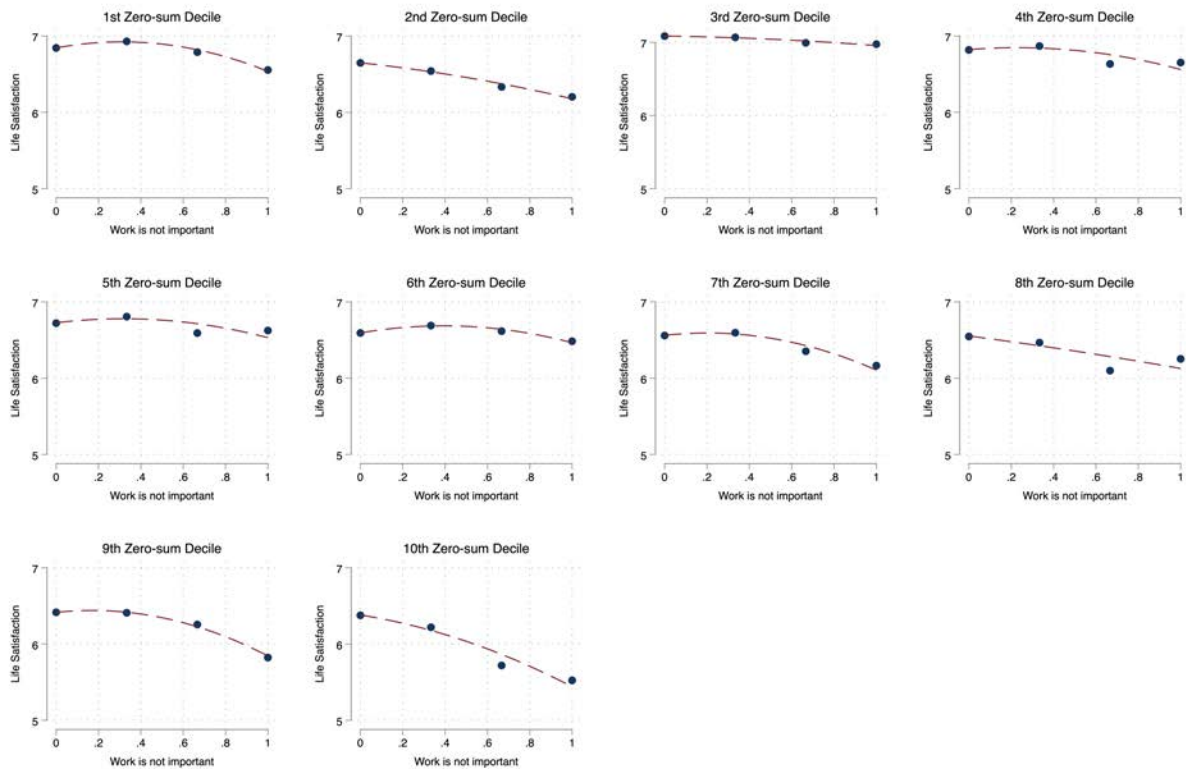
**Figure D26:** Relationship Between Demotivating Beliefs and Socioeconomic Class – Holding Constant Zero-Sum Perceptions



*Notes:* The figure reports the relationship between respondents' demotivating beliefs and their socioeconomic class for each zero-sum decile. Country-wave fixed effects and demographic controls are netted out before creating the zero-sum deciles. The demotivating belief in this figure is reported based on how much respondents agreed with the statement "In the long run, hard work usually brings a better life" on a scale of one to ten, with one indicating complete agreement with the statement and ten indicating "Hard work doesn't generally bring success—it's more a matter of luck and connections." These responses are reversed so the variable is increasing in the demotivating belief "Hard work does not bring success." ( $N = 205,451$ )

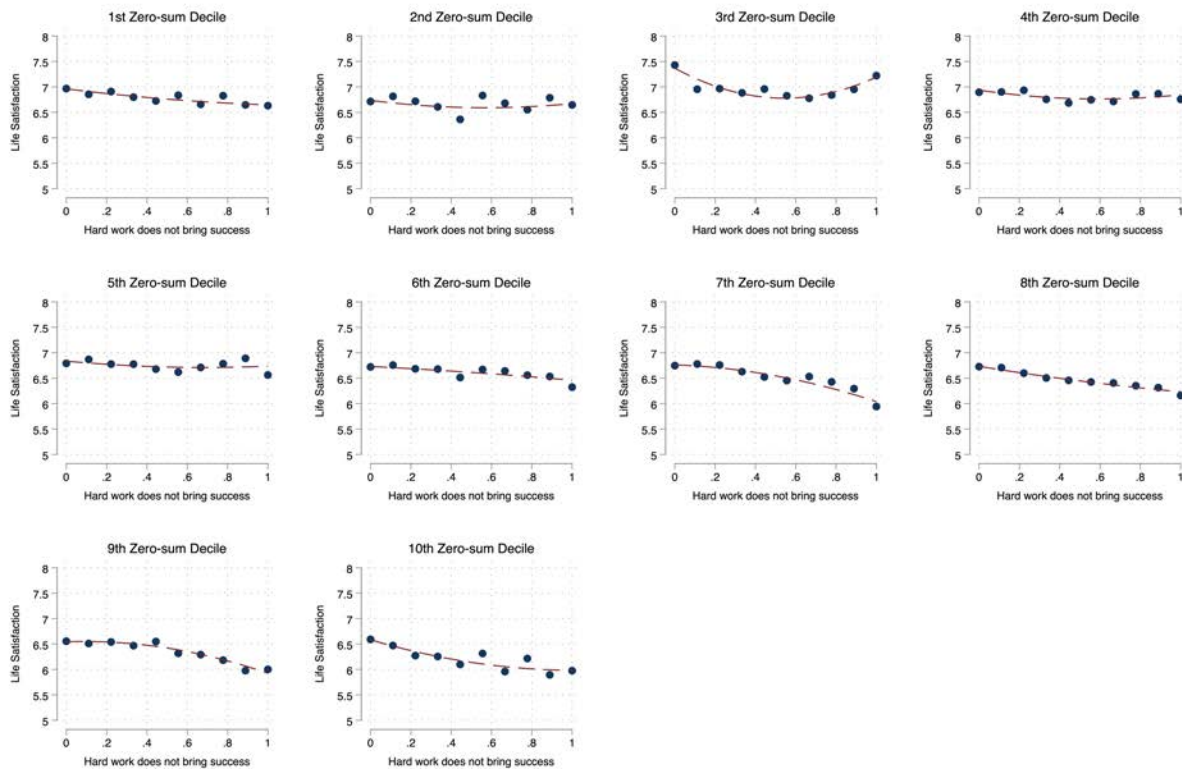


**Figure D27:** Relationship Between Demotivating Beliefs and Life Satisfaction – Holding Constant Zero-Sum Perceptions



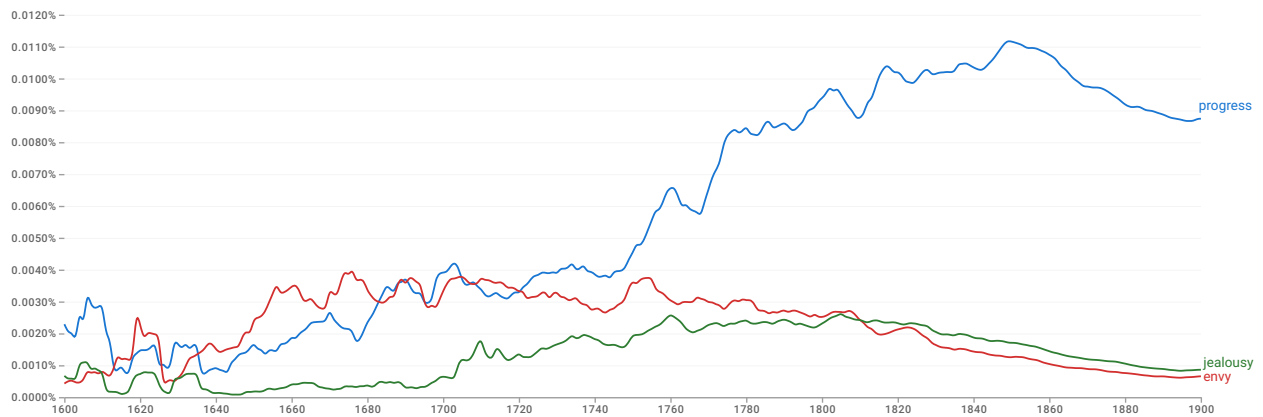
*Notes:* The figure reports the relationship between respondents' demotivating beliefs and life satisfaction for each zero-sum decile. Country-wave fixed effects and demographic controls are netted out before creating the zero-sum deciles. The demotivating belief in this figure is reported based on respondents' answers to the question (with work being the aspect respondents were asked the question about) "For each of the following, indicate how important it is in your life. Would you say it is," with options "1 Very important, 2 Rather important, 3 Not very important, 4 Not at all important." These responses are reversed so the variable is increasing in the demotivating belief "Work is not important at all." ( $N = 239,497$ )

**Figure D28:** Relationship Between Demotivating Beliefs and Life Satisfaction – Holding Constant Zero-Sum Perceptions



*Notes:* The figure reports the relationship between respondents' demotivating beliefs and life satisfaction for each zero-sum decile. Country-wave fixed effects and demographic controls are netted out before creating the zero-sum deciles. The demotivating belief in this figure is reported based on how much respondents agreed with the statement "In the long run, hard work usually brings a better life" on a scale of one to ten, with one indicating complete agreement with the statement and ten indicating "Hard work doesn't generally bring success—it's more a matter of luck and connections." These responses are reversed so the variable is increasing in the demotivating belief "Hard work does not bring success." ( $N = 243,631$ )

**Figure D29:** Frequency of the words “progress,” “jealousy,” and “envy” from 1600 to 1900



*Notes:* The figure reports the frequency of the words “progress,” “jealousy,” and “envy” from 1600 to 1900. It is generated by the Google-N-grams viewer (Michel et al., 2010), which searches Google Books, predominantly in the English language, published in any country, and available on Google Books’ 2019 corpora.

**Table D4: Principal Component Analysis for Envy Measures in the DRC**

	(1)	(2)
Envy survey questions	200 sample	1,000 sample
It is frustrating to see some people succeed in life easily	0.547	0.509
It is not fair that some people seem to have all the talent	0.347	0.475
The success of my neighbors makes me resent them	0.544	0.509
I sometimes wish that rich and powerful people lose their advantage	0.532	0.506
Eigenvalue	2.046	2.406
Proportion of variance explained	0.511	0.602
Observations	224	1,019

Notes: The table reports the estimated factor loadings from the principal components of the measure of jealousy. Both sets of estimates are reported in one column with the eigenvalue of the first principal component reported in the bottom panel. The questions used in the principal components analyses are respondents' self-reported jealousy. In the 200-person sample, the respondents choose from one of five options: "Strongly agree", "Agree", "Neutral", "Disagree", and "Strongly disagree". In the 1,000-person sample, the respondents choose from one of six options: "Strongly disagree", "Moderately disagree", "Slightly disagree", "Slightly agree", "Moderately agree", "Strongly agree". Columns 1 and 2 report the factor loadings of the first principal component using the 200-person and the 1,000-person samples, respectively.

**Table D5: Principal Component Analysis for Witchcraft Measures in the DRC**

	(1)	(2)
Witchcraft survey questions	200 sample	1,000 sample
Aside from the Christian God, what is the strength of your belief in the existence of other gods and spirits, including ancestor spirits?	0.436	0.569
How often do you pray to gods and spirits other than the Christian God, including ancestor spirits?	0.600	0.584
How often do you attend rituals devoted to gods and spirits other than the Christian God, including ancestor spirits?	0.586	0.579
Using the figures provided, which set of figures best represents how close you feel to non-Christians in Kananga?	0.326	0.010
Eigenvalue	2.416	2.640
Proportion of variance explained	0.604	0.660
Observations	217	1,019

Notes: The table reports the estimated factor loadings from the principal components of the measure of Witchcraft. Both sets of estimates are reported in one column with the eigenvalue of the first principal component reported in the bottom panel. The questions used in the principal components analyses are respondents' self-reported belief in Gods and spirits aside from the Christian God. In the 200 person sample, for the first question, respondents choose from one of five options: "Very strong", "Strong", "Weak", "Very weak", and "Nonexistent". In the 1,000-person sample, for the first question, respondents choose from one of five options: "With all my heart", "With a lot of strength", "With strength", "With a little bit of strength", and "With no strength at all". In the 200 person sample, for the second and third questions, respondents choose from one of six options: "Very frequently", "Frequently", "Sometimes", "Infrequently", "Very infrequently", and "Never". In the 1,000-person sample, for the second and third questions, respondents choose between one of five options: "A few times per week", "A few times per month", "A few times per year", "Very rarely", and "Never". In both samples, for the final question, respondents choose one number on a scale of zero to five. Columns 1 and 2 report the factor loadings of the first principal component using the 200-person and the 1,000-person samples, respectively.

**Table D6: Principal Component Analysis for Christianity Measures in the DRC**

Christianity survey questions	(1)	(2)
	200 sample	1,000 sample
What is the strength of your belief in the existence of the Christian God?	0.543	0.463
How often do you pray to the Christian God or Jesus?	0.643	0.630
How often do you attend church or other communal religious rituals?	0.437	0.601
Using the figures provided, which set of figures best represents how close you feel to devout Christians in Kananga?	0.317	0.167
Eigenvalue	1.869	1.424
Proportion of variance explained	0.467	0.356
Observations	217	1,019

*Notes:* The table reports the estimated factor loadings from the principal components of the measure of Christianity. Both sets of estimates are reported in one column with the eigenvalue of the first principal component reported in the bottom panel. The questions used in the principal components analyses are respondent's self-reported devotion to the Christian God. In the 200-person sample, for the first question, respondents choose from one of five options: "Very strong", "Strong", "Weak", "Very weak", and "Nonexistent". In the 1,000-person sample, for the first question, respondents choose from one of five options: "With all my heart", "With a lot of strength", "With strength", "With a little bit of strength", and "With no strength at all". In the 200 person sample, for the second and third questions, respondents choose from one of six options: "Very frequently", "Frequently", "Sometimes", "Infrequently", "Very infrequently", and "Never". In the 1,000-person sample, for the second and third questions, respondents choose between one of five options: "A few times per week", "A few times per month", "A few times per year", "Very rarely", and "Never". In both samples, for the final question, respondents choose one number on a scale of zero to five. Columns 1 and 2 report the factor loadings of the first principal component using the 200-person and the 1,000-person samples, respectively.

**Table D7: Zero-Sum Index of Six Survey Questions, Envy, and Witchcraft in the DRC – Clustered Standard Errors and Randomization Inference**

	Dependent Variable: Principal-Component Based Measures of:							
	Envy of Others' Success		Witchcraft Beliefs		Christianity Beliefs		Difference Between Witchcraft & Christianity	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<b>Panel A: 200 Person Sample (2015)</b>								
Zero-sum thinking, 0-1	0.421 (0.114)*** [0.113]*** {0.130}**	0.454 (0.136)** [0.136]** {0.162}**	0.545 (0.165)** [0.175]** {0.177}**	0.550 (0.183)** [0.181]** {0.197}**	-0.210 (0.119)* [0.118]* {0.136}	-0.260 (0.129)** [0.133]* {0.151}*	0.755 (0.243)** [0.259]** {0.280}**	0.810 (0.275)** [0.282]** {0.321}**
Observations	204	204	197	197	197	197	197	197
R squared	0.575	0.615	0.455	0.501	0.417	0.476	0.430	0.484
Randomization inference <i>p</i> -value	0.000	0.000	0.000	0.001	0.036	0.012	0.000	0.000
<b>Panel B: 1,000 Person Sample (2019)</b>								
Zero-sum thinking, 0-1	0.157 (0.033)*** [0.033]*** {0.036}***	0.154 (0.034)*** [0.034]*** {0.037}***	0.028 (0.027) [0.026] {0.026}	0.028 (0.027) [0.027] {0.026}	-0.049 (0.018)** [0.018]** {0.019}**	-0.049 (0.018)** [0.019]** {0.019}**	0.077 (0.032)** [0.033]** {0.034}**	0.077 (0.033)** [0.034]** {0.035}**
Observations	984	984	984	984	984	984	984	984
R squared	0.164	0.170	0.166	0.171	0.132	0.141	0.148	0.157
Randomization inference <i>p</i> -value	0.000	0.000	0.123	0.127	0.006	0.013	0.017	0.010
Demographic Controls	Y	Y	Y	Y	Y	Y	Y	Y
Ethnicity FE	N	Y	N	Y	N	Y	N	Y

*Notes:* This table replicates the specifications and results presented in Table 2. However, coefficients are reported with standard errors clustered at the neighborhood-by-ethnicity level in parenthesis (), at the neighborhood-by-gender level in square brackets [], and at the neighborhood level in curly brackets {}. Ethnicity is defined as a dummy indicator for being a member of the ethnic majority, which is the Luluwa tribe. At the bottom of each panel, we also report the randomization inference *p*-value associated with each regression specification. \*\*\*, \*\*, and \* indicate significance at the 1, 5, and 10 percent levels.

**Table D8: Zero-Sum Index of Ten Survey Questions, Envy, and Witchcraft in the DRC: 200 Person Sample**

	Dependent Variable: Principal-Component Based Measures of:							
	Envy of Others Success		Witchcraft Beliefs		Christianity Beliefs		Difference Between Witchcraft & Christianity	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Zero-sum thinking, 0-1	0.444*** (0.106)	0.479*** (0.126)	0.518** (0.177)	0.553** (0.183)	-0.182* (0.097)	-0.257** (0.113)	0.700** (0.238)	0.810** (0.258)
Observations	192	192	186	186	186	186	186	186
R squared	0.572	0.613	0.480	0.534	0.457	0.529	0.455	0.527
Demographic Controls	Y	Y	Y	Y	Y	Y	Y	Y
Ethnicity FE	N	Y	N	Y	N	Y	N	Y

*Notes:* This table examines the relationship between zero-sum views and an individual's self-reported envy of others, beliefs in witchcraft and beliefs in Christianity for the sample of about 200 respondents collected in 2015 in Kananga, DRC. It reports estimates of equation (8). In all columns, the explanatory variable is the first principal component of the ten zero-sum statements described in Section 4.B. In columns 1 and 2, the dependent variable is the principal component of four survey questions measuring self-reported envy of others. The first three questions ask about experiencing frustration when people succeed in life easily, resentment when neighbors are successful, or feelings of injustice when some people seem to have all the talents. The fourth question asks if the respondent sometimes wishes that rich and powerful people lose their advantage. In columns 3 and 4, it is the principal-component-based measure of beliefs in witchcraft using four survey questions that ask about the strength of belief in traditional religion, frequency of prayer to ancestors, frequency of participation in rituals devoted to ancestors, and how close they feel to non-Christians who live in Kananga. In columns 5 and 6, it is a principal-component-based measure of beliefs in Christianity using four survey questions that ask about the strength of one's belief in the Christian God, frequency of prayer, frequency of attending church, and how close the respondent feels to Christians who live in Kananga. In columns 7 and 8, it is the differences in the principal-component-based measure of beliefs in witchcraft and Christianity. We include controls for gender, age, and age squared and their interactions in all columns. In columns 2, 4, 6, and 8, we also include ethnicity fixed effects. We report robust standard errors in parentheses. \*\*\*, \*\*, and \* indicate significance at the 1, 5, and 10 percent levels.

**Table D9: Zero-Sum Index of Twelve Survey Questions, Envy, and Witchcraft in the DRC: 200 Person Sample**

	Dependent Variable: Principal-Component Based Measures of:							
	Envy of Others Success		Witchcraft Beliefs		Christianity Beliefs		Difference Between Witchcraft & Christianity	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Zero-sum thinking, 0-1	0.464*** (0.119)	0.533*** (0.154)	0.574** (0.208)	0.688** (0.231)	-0.213* (0.115)	-0.304** (0.133)	0.788** (0.275)	0.991** (0.317)
Observations	162	162	157	157	157	157	157	157
R squared	0.656	0.682	0.559	0.625	0.548	0.652	0.540	0.629
Demographic Controls	Y	Y	Y	Y	Y	Y	Y	Y
Ethnicity FE	N	Y	N	Y	N	Y	N	Y

*Notes:* This table examines the relationship between zero-sum views and an individual's self-reported envy of others, beliefs in witchcraft and beliefs in Christianity, for the sample of about 200 respondents collected in 2015 in Kananga, DRC. It reports estimates of equation (8). In all columns, the explanatory variable is the first principal component of the twelve zero-sum statements described in Section 4.B. In columns 1 and 2, the dependent variable is the principal component of four survey questions measuring self-reported envy of others. The first three questions ask about experiencing frustration when people succeed in life easily, resentment when neighbors are successful, or feelings of injustice when some people seem to have all the talents. The fourth question asks if the respondent sometimes wishes that rich and powerful people lose their advantage. In columns 3 and 4, it is the principal-component-based measure of beliefs in witchcraft using four survey questions that ask about the strength of belief in traditional religion, frequency of prayer to ancestors, frequency of participation in rituals devoted to ancestors, and how close they feel to non-Christians who live in Kananga. In columns 5 and 6, it is a principal-component-based measure of beliefs in Christianity using four survey questions that ask about the strength of one's belief in the Christian God, frequency of prayer, frequency of attending church, and how close the respondent feels to Christians who live in Kananga. In columns 7 and 8, it is the differences in the principal-component-based measure of beliefs in witchcraft and Christianity. We include controls for gender, age, and age squared and their interactions in all columns. In columns 2, 4, 6, and 8, we also include ethnicity fixed effects. We report robust standard errors in parentheses. \*\*\*, \*\*, and \* indicate significance at the 1, 5, and 10 percent levels.

**Table D10: Principal Component Analysis for Network Measures in the DRC**

Network measures	6 question index (1000 sample)
Fraction of tribe in network	0.307
Fraction of church in network	0.544
Fraction of nuclear family in network	0.400
Fraction of extended family in network	0.390
Fraction of religion in network	0.545
Eigenvalue	2.424
Observations	975

*Notes:* The table reports the estimated factor loadings from the principal components of the network measures. The estimates for the 1000-person sample are reported in one column with the eigenvalue of the first principal component reported in the bottom panel. The variables used in the principal components analyses are the fraction of the individuals in the respondent's network who belong to the same tribe, church, nuclear family, extended family and religion as the respondent. We measure this using the social network questionnaires from the Aggregated Relations Data methodology introduced by Breza, Chandrasekhar, McCormack and Pan (2020). Specifically, we asked respondents to list the individuals they would go to (or who would come to them) in nine different situations and collected information about the individuals they listed, including their tribe and religion and whether they belong to the respondent's church, extended family, or nuclear family. The nine situations considered are (1) borrowing or lending cooking fuel (coal), (2) borrowing or lending coffee, milk and/or sugar, (3) borrowing or lending CF3,000-CF5,000, (4) borrowing or lending US\$50 to start a business, (5) giving or receiving advice about financial matters, (6) giving or receiving advice about a child's schooling, (7) giving or receiving advice about finding housing, (8) giving or receiving advice about health concerns, (9) listening to the radio or watching television together. The first five situations aimed at eliciting the respondent financial network, while the goal of the last four activities was to capture the respondent's non-financial social network. Answers to these questions were used to construct the fraction of the individuals the respondent listed who share their tribe, church, nuclear family, extended family or religion. The exact survey questions used to define these variables are provided in Appendix E.IV.

**Table D11: Zero-Sum Perceptions and Networks**

	Dependent Variable: Principal-Component Based Measure of:			
	Zero-sum thinking, 0-1			
	(1)	(2)	(3)	(4)
Sigma	-0.040 (0.027)	-0.033 (0.030)	-0.035 (0.030)	-0.035 (0.031)
Observations	942	942	942	942
R squared	0.002	0.140	0.143	0.154
Demographic Controls	N	Y	Y	Y
Ethnicity FE	N	N	Y	Y
Religion FE	N	N	N	Y

*Notes:* This table examines the relationship between the fraction of an individual's network that belongs to the same social group as them and their zero-sum perceptions for the sample of about 1000 respondents collected in 2019 in Kananga, DRC. In all columns, the dependent variable is the first principal component of the six zero-sum statements. The explanatory variable (Sigma) is a principal component measure of four measures indicating the fraction of people in a respondent's network that are from the same tribe, church, nuclear family, extended family and religion as the respondent. We measure this using the social network questionnaires from the Aggregated Relations Data methodology introduced by Breza et al. (2020). Specifically, we asked respondents to list the individuals they would go to (or who would come to them) in nine different situations and collected information about the individuals they listed, including their tribe and religion and whether they belong to the respondent's church, extended family, or nuclear family. The nine situations considered are (1) borrowing or lending cooking fuel (coal), (2) borrowing or lending coffee, milk and/or sugar, (3) borrowing or lending CF3,000-CF5,000, (4) borrowing or lending US\$50 to start a business, (5) giving or receiving advice about financial matters, (6) giving or receiving advice about a child's schooling, (7) giving or receiving advice about finding housing, (8) giving or receiving advice about health concerns, (9) listening to the radio or watching television together. The first five situations aimed at eliciting the respondent financial network, while the goal of the last four activities was to capture the respondent's non-financial social network. Answers to these questions were used to construct the fraction of the individuals the respondent listed who share their tribe, church, nuclear family, extended family or religion. The exact survey questions used to define these variables are provided in Appendix E.IV. Coefficients are reported with robust standard errors in parentheses. \*\*\*, \*\*, and \* indicate significance at the 1, 5, and 10 percent levels.

**Table D12:** Zero-Sum Index of Six Survey Questions, Envy, and Witchcraft: Controlling for the fraction of a respondent's social group in their network

	Dependent Variable: Principal-Component Based Measures of:							
	Envy of Others' Success		Witchcraft Beliefs		Christianity Beliefs		Difference Between Witchcraft and Christianity	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Zero-sum thinking, 0-1	0.158*** (0.028)	0.156*** (0.028)	0.037 (0.034)	0.037 (0.034)	-0.068** (0.024)	-0.068** (0.023)	0.104** (0.050)	0.106** (0.049)
Mean	0.152	0.152	0.041	0.041	0.920	0.920	-0.880	-0.880
Observations	942	942	942	942	942	942	942	942
R squared	0.168	0.173	0.177	0.187	0.129	0.166	0.154	0.181
Demographic Controls	Y	Y	Y	Y	Y	Y	Y	Y
Sigma	Y	Y	Y	Y	Y	Y	Y	Y
Ethnicity FE	N	Y	N	Y	N	Y	N	Y

*Notes:* This table examines the relationship between zero-sum perceptions and an individual's self-reported envy of others, beliefs in witchcraft, and beliefs in Christianity, for the sample of about 200 respondents collected in 2015 (panel A) and the sample of about 1,000 respondents collected in 2019 (panel B) in Kananga, DRC. It reports estimates of equation (8). In all columns, the explanatory variable is the first principal component of the six zero-sum statements. In columns 1 and 2, the dependent variables are the first principal component of the four survey questions measuring self-reported envy of others' success. The first three questions ask about experiencing frustration when people succeed in life easily, resentment when neighbors are successful, or feelings of injustice when some people seem to have all the talents. The fourth question asks if the respondent sometimes wishes that rich and powerful people lose their advantage. In columns 3 and 4, the dependent variables are the principal-component-based measure of beliefs in witchcraft using four survey questions that ask about the strength of belief in traditional religion, frequency of prayer to ancestors, frequency of participation in rituals devoted to ancestors, and how close they feel to non-Christians who live in Kananga. In columns 5 and 6, the dependent variables are the principal-component-based measure of beliefs in Christianity using four survey questions that ask about the strength of one's belief in the Christian God, frequency of prayer, frequency of attending church, and how close the respondent feels to Christians who live in Kananga. In columns 7 and 8, the dependent variables are the difference in the principal-component-based measure of beliefs in witchcraft and Christianity. We include controls for gender, age, and age squared and their interactions in all columns. We also control for the composition of the respondent's network using a principal component measure of the fraction of people in a respondent's network that is from the same tribe, church, nuclear family, extended family, and religion as the respondent. Coefficients are reported with robust standard errors in parentheses. \*\*\*, \*\*, and \* indicate significance at the 1, 5, and 10 percent levels.



**Table D13: Zero-Sum Perceptions or Demotivating Beliefs and Economic Welfare**

	Measure of demotivating beliefs used:						
	Hard work brings success, 0 = fully agree to 1 = fully disagree	People are poor because of laziness, 0 = agree or 1 = disagree	People have a chance to escape poverty, 0 = agree or 1 = disagree	Humiliating to receive money without working for it, 0 = strongly agree to 1 = strongly disagree	Important to me to be successful, 0 = very much to 1 = not at all	How important is work, 0 = very important to 1 = not at all	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Income Decile (0-1) as Dependent Variable							
Zero-sum thinking, 0-1	-0.039*** (0.002)						
Demotivating belief, $\theta$		-0.015*** (0.001)	-0.045*** (0.003)	-0.030*** (0.002)	0.001 (0.003)	-0.053*** (0.002)	-0.006*** (0.002)
Mean dependent variable	0.407	0.410	0.382	0.383	0.398	0.420	0.407
Std. dev. dependent variable	0.257	0.250	0.278	0.281	0.257	0.242	0.251
Mean independent variable	0.404	0.364	0.708	0.601	0.346	0.392	0.159
Std. dev. independent variable	0.309	0.322	0.455	0.490	0.296	0.291	0.247
Observations	229,719	311,233	54,785	57,087	95,304	149,713	375,394
R squared	0.159	0.143	0.192	0.190	0.139	0.128	0.142
Panel B: Family Savings (0-1) as Dependent Variable							
Zero-sum thinking, 0-1	-0.032*** (0.002)						
Demotivating belief, $\theta$		-0.047*** (0.002)	-0.051*** (0.003)	-0.044*** (0.003)	-0.020*** (0.003)	-0.028*** (0.003)	0.001 (0.002)
Mean dependent variable	0.625	0.632	0.586	0.592	0.635	0.627	0.627
Std. dev. dependent variable	0.309	0.307	0.309	0.309	0.306	0.309	0.307
Mean independent variable	0.406	0.365	0.704	0.600	0.346	0.391	0.159
Std. dev. independent variable	0.308	0.321	0.456	0.490	0.295	0.290	0.247
Observations	203,716	284,604	57,957	61,861	97,195	143,652	348,941
R squared	0.090	0.092	0.076	0.074	0.066	0.089	0.087
Panel C: Educational Attainment (0-1) as Dependent Variable							
Zero-sum thinking, 0-1	-0.030*** (0.002)						
Demotivating belief, $\theta$		-0.015*** (0.002)	-0.005* (0.003)	-0.014*** (0.003)	0.001 (0.004)	-0.068*** (0.003)	-0.028*** (0.002)
Mean dependent variable	0.522	0.532	0.495	0.500	0.494	0.526	0.522
Std. dev. dependent variable	0.337	0.341	0.341	0.340	0.339	0.336	0.343
Mean independent variable	0.406	0.367	0.703	0.605	0.353	0.396	0.159
Std. dev. independent variable	0.309	0.322	0.457	0.489	0.296	0.291	0.246
Observations	219,524	301,793	60,784	63,245	96,148	146,705	367,265
R squared	0.173	0.200	0.156	0.150	0.178	0.184	0.193
Panel D: Manual vs. Cognitive Work Tasks (0-1) as Dependent Variable							
Zero-sum thinking, 0-1	-0.049*** (0.004)						
Demotivating belief, $\theta$		0.007** (0.003)	-	-	0.010* (0.006)	-0.063*** (0.004)	-0.006 (0.004)
Mean dependent variable	0.446	0.444	-	-	0.411	0.444	0.442
Std. dev. dependent variable	0.346	0.347	-	-	0.355	0.346	0.347
Mean independent variable	0.416	0.366	-	-	0.355	0.404	0.158
Std. dev. independent variable	0.301	0.313	-	-	0.293	0.290	0.244
Observations	116,885	120,257	-	-	42,292	119,046	121,223
R squared	0.087	0.087	-	-	0.102	0.091	0.089
Panel E: Supervising Someone at Work (0-1) as Dependent Variable							
Zero-sum thinking, 0-1	-0.046*** (0.004)						
Demotivating belief, $\theta$		-0.039*** (0.004)	-	-	-0.030*** (0.008)	-0.100*** (0.005)	-0.073*** (0.005)
Mean dependent variable	0.327	0.324	-	-	0.326	0.324	0.320
Std. dev. dependent variable	0.469	0.468	-	-	0.469	0.468	0.466
Mean independent variable	0.415	0.362	-	-	0.352	0.400	0.160
Std. dev. independent variable	0.302	0.315	-	-	0.293	0.291	0.246
Observations	119,888	123,491	-	-	43,035	122,245	125,653
R squared	0.106	0.106	-	-	0.103	0.109	0.107
Panel F: Socioeconomic Class (0-1) as Dependent Variable							
Zero-sum thinking, 0-1	-0.045*** (0.002)						
Demotivating belief, $\theta$		-0.032*** (0.001)	-0.051*** (0.002)	-0.038*** (0.002)	-0.001 (0.003)	-0.075*** (0.002)	-0.006*** (0.002)
Mean dependent variable	0.421	0.422	0.417	0.419	0.406	0.419	0.419
Std. dev. dependent variable	0.245	0.245	0.235	0.235	0.249	0.249	0.246
Mean independent variable	0.409	0.363	0.701	0.601	0.344	0.390	0.160
Std. dev. independent variable	0.307	0.320	0.458	0.490	0.295	0.290	0.247
Observations	207,165	288,364	60,637	63,173	96,221	146,644	355,489
R squared	0.111	0.105	0.070	0.063	0.111	0.132	0.100
Demographic Controls	Y	Y	Y	Y	Y	Y	Y
Wave-country FE	Y	Y	Y	Y	Y	Y	Y

Notes: The table reports OLS estimates of the relationship between zero-sum perceptions or demotivating beliefs and either the respondent's income decile (panel A), family savings (panel B), educational attainment (panel C), employment in cognitive vs. manual work tasks (panel D), supervising someone at work (panel E), and socioeconomic class (panel F). An observation is an individual. In column 1, the independent variable, zero-sum thinking, is a scale ranging from zero to one, with one representing "People can only get rich at the expense of others" and zero representing "Wealth can grow so there's enough for everyone". The estimates from column 1 correspond to those presented in Table 4. In columns 2-6, the independent variables, demotivating beliefs, are categorical variables, where zero represents agreement (or full agreement), and one represents (full) agreement with the statement reported in the column heading. In column 7, the demotivating belief measure uses the statement "How important is work," and 0 indicates "very important," and 1 indicates "not at all." All specifications include country-wave fixed effects and demographic controls (age, age squared, gender, and their interactions). Coefficients are reported with robust standard errors in parentheses. \*\*\*, \*\*, and \* indicate significance at the 1, 5, and 10 percent levels.

## Supplementary Materials (Not for Online Publication)

### Appendix E. Data: Sources and Measurement

#### *I. Surveys Conducted in the DRC*

The empirical analysis uses two samples from the city of Kananga in the Democratic Republic of the Congo (DRC). The first sample is from surveys undertaken in 2015 and comprises about 200 respondents. The second is from 2019 and has about 1,000 respondents. We provide details of the sampling and survey implementation here.

##### *200-Person Sample*

For the 200-person sample, the data were collected between June and September 2015. Sampling occurred in several steps. First, we conducted a screening survey in 85 neighborhoods across the city of Kananga: 60 were randomly sampled, and 25 were targeted because they contained ethnic minorities. The neighborhoods were chosen with probabilities proportional to their estimated populations.

In each neighborhood, enumerators sampled 33 households by walking along each street and counting houses according to a neighborhood-specific skip pattern. In targeted neighborhoods, enumerators similarly sampled households following a skip pattern. In total, enumerators conducted 2,496 screening surveys, of which 1,964 came from the 60 randomly chosen neighborhoods, and the remaining 532 came from the targeted neighborhoods.

From this screening survey sample, we then selected the sub-sample for this project: those who had not participated in a previous study were not planning to travel during the study period and belonged to an ethnic group with ten or more individuals in the random screening survey. We then randomly chose up to 18 individuals from each ethnicity. We prioritized sampling from the random sample, but if we did not reach 18 surveys for a particular ethnic group, we also sampled respondents from the targeted sample. The final sample comprises 223 individuals (193 from the random sample and 30 from the targeted sample).

Each respondent was invited to participate in a set of activities at their home. Home activities were conducted during two enumerator visits. During the first visit, enumerators conducted a 90-

minute survey, on which our measures of zero-sum views and envy are based. In a second home visit, respondents completed a short survey module about religious beliefs, which contained our measures of the strength of beliefs in witchcraft and Christianity. Of the 223 individuals selected to participate, 222 completed the first survey, and 211 completed the second survey.

### *1,000-Person Sample*

For the 1,000-person sample, the data were collected between June and September of 2019. We conducted a screening survey with 3,372 respondents in 225 neighborhoods across the city of Kananga. The neighborhoods were selected using two-stage clustered sampling, where the probability of selecting a neighborhood was proportional to its estimated population. In each randomly selected neighborhood, enumerators sampled 15 households by walking along each street and counting houses according to a neighborhood-specific skip pattern.

We then selected the sub-sample that satisfied two criteria: (1) the respondents' village of origin is in one of the five provinces of the Kasai region (Kasai Central, Kasai, Kasai Oriental, Sankuru or Lomami), and (2) their ethnicity is one of the four main ethnicities in their province of origin. The ethnicities are Luluwa, Luntu, Bindi and Kete in Kasai-Central; Luluwa, Kete, Kuba, Lele in Kasai; and Luba, Tetela, Songe in Kasai-Oriental, Sankuru, and Lomami. The final sample includes 1,019 individuals. Each respondent was invited to participate in a survey at their home, which contained the same questions used to measure zero-sum views, envy, and strength of beliefs in witchcraft and Christianity.

### *Both Samples*

The zero-sum, envy, witchcraft, and Christianity questions were identical in both surveys. The precise wording of the survey questions and their responses are reported below. We also offer respondents the option to respond with "Agree with neither statement" or "He/she does not know" and code these as missing in our analysis.

- Age: How old were you at your last birthday?
- Tribe: Bindi, Tshokwe, Kete, Kongo, Kuba, Lele, Luba, Luluwa, Luntu, Sala, Songe, Tetela.
- Zero-sum 1: Which Statement do you agree with? Statement 1: Gaining happiness requires taking it away from others. Statement 2: It is possible for everyone to be happy. 1 Agree

strongly with statement 1; 2 Agree with statement 1; 3 Agree with statement 2; 4 Agree strongly with statement 2.

- Zero-sum 2: Which Statement do you agree with? Statement 1: A person can only gain power by taking it away from others. Statement 2: A person can gain power without taking it away from others. 1 Agree strongly with statement 1; 2 Agree with statement 1; 3 Agree with statement 2; 4 Agree strongly with statement 2.
- Zero-sum 3: Which Statement do you agree with? Statement 1: In trade, if one party gains the other party loses. Statement 2: In trade, it is possible for both parties to gain at the same time. 1 Agree strongly with statement 1; 2 Agree with statement 1; 3 Agree with statement 2; 4 Agree strongly with statement 2.
- Zero-sum 4: Which Statement do you agree with? Statement 1: If one person in a village gets very wealthy, other people in the village will become poorer. Statement 2: If one person in a village gets very wealthy, other people in the village will not necessarily become poorer. 1 Agree strongly with statement 1; 2 Agree with statement 1; 3 Agree with statement 2; 4 Agree strongly with statement 2.
- Zero-sum 5: Which Statement do you agree with? Statement 1: In Kananga, people only make money when others lose money. Statement 2: In Kananga, no one need to lose money for others to make money. 1 Agree strongly with statement 1; 2 Agree with statement 1; 3 Agree with statement 2; 4 Agree strongly with statement 2.
- Zero-sum 6: Which Statement do you agree with? Statement 1: In Kananga, businesses only make money when others lose money. Statement 2: In Kananga, no one need to lose money for businesses to make money. 1 Agree strongly with statement 1; 2 Agree with statement 1; 3 Agree with statement 2; 4 Agree strongly with statement 2.
- Envy 1: It is so frustrating to see some people succeed so easily. 1 strongly disagree; 2 moderately disagree; 3 slightly disagree; 4 slightly agree; 5 moderately agree; 6 strongly agree.
- Envy 2: It somehow doesn't seem fair that some people seem to have all the talents. 1 strongly disagree; 2 moderately disagree; 3 slightly disagree; 4 slightly agree; 5 moderately agree; 6 strongly agree.

- Envy 3: The success of my neighbors makes me resent them. 1 strongly disagree; 2 moderately disagree; 3 slightly disagree; 4 slightly agree; 5 moderately agree; 6 strongly agree.
- Envy 4: I sometimes wish that rich and powerful people lose their advantage. 1 strongly disagree; 2 moderately disagree; 3 slightly disagree; 4 slightly agree; 5 moderately agree; 6 strongly agree.
- Witchcraft beliefs 1: Aside from the Christian God, what is the strength of your belief in the existence of other gods and spirits, including ancestor spirits? 1 With no strength at all; 2: With a little bit of strength; 3 With strength; 4 With a lot of strength; 5 With all my heart.
- Witchcraft beliefs 2: How often do you pray other gods and spirits including ancestor spirits? 1 never; 2 very rarely; 3 a few times per year; 4 a few times per month; 5 a few times per week.
- Witchcraft beliefs 3: How often do you participate in rites devoted to other gods and spirits, including ancestor spirits? 1 never; 2 very rarely; 3 a few times per year; 4 a few times per month; 5 a few times per week.
- Witchcraft beliefs 4: Using the figures provided, which set of figures best represents how close you feel to Pagans in Kananga?
- Christian beliefs 1: What is the strength of your belief in the existence of the Christian God? 1 With no strength at all; 2: With a little bit of strength; 3 With strength; 4 With a lot of strength; 5 With all my heart.
- Christian beliefs 2: How often do you pray the Christian God or Jesus? 1 never; 2 very rarely; 3 a few times per year; 4 a few times per month; 5 a few times per week.
- Christian beliefs 3: How often do you attend church? 1 never; 2 very rarely; 3 a few times per year; 4 a few times per month; 5 a few times per week.
- Christian beliefs 4: Using the figures provided, which set of figures best represents how close you feel to Christians in Kananga?

## *II. Additional Survey Questions in the 200-Person DRC Sample*

The 2015, 200-person sample also included additional zero-sum questions that were used to help test and validate our baseline measure. These are reported below. We also offer respondents the option to respond with "Agree with neither statement" or "He/she does not know" and code these as missing in our analysis.

- Zero-sum 7: Which Statement do you agree with? Statement 1: Most of the wealth of the rich was created without taking it from others. Statement 2: Most of the wealth of the rich was obtained by taking it from others. 1 Agree strongly with statement 1; 2 Agree with statement 1; 3 Agree with statement 2; 4 Agree strongly with statement 2.
- Zero-sum 8: Which Statement do you agree with? Statement 1: The success of the wealthy generally helps other people in the community. Statement 2: The success of the wealthy generally hurts other people in the community. 1 Agree strongly with statement 1; 2 Agree with statement 1; 3 Agree with statement 2; 4 Agree strongly with statement 2.
- Zero-sum 9: Which Statement do you agree with? Statement 1: Most wealth is created without exploiting others. Statement 2: Most wealth is obtained by exploiting others. 1 Agree strongly with statement 1; 2 Agree with statement 1; 3 Agree with statement 2; 4 Agree strongly with statement 2.
- Zero-sum 10: Which Statement do you agree with? Statement 1: If one farmer has a huge crop, his neighbor is likely to also have a huge crop. Statement 2: If one farmer has a huge crop, his neighbor is likely to have a small crop. 1 Agree strongly with statement 1; 2 Agree with statement 1; 3 Agree with statement 2; 4 Agree strongly with statement 2.
- Zero-sum 11: Which Statement do you agree with? Statement 1: If God is looking out for my brother, He is less likely to be looking out for me. Statement 2: If God is looking out for my brother, He is more likely to also be looking out for me. 1 Agree strongly with statement 1; 2 Agree with statement 1; 3 Agree with statement 2; 4 Agree strongly with statement 2.
- Zero-sum 12: Which Statement do you agree with? Statement 1: If my ancestors' spirits are looking out for my brother, they are less likely to be looking out for me. Statement 2: If my ancestors' spirits are looking out for my brother, they are more likely to also be looking

out for me. 1 Agree strongly with statement 1; 2 Agree with statement 1; 3 Agree with statement 2; 4 Agree strongly with statement 2.

- Respondent's employment status: 1 if What is your job, that's to say, what type of work do you do primarily? = 5 Unemployed-no work, 2 if What is your job, that's to say, what type of work do you do primarily? = 8 Farmer, 3 otherwise (formal employment)
- Mother's employment status: 1 if What is/was the main occupation of your mother? = 5 Unemployed-no work, 2 if What is/was the main occupation of your mother? = 8 Farmer, 3 otherwise (formal employment)
- Father's employment status: 1 if What is/was the main occupation of your father? = 5 Unemployed-no work, 2 if What is/was the main occupation of your father? = 8 Farmer, 3 otherwise (formal employment)
- Respondent had job in the last 5 years: Did you get a new job in the last five years? 0 No 1 Yes
- Member of nuclear family had job in last 5 years: Did one of your nuclear family members get a new job in the last five years? 0 No 1 Yes

### *III. Zero-Sum Vignette Questions in the 200-Person DRC Sample*

The 2015 survey also included zero-sum vignettes. The exact wording of these is as follows. They first begin with the following preamble. We also offer respondents the option to respond with "Doesn't know" and code these as missing in our analysis.

"Now, we would like to tell you some short stories about people living in Kananga or nearby. After telling you these stories, I will ask you some questions about your opinion about the success or failure of these people. These are not mathematics questions like those you solve in school. Please just give the response that seems most likely in your opinion."

The remainder of the vignette questions vary by scenario and are reported below.

#### *Banana Retailers*

Think of two women, Kapinga and Tshilomba, selling bananas on the side of the road. They sell bananas for two days. On the first day, Kapinga sells 10 bananas and Tshilomba sells 20 bananas. On the second day, Kapinga sells 20 bananas.

- How many bananas do you think Tshilomba sold on the second day?
- Imagine that Tshilomba sold either 10 bananas or 40 bananas. Which outcome do you think is more likely? 1 10 bananas; 2 40 bananas.
- Do you remember how many bananas Kapinga sold on the first day? 1 gives the correct answer; 2 gives the correct answer after a while; 3 gives the wrong answer; 4 does not even try to answer

#### *Maize Farmers*

Think of two farmers, Lukusa and Badibanga, in a rural village far from Kananga. They grow crops each year. In one year, Lukusa harvests \$50 worth of maize, and Badibanga harvests \$100 worth of maize. In the following year, Lukusa harvests \$100 worth of maize.

- How much money do you think Badibanga made for the maize he harvested in the second year?
- Imagine that Badibanga harvested either \$50 worth of maize or \$200 worth of maize. Which outcome do you think is more likely? 1 \$50 worth of maize; 2 \$200 worth of maize.
- Do you remember how much money Badibanga earned for the maize he harvested in the first year? 1 gives the correct answer; 2 gives the correct answer after a while; 3 gives the wrong answer; 4 does not even try to answer.

#### *IV. Network Data Used to Measure $\sigma$*

The following are the full original survey questions from the survey used to construct the variables which measure  $\sigma$ . We rely on the social network questionnaires from the Aggregated Relations Data methodology introduced by Breza et al. (2020) and ask the following questions to the respondents to ascertain the size and composition of their social network.

- I am now going to describe several situations. For each situation that I describe, I will ask you who you would go to in Kananga in this situation and who would come to you in Kananga in the same situation.



1. If your gas cylinder, kerosene or any cooking fuel gets over while cooking and you don't have it readily available at home, name the people you would go to in Kananga to borrow some and who would come to you in a similar situation.
2. If you need 1,000-5,000 FC because you're falling short for some payment, who would you borrow this money from and who would you come to you in a similar situation
3. If you need to borrow \$50 to start your own business/activity, who would you borrow this money from and who would you come to you in a similar situation
4. If you had visitors and needed some coffee, milk or sugar to make coffee but the shop is closed, who would you borrow it from and who would come to you in a similar situation
5. If you need advice on financial matters, for example opening a savings account, buying gold, taking a loan, buying insurance, making investments, etc. who would you go to and who would come to you for similar advice?
6. If you needed advice on which school/college to put your children in, who would you go to and who would come to you for similar advice?
7. If you had to move to another house in Kananga, who would you ask for help to find a house and who would come to you for help to find a house?
8. If your child or another member of your family falls sick, who would you go to for advice and who would come to you for similar advice?
9. Who would send their children to your house for you to look after them and so that their do their homework, listen to the radio, watch television or play? And to whom would you send your children for the same reasons?

For each named individual, the respondent is asked whether they are of the same tribe, if they are a member of their nuclear family, a member of their extended family, or a member of their church. The responses for each unique network member named are aggregated (or matched to the respondent, as in case of religion) over the nine situations described above to obtain the following variables:

- Fraction of tribe in network: Fraction of uniquely named individual who are from the same tribe as the respondent.

- Fraction of church in network: Fraction of uniquely named individual who belong to the same church as the respondent.
- Fraction of nuclear family in network: Fraction of uniquely named individual who belong to the respondent's nuclear family.
- Fraction of extended family in network: Fraction of uniquely named individual who belong to the respondent's extended family.
- Fraction of religion in network: Fraction of uniquely named individual who are of the same religion as the respondent.

#### ***V. Rainfall Data Used to Validate DRC Zero-Sum Measure***

The following are the variables used to validate the DRC Zero-sum measure in the 200-person sample based on rainfall data from CRU TS4.07 (Climatic Research Unit (CRU) Time-Series (TS) version 4.07 of high-resolution (0.5 by 0.5 degree) gridded data of month-by-month variation in climate) produced by CRU at the University of East Anglia available for the period January 1901–December 2022.

- Rainfall: First 20 years of life: Average annual rainfall in the respondent's village of origin in the first 20 years of their life (in mm/month).
- Rainfall: First 30 years of life: Average annual rainfall in the respondent's village of origin in the first 30 years of their life (in mm/month).

#### ***VI. GDP Data Used to Validate WVS Zero-Sum Measure***

The following variables are used in the analysis that validates the WVS Zero-sum measure using GDP data from the World Bank DataBank.

- GDP 20-year growth: Average annual growth in aggregate GDP (constant 2010 US\$) in their country during the first 20 years of their life.
- GDP 30-year growth: Average annual growth in aggregate GDP (constant 2010 US\$) in their country during the first 30 years of their life.
- GDP per capita 20-year growth: Average annual growth of per capita GDP (constant 2010 US\$) in their country during the first 20 years of their life.

- GDP per capita 30-year growth: Average annual growth of per capita GDP (constant 2010 US\$) in their country during the first 30 years of their life.

## VII. *World Values Survey Questions*

The following are the full original survey questions for the World Values Survey variables used in the analysis. The respondents were also offered the option to respond with “Don’t know” and we code these as missing in our analysis. The survey also records if the respondent does not answer or was not asked the question in certain cases or if the question was not applicable and these are also recorded as missing in our analysis.

- Income decile: 0 = bottom decile to 1 = top decile [X047\_WVS]<sup>E2</sup> On this card is an income scale on which 1 indicates the lowest income group and 10 the highest income group in your country. We would like to know in what group your household is. Please, specify the appropriate number, counting all wages, salaries, pensions and other incomes that come in.
- Family savings: 0=borrowed to 1=saved [X044] During the past year, did your family: 1 Save money; 2 Just get by; 3 Spent some savings and borrowed money; 4 Spent savings and borrowed money.
- Educational attainment: 0 = primary school or less to 1 = university or more [X025 and X025A\_01]<sup>E3</sup> 1 Inadequately completed elementary education; 2 Completed (compulsory) elementary education; 3 Incomplete secondary school: technical/vocational type/(Compulsory) elementary education and basic vocational qualification; 4 Complete secondary school: technical/vocational type/Secondary, intermediate vocational qualification; 5 Incomplete secondary: university-preparatory type/Secondary, intermediate general qualification; 6 Complete secondary: university-preparatory type/Full secondary, maturity level certificate; 7 Some university without degree/Higher education - lower-level tertiary certificate; 8 University with degree/Higher education - upper-level tertiary certificate.
- Cognitive vs. manual work tasks: 0=manual to 1=cognitive [X053]<sup>E4</sup> Are the tasks you perform at work mostly manual or mostly cognitive? If you do not work currently, characterize

<sup>E2</sup>In waves 1 through 4, the question text also instructed respondents to count income before taxes and other deductions.

<sup>E3</sup>These education codes changed noticeably in Wave 7 (not listed here). For analysis, we collapse the education groups into the smallest yet not overlapping groups as possible.

<sup>E4</sup>Wave 5 used the word “cognitive” while wave 6 used the word “intellectual.”

your major work in the past. Use this scale where 1 means “mostly manual tasks” and 10 means “mostly cognitive tasks.” 1 Mostly manual tasks to 10 Mostly non-manual tasks.

- Supervising someone at work: 0=no to 1=yes [X031] Do you or did you supervise other people at work? 0 No; 1 Yes.
- Class: 0 = lower class to 1 = upper class [X045] People sometimes describe themselves as belonging to the working class, the middle class, or the upper or lower class. Would you describe yourself as belonging one of them? 1 Upper class; 2 Upper middle class; 3 Lower middle class; 4 Working class; 5 Lower class.
- Hard work brings success: 0 = complete agreement to 1 = complete disagreement [E040] Now I'd like you to tell me your views on various issues. How would you place your views on this scale? 1 means you agree completely with the statement on the left; 10 means you agree completely with the statement on the right; and if your views fall somewhere in between, you can choose any number in between. 1 In the long run, hard work usually brings a better life; 10 Hard work doesn't generally bring success - it's more a matter of luck and connections.
- People are poor because of laziness: 0 = agreement to 1 = disagreement [E131] Why, in your opinion, are there people in this country who live in need? Here are two opinions: Which comes closest to your view? 1 Poor because of laziness and lack of will power; 2 Poor because society treats them unfairly; 3 Other answer.
- People have a chance to escape poverty: 0 = have a chance to 1 = very little chance [E132] In your opinion, do most poor people in this country have a chance of escaping from poverty, or is there very little chance of escaping? 1 They have a chance; 2 There is very little chance; 3 Other answer.
- Humiliating to receive money without working for it: 0 = strongly agree to 1 = strongly disagree [C037]<sup>E5</sup> Do you agree with “Humiliating to receive money without having to work for it”? 1 Strongly agree; 2 Agree; 3 Neither agree or disagree; 4 Disagree; 5 Strongly disagree.
- Important to me to be very successful and have achievements recognized: 0 = very much to 1 = not at all [A194] Now I will briefly describe some people. Using this card, would you

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<sup>E5</sup>Wave 5 changed the wording to “It is humiliating to receive money without working for it.”

please indicate for each description whether that person is very much like you, like you, somewhat like you, not like you, or not at all like you? “Being very successful is important to this person; to have people recognize one’s achievements.” 1 Not at all like me; 2 Not like me; 3 A little like me; 4 Somewhat like me; 5 Like me; 6 Very much like me.

- How important is work: 0 = very important to 1 = not at all [A005]<sup>E6</sup> For each of the following aspects, indicate how important it is in your life. Would you say it is very important, rather important, not very important or not important at all: Work. 1 Very important; 2 Rather important; 3 Not very important; 4 Not at all important.
- How satisfied are you with your life: 1 = completely dissatisfied to 10 = completely satisfied [A170] How satisfied are you with the financial situation of your household? If “1” means you are completely dissatisfied on this scale, and “10” means you are completely satisfied, where would you put your satisfaction with your household’s financial situation? 1 Dissatisfied; 10 Satisfied.
- How happy are you: 0 = Not at all happy to 1 = very happy [A008] Taking all things together, would you say you are: 1 Very happy; 2 Quite happy; 3 Not very happy; 4 Not at all happy.

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<sup>E6</sup>In wave 2, work was put as the first of a list of five things that people could rate as important. The ordering changed for the following waves, such that work was listed towards the end.