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, such as beliefs about envy, witchcraft, the importance of luck for success, or disdain for competitive effort. In our framework, demotivating beliefs evolve when interactions are zero-sum, i.e., where one person's gain comes at others' expense. They improve material welfare but reduce subjective well-being. The model delivers testable predictions about the relationship between the degree of zero-sumness, demotivating beliefs, material welfare, subjective well-being, and long-run economic development. We find that the predictions are supported by data from two samples in the Democratic Republic of Congo, as well as global evidence from the World Values Survey and the European Values Study.

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1. Introduction

Cultural beliefs and values discouraging individual effort and achievement 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 sometimes more subtly, in contemporary industrialized societies. 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."[1] Other forms of demotivating belief systems include beliefs in an "unjust world" (Bénabou and Tirole, 2006), pessimism (Mansour, Jouini and Napp, 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 small-scale pre-industrial societies meant that anything good was scarce and in limited supply. "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). Thus, the presumption in most 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 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 work, thrift,

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[1]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."

and individual exceptionalism. Foster believed this worldview inhibited entrepreneurial activity, wealth accumulation, innovation, and economic development.

Our analysis makes two contributions. The first is to develop an evolutionary model that tests the validity of Foster's assertion that demotivating beliefs arise in zero-sum environments. The model allows for production that has varying degrees of zero-sumness. While an individual's effort increases their output, a portion of their output comes at the cost of another player with whom they are paired. The 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).

We allow individuals to hold incorrect, demotivating beliefs of varying strength that discount the perceived return to their effort. We also allow for neutral or correct beliefs that correspond to the true return to effort. 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. 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.[2] While individuals choose effort based on their (subjective) beliefs, cultural evolution is driven by (true) material payoffs.

Within this framework, Foster's hypothesis can be reframed as: Do demotivating beliefs emerge in zero-sum environments? And are they stronger in more zero-sum settings? Our model shows that despite the distortions in effort generated by demotivating beliefs, such beliefs can still emerge and spread when economic interactions are zero-sum in nature. Incorrect demotivating beliefs arise and, over time, come to dominate the population, reaching fixation. Meanwhile, accurate non-demotivating beliefs are driven to extinction.

Core to these results is the fact that for zero-sum interactions, equilibrium effort exceeds the socially optimal level due to the negative externality that an individual's success imposes on others. Demotivating beliefs mitigate this by reducing individual effort, thereby improving (static) social efficiency. However, reduced effort also diminishes individual material payoffs, which drive the evolutionary process. As a result, demotivating beliefs do not automatically arise. We show

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[2]An alternative label to 'demotivating beliefs' that could be used throughout is 'demotivating values,' and it is these values that are formed through cultural evolution.

that they emerge only under conditions of positive assortative matching – such as homophily, culturally similar communities, or group-level selection – which occurs when individuals with similar cultural beliefs are geographically or socially clustered. In such environments, the direct cost of holding a demotivating belief is outweighed by the benefit of being matched with others who share the belief and, therefore, do not engage in excessive competition.

More broadly, we find that within a society with a given degree of zero-sumness, there is an intensity of demotivating belief that maximizes an individual's income. As a result, the model predicts a hump-shaped (strictly concave) relationship between the strength of demotivating beliefs and economic welfare. However, when considering subjective well-being – that is, an individual's perceived payoff, inclusive of the demotivating belief – the relationship is markedly different. For a given level of zero-sumness, subjective well-being is typically maximized at the true (non-demotivating) belief. Moreover, we find a strictly convex and generally decreasing relationship between the strength of demotivating beliefs and subjective well-being. Intuitively, this occurs because demotivating beliefs cause individuals to perceive their situation as worse than it is, thereby lowering their subjective well-being.

Having derived hypotheses about cross-individual variation within a setting with a set degree of zero-sumness, we next examine the model's predictions across environments with varying degrees of zero-sumness. The model predicts a positive relationship between the zero-sumness of an individual's environment and the strength of their demotivating beliefs. However, in contrast to predictions within a fixed zero-sum environment, the model also predicts that greater zero-sumness of the environment – and the resulting demotivating beliefs – are associated with lower material welfare and lower subjective well-being. These negative relationships arise primarily because zero-sum interactions directly reduce both objective and subjective payoffs.

The paper's second contribution is empirical. Having formalized Foster's arguments, we turn to the data to test the model's predictions. We begin by analyzing data collected in Kananga, an urban hub and provincial capital in the Democratic Republic of the Congo (DRC). Home to approximately 1.6 million people originating from villages and towns across the region, the city hosts a large and diverse population. Despite its size, Kananga remains pre-industrial: 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 within the urban landscape.

We use this pre-industrial urban setting to test the model's prediction of a relationship be-

tween the zero-sumness of a person's environment, their demotivating beliefs, and their material welfare. Our analysis draws on two samples: a 200-person survey conducted in 2015 and a 1,000-person survey from 2019. We use the 2015 sample to develop our zero-sum measure and explore its relationship with demotivating beliefs. We then validate and replicate the findings in the larger 2019 sample.

To measure the zero-sumness of a respondent's environment, we use multiple survey questions asking whether various types of gains – earnings, profits, wealth, gains in trade, power, and happiness – come at the expense of others. We then use principal components analysis to identify and distill a single factor that captures the extent to which a person views their environment as being zero-sum, which serves as our baseline zero-sum measure. We validate this measure using several strategies. First, we compare it with respondents' expectations in vignette-based scenarios, finding that individuals with a higher zero-sum measure are more likely to predict zero-sum outcomes in the vignettes. Second, we also compare the measure to pre-determined covariates that are likely indicators of a more zero-sum environment. We find that individuals with a history of worse employment conditions or lower rainfall in their village of origin are more likely to perceive their current environment as zero-sum.

We then examine the relationship between the zero-sumness of a person's environment, demotivating beliefs, and material welfare. First, we estimate the relationship between zero-sum perceptions and the demotivating beliefs emphasized in Foster's ethnography – specifically, envy and traditional religious beliefs, commonly referred to as 'witchcraft.' In both samples, respondents who perceive their environment as more zero-sum are more envious of others' success and more likely to hold traditional religious beliefs. Consistent with the model's predictions, we also find that stronger zero-sum perceptions are associated with lower material welfare.

Given the correlational nature of our findings, we also implement an experiment to causally identify the effects of a zero-sum environment. Within the 200-person sample, we invited groups of participants to visit a lab and randomly varied the monetary payment (endowment) they received before participating in other behavioral games. In the zero-sum treatment, they completed an effortful task, and their relative rank in the task outcome determined their endowment. Only one person per group could receive the highest payment. In the non-zero-sum condition, endowments were assigned randomly, with replacement, and independently of any ranking. All participants could receive the highest payment. Participants then played a Joy of Destruction

game, where they could reduce another player's payoff at a personal cost. This decision was private – unobserved by others – but players knew each other's identities. We find that participants were more likely to reduce the payoff of those with higher baseline endowments in the zero-sum treatment but not in the non-zero-sum treatment. These results align with the theory, suggesting that in zero-sum environments, norms of envy and spite emerge to curb excessive competition.

We then examine the same relationships globally using data from the Integrated Values Surveys (IVS), which is constructed by combining the World Values Survey (WVS) and European Values Study (EVS). Although the survey does not ask about envy or witchcraft, it captures a broader set of demotivating beliefs relevant for more developed countries, which make up the majority of the IVS sample. These beliefs 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. Consistent with the model's predictions, we observe a robust positive association between zero-sum perceptions and demotivating beliefs. While the specific beliefs vary between the Congolese and IVS samples, in both settings, demotivating beliefs co-vary with the perceived zero-sumness of one's environment. We also find that, in line with the model's predictions regarding material welfare and subjective well-being, a more zero-sum environment is associated with lower material welfare, as measured by income, educational attainment, savings, and occupational status. Furthermore, it is associated with lower subjective well-being, as measured by life satisfaction and happiness.

The large size of the IVS sample allows us to test the model's prediction that across individuals within a fixed zero-sum environment, there is a level of demotivating belief that maximizes material welfare. Empirically, we observe a hump-shaped relationship between demotivating beliefs and economic welfare: among individuals with the same degree of zero-sum perceptions, those with an intermediate level of demotivating beliefs have the highest incomes. This pattern holds across all measures of demotivating beliefs. By contrast, the model predicts that within a fixed zero-sum environment, subjective well-being is maximized by the true (non-demotivating) belief, is strictly convex, and generally decreases in the strength of demotivating beliefs. Our findings support this prediction in the IVS data. Among individuals with the same zero-sum environment, those with stronger demotivating beliefs report lower life satisfaction and less happiness.

This paper provides a rare empirical application and test of an evolutionary game-theoretic

model in economics. While much of the existing literature has focused on the evolution of trust and other-regarding preferences, we introduce the concept of a demotivating belief system. Although distorted beliefs also arise in models of motivated reasoning (Bénabou and Tirole, 2006) and misspecified beliefs (Esponda and Pouzo, 2016, Massari and Newton, 2020), our model does not assume psychological motivations or belief misspecification. 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 through cultural evolution.[3] In particular, we build on the approach of Alger and Weibull (2013, 2016) which relies on positive assortativity. A particularly novel aspect of our analysis is that we place some structure on the divergence between material and subjective payoffs and empirically test these predictions.

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). Specifically, they add to research 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), and 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). Our paper helps elucidate the role of demotivating beliefs, their relationship with zero-sum environments, and their implications for economic development.

Our belief-based channel complements and extends 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. Gershman (2015) develops a model in which these beliefs emerge to reduce an individual's output and thereby discourage envious destruction. Consistent with our findings, Gershman (2022a) documents a positive relationship between the 'image of limited good' and witchcraft beliefs, and Gershman (2023) finds a negative relationship between witchcraft beliefs and subjective

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[3]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.

well-being. Our findings also relate to work on sharing norms (Platteau, 2000). For instance, 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 – 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 (forthcoming), which highlights the importance of Foster's insights for contemporary U.S. politics. Their empirical analysis documents relationships between zero-sum thinking and political views, explaining much of the variation not captured by party affiliation. They also show that economic mobility and immigration weaken zero-sum perceptions, while enslavement strengthens them. These relationships provide additional validation for the use of survey-based zero-sum measures, which are central to our empirical analysis.

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, 1962, 1967, 1972). Based primarily 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 get 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. 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."

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, traditional supernatural beliefs, and envy in the DRC. The traditional beliefs, commonly labeled "witchcraft" in Western European cultures, typically serve to discourage effort because there is often suspicion that personal success arose through the use of witchcraft and at the expense of others. Envy and concerns about the envy of others are also common demotivating beliefs. In contemporary post-industrial societies, the specific content of demotivating beliefs differs. But, as noted in the introduction with examples from Scandinavia, Australia, New Zealand, and Japan, a variety of alternative beliefs discourage personal ambition and success.

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. Consider a large population which we approximate as infinite, formally 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 $\Theta = \{\theta_1, \theta_2, \ldots, \theta_n\}$, where the intensity of belief i is $\theta_i \in [0,1]$, $i = 1, 2, \ldots, n$. We view each θ_i as a cultural belief (or trait) rather than the more conventional notion of a belief as a probability distribution over known states of the world. As we shall see, $\theta_i = 0$ is the true belief, and any $\theta_i > 0$ is a demotivating belief. (We could also allow for hypermotivating beliefs $\theta_i < 0$, but such beliefs would not evolve in our setting.) The share of each belief i in the population is denoted by q_i, with the population state denoted by $\mathbf{q} = (q_1, q_2, \ldots, q_n)$ and $\sum_{i=1}^{n} q_i = 1$.

ACTIONS. Individuals are paired and engage in production. The effort exerted by a trait i individual 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.

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 α 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.[4] 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 an individual with trait i when matched with an individual with trait j is

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

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 trait i player chooses production effort x_i to maximize the following subjective payoff:

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

That is, an individual with a 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

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[4]An alternative incomplete-information interpretation is that the environment is zero-sum with probability α. In this case, whatever an individual with trait 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.

of supernatural tax on effort, with believers expecting to lose a fraction θ_i of their output. These belief systems reduce perceived returns to effort and are thus demotivating. The higher the belief intensity θ_i, the more demotivating the belief of individual i.

Maximizing (2) with respect to x_i, we get optimal production effort for each trait i:[5]

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

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).[6] Denote the equilibrium (true) payoff to a trait i individual matched with a trait j individual by

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

By observation, the payoff to i in an i,j match is strictly decreasing in the intensity of i's belief θ_i and strictly increasing in the intensity of j's belief θ_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 σ such that an individual is matched with someone who shares their trait with probability σ and with an individual chosen uniformly at random from the population with probability $1 - \sigma$. There is ample evidence, which we summarize in Appendix B.V, for positive assortativity on cultural traits in human populations, ranging from small-scale hunter-gatherer bands to modern large-scale societies. We also show how this particular population structure can be the outcome of stable matching when individuals can choose whom to match with (Gale and Shapley, 1962).[7]

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[5]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 trait.

[6]Our results are preserved when the fitness function is a convex combination of material and subjective payoffs.

[7]Another interpretation is that σ 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 σ is then the likelihood of a within-population match.

Given an index of assortativity σ, the cultural fitness of belief i is:[8]

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

B. *Cultural Evolution*

The evolution of beliefs in the population is given by a dynamic 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 $q_j > 0$,

$$
F_i(\mathbf{q}) \gtreqless F_j(\mathbf{q}) \iff \frac{\frac{dq_i}{dt}}{q_i} \gtreqless \frac{\frac{dq_j}{dt}}{q_j}.
$$

That is, if the payoff to trait i is higher than the payoff to trait 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 θ^* is in the set of beliefs, then eventually, the entire population will hold this belief. Formally:*

(i) *If the set of beliefs Θ 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, $\lim_{t\to\infty} q^0(t) = 1$.*

(ii) *If the set of beliefs Θ 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.

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[8]Since x_i^* is independent of α, the fitness of each belief i does not depend on individuals having accurate perceptions about the degree of zero-sumness.

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 α.[9] These results do not depend on the specific form of the payoff monotone cultural dynamic. In addition, even when $q^*(0) = 0$, Corollary 1 in Appendix A shows that evolution will select a belief intensity in support of $\mathbf{q}(0)$ that is approximately equal to θ^*.

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 (α is large) and there is a high degree of assortative matching (σ is large), the interactive effect dominates. Demotivating beliefs evolve and internalize part of the negative externalities in such environments.

These results are related to Alger and Weibull's (2012) work on *Homo moralis* and altruistic preferences. Altruistic preferences and our notion of demotivating beliefs are behaviorally equivalent since both cultural traits can produce the same effort choices. However, they differ in how they respond to the zero-sumness of the environment, which yields distinct empirical predictions.[10] We establish this in Appendix B.II. 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 for 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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[9]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 $\theta^* = \sigma\alpha$.

[10]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 θ_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:

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

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 θ.*

The proposition, which holds regardless of the initial condition $\mathbf{q}(0)$, shows that there is a demotivating belief ($\theta^* = \sigma\alpha$) that maximizes i's material welfare. Deviations from θ^* in either direction reduce material welfare. In other words, there is a hump-shaped relationship between material welfare and the intensity of demotivating beliefs.

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

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

Proposition 3 . *Demotivating Beliefs and Subjective Well-Being. Subjective well-being at time t is strictly decreasing in the intensity of demotivating beliefs θ if $\theta < 1 - \sigma\alpha$. Otherwise, it is increasing in the intensity of demotivating beliefs. Subjective well-being is also strictly convex in θ. 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 θ, as long as the most intense demotivating belief in the set of beliefs is not too intense: $\max \Theta \leq 1 - \sigma\alpha$. Otherwise, subjective well-being is increasing

for the highest values of θ. Even when $\max \Theta > 1 - \sigma\alpha$, numerical examples show that subjective well-being rises only slightly for higher values of θ, even with high degrees of positive sorting (see Figure A1).

Regardless of the shape of the function, subjective well-being is highest 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. Even for hunter-gatherers, who exhibit a high degree of positive assortativity on cultural traits, estimates of σ are typically well below 0.5 (Smith, Larroucau, Mabulla and Apicella, 2018, Henrich, 2018). 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 θ 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 $1 - \theta$, which makes people feel they are doing worse than they actually are. This affective cost is hump-shaped in θ, causing subjective well-being to be typically decreasing in θ. Thus, Propositions 2 and 3 predict a divergence between material welfare and subjective well-being. These are testable predictions that we take to the data.

D. *Comparative Dynamics across Populations*

Thus far, we have considered a population interacting in an environment characterized by a fixed degree of zero-sumness, α. 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 comparing populations interacting in environments with different degrees of zero-sumness. This allows us to derive cross-population predictions, which we also take to the data.

Consider a finite set of populations indexed by $k \in \{1,2,\ldots,K\}$. The degree to which the environment faced by population k is zero-sum is α^k, and the populations are ordered such that $k > k'$ implies $\alpha^k > \alpha^{k'}$. To focus on the degree of zero-sumness α^k, we assume each population has the same index of assortativity $\sigma > 0$ and set of beliefs Θ.[11]

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[11]We assume unchanging α^k. If we were to allow the environment to change, all results would apply regardless of the history of α^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:

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

where x_i^* is given by (3), $W_i^k(t)$ is given by (5), and $\hat{W}_i^k(t)$ is given by (6). If we also assume a *regular environment* where the set of beliefs is the discrete grid $\Theta = \left\{0, \frac{1}{\Delta}, \frac{2}{\Delta}, \ldots 1\right\}$ and the initial state $\mathbf{q}(0)$ has full support on Θ, we can then state three propositions. First, demotivating beliefs vary with the zero-sumness of the environment as follows:

Proposition 4 . *Zero-Sum Environments and Demotivating Beliefs. Consider a regular environment with a sufficiently fine set of beliefs (Δ 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.*

Second, effort and material welfare vary with zero-sumness as follows:

Proposition 5 . *Zero-Sum Environments and Economic Outcomes. Consider a regular environment with a sufficiently fine set of beliefs (Δ large). If cultural evolution is allowed enough time to operate, the mean effort and material welfare will be lower in populations with higher degrees of zero-sumness.*

Third, subjective well-being varies with zero-sumness as follows:

Proposition 6 . *Zero-Sum Environments and Subjective Well-Being. If, in addition to the conditions of Proposition 5, $\sigma \leq \frac{1}{2}$ 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.*

Hence, under the stated conditions, there exists a finite time T such that for all $t \geq T$, $\theta^k(t)$ is strictly increasing in α^k and $X^k(t)$, $W^k(t)$, and $\hat{W}^k(t)$ are strictly decreasing in α^k. That is, where a population interacts in a more zero-sum environment, it will eventually hold more intense demotivating beliefs, and, as a consequence, exert less effort, have lower material welfare, and experience lower subjective well-being. 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 intuition behind the proposition's additional condition for the prediction of 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. 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 σ and the degree of zero-sumness α^k are large, the third effect dominates, and subjective well-being can rise with α^k. As noted, empirically, this is unlikely because estimates of σ in human populations are typically below 0.5 (Smith et al., 2018, Henrich, 2018). Moreover, numerical examples indicate that $\hat{W}^k$ only increases slightly with α^k and on a small part of the domain (see Figure A2).

Propositions 4-6 also have implications for the relationship between demotivating beliefs, economic outcomes, and subjective well-being across populations, which we summarize as follows.[12]

Proposition 7 . *Demotivating Beliefs, Economic Outcomes, and Subjective Well-being.* *Under the conditions of Propositions 4-6, 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 $\hat{W}^k(t) < \hat{W}^{k'}(t)$.*

That is, mean effort, material welfare, and subjective well-being are all strictly decreasing in a population's mean demotivating belief.

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 (Proposition 7). This is due to the variation in zero-sumness across populations, leading to both more intense demotivating beliefs and lower material welfare.

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[12]Propositions 4–7 deliver comparative statics *from any initial condition* as long as sufficient time has passed. They do not require $t \to \infty$.

We now take the predictions from our theory to the data. Propositions 2 and 3 concern the effect of varying demotivating beliefs for a given zero-sumness of the environment. Proposition 2 predicts a hump-shaped relationship between demotivating beliefs and income when looking within an environment with a fixed degree of zero-sumness. By contrast, Proposition 3 suggests that happiness is maximized by the true (non-demotivating) belief $\theta = 0$ and is generally decreasing in the strength of one's demotivating belief. Together, the two propositions predict a divergence between material welfare and subjective well-being.

Propositions 4–6 examine variation across environments with varying degrees of zero-sumness. Proposition 4 predicts that a more zero-sum environment will increase the prevalence of demotivating beliefs in the population. Propositions 5 and 6 demonstrate that, as a consequence, reduced effort, lower levels of material welfare, and worse subjective well-being should be found in more zero-sum environments. An implication, which is summarized in Proposition 7, is that a stronger presence of demotivating beliefs should be associated with lower levels of effort, lower material welfare, and lower subjective well-being.

We test these predictions in two settings. The first is a pre-industrial setting in the DRC, similar to that studied by Foster. Here, we use information from surveys and experiments, gathered through our fieldwork. The second is an industrialized global sample that is beyond what Foster considered. The sample, which relies on publicly available survey data from the WVS and EVS, provides a much larger sample and sufficient variation to test all predictions of the model, including those concerning cross-individual variation in an environment where α is fixed (Propositions 2 and 3).

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

A. *Data Collection*

Our empirical analysis draws on two samples from Kananga, the capital of the Kasaï-Central province in the Democratic Republic of the Congo (DRC), collected in 2015 and 2019. The city has a population of roughly 1.6 million.

The 2015 sample includes approximately 200 individuals, while the 2019 sample includes about 1,000 individuals. Respondents were randomly selected, subject to inclusion criteria ensuring ad-

equate ethnic representation. All surveys were conducted face-to-face at respondents' homes. We use the 2015 sample to develop and validate our measure of the zero-sumness of the environment and to examine its relationship with demotivating beliefs and material welfare (Propositions 4 and 5) as well as the effect of demotivating beliefs on material welfare (Proposition 7). We then replicate these patterns in the larger 2019 sample.[13] We also conducted a lab experiment in 2015 that randomly varied the zero-sumness of the environment, allowing us to assess whether the observed relationships are plausibly causal.

The years in which these two surveys were administered offer another source of variation relevant to our theory. Between mid-2016 and late-2017, a violent conflict swept through the region, claiming an estimated 5,000 lives.[14] The conflict triggered a substantial influx of foreign aid. For the first time, major NGOs such as Médecins Sans Frontières, the International Rescue Committee, and Handicap International established operations in the city. Unlike the 2015 survey, the 2019 survey took place after the conclusion of the violence and at the height of the influx of foreign aid, which, at least anecdotally, created a less zero-sum environment. For this reason, our empirical analysis reports results disaggregated by survey wave, in addition to pooled estimates (with survey year fixed effects).

B. *Measuring a Zero-Sum World*

Central to our analysis is the extent to which the world is zero-sum, denoted by α. Since we cannot directly observe the zero-sumness of each respondent's environment, we measure their perception instead. While perceived α is an imperfect proxy, this poses no conceptual issues, as our theoretical results hold even if individuals form biased beliefs about the zero-sumness of their environment.[15] The challenge is therefore empirical – specifically, how well perceptions of zero-sumness align with reality. Fortunately, substantial evidence shows that these perceptions are shaped by the actual zero-sum nature of the world. For instance, in the United States, zero-sum perceptions strongly correlate with factors that shape the zero-sumness of the environment,

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[13]Appendix S provides further details on survey design and sampling.

[14]A local militia known as the Kamuina Nsapu contested the national government. Although most violence occurred in rural villages, the militia seized land near Kananga, including the airport, and there was active fighting in the city in early 2017.

[15]Demotivating beliefs are shaped through a dynamic process driven by α, and individuals' (mis)perceptions of α do not influence this process.

including economic growth, intergenerational mobility, immigration, and enslavement (Chinoy et al., forthcoming). We further validate this relationship in our empirical setting in Section 4.C.

We measure respondents' perceived α using six survey questions designed to gauge the extent to which they believe that the gains achieved by an individual or group come at the expense of others. Each question presents respondents with two contrasting statements, asking how much they agree with one over the other. For example, *In Kananga, people only make money when others lose money*, versus *In Kananga, no one needs to lose money for others to make money.* All six statement pairs are reported in Table 1.

After being told the two statements, respondents then choose one of the following options: "agree strongly with statement 1," "agree with statement 1," "agree with statement 2," or "agree strongly with statement 2." For each question, we assign a score ranging from 1–4, increasing with the extent to which the response reflects a zero-sum belief. We then apply principal component analysis (PCA) to construct an index of zero-sumness based on the first principal component, which explains 35% 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, with similar magnitude (columns 1 and 2). This consistency is informative. Ex-ante, it is unclear whether there exists a generalized perception – or "worldview" as Foster describes it – of zero-sumness that applies equally 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 perspective across these different domains and settings.[16]

In the 200-person sample, we included additional zero-sum questions, introducing new scenarios (e.g., farming) and more varied language (e.g., "created" vs. "taking from others"; "exploiting others" vs. "without exploiting"; "helps people" vs. "hurts people"). We then constructed an additional measure of zero-sum views by incorporating these four questions. The PCA estimates for this extended measure are shown in column 3 of Table 1. The variables generally load as expected.[17] Our measure of zero-sum is very similar whether we use six or ten questions. Their correlation coefficient is 0.98. All of the findings we report using our baseline six-question

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[16]It may seem surprising that happiness is viewed as zero-sum, given that, in principle, everyone can be happy. However, if happiness is determined primarily by prestige, power, income, and/or wealth – which are perceived as zero-sum – then it is natural that happiness will be perceived as being zero-sum.

[17]The factor loadings are close to zero for the wealth-related questions that use the phrases "created" versus "taking from others" and "exploiting others." This suggests that, consistent with Foster, respondents do not perceive individual wealth as literally being stolen. Instead, they view the system as having "limited good."

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)
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
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
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
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
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
1. Gaining happiness requires taking it away from others 2. It is possible for everyone to be happy	0.456	0.336	0.436
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
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
1. Most wealth is created without exploiting others 2. Most wealth is obtained by exploiting others			0.049
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
Eigenvalue	2.067	2.169	2.209
Proportion of variance explained	0.345	0.362	0.221
Observations	205	984	193

Notes: The table reports the estimated factor loadings from three 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 and 1,000-person samples, respectively. Column 3 reports the factor loadings of the first principal component using the set of 10 questions for the 200-person sample.

zero-sum index are similar if we instead use the ten-question index.

C. *Validating the Zero-Sum Indices*

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

First, we compare the distribution of zero-sum perceptions across the two surveys. Given the unprecedented inflow of foreign aid before the 2019 survey, we expect that period to be perceived as less zero-sum than 2015. For residents of Kananga, the aid may have been seen as "enlarging the pie," enabling gains for many, which mirrors Foster's notion of "treasure" – a non-zero-sum resource, where one person's gain does not come at another's expense. Consistent with this view, we observe a substantial shift in the distribution of zero-sum indices (Figure E3). The mean

zero-sum perception falls from 0.372 in 2015 to 0.158 in 2019.[18]

Second, we compare our survey measures to a revealed measure of zero-sum views. In the 200-person sample, respondents were presented with vignettes paired with illustrations to enhance comprehension.[19] In one scenario, shown in Figure E4a, respondents were asked about two women, Kapinga and Tshilomba, who sell bananas. On day 1, Kapinga sells 10 bananas, and Tshilomba sells 20. On day 2, Kapinga sells 20 bananas. Respondents were then asked how many bananas they thought Tshilomba sold on day 2, with options of 10 or 40. If respondents perceived sales as zero-sum, they would likely assume Tshilomba sold 10 bananas. If they believed that sales were not zero-sum, they might expect Tshilomba's sales to also double, meaning she sold 40 bananas. A second vignette, shown in Figure E4b, presents an analogous scenario with two farmers growing maize. The responses to these vignettes align well with the zero-sum indices: respondents who chose the zero-sum response had significantly higher scores on the six-question index (Figures E4c and E4d) and the ten-question index (Figures E4e and E4f).

Third, we examine the relationship between zero-sum perceptions and factors that are likely to influence the actual zero-sum nature of the environment. In the 200-person survey, we collected data on the employment history of respondents and their families. Drawing on Foster's observation that pre-industrial economic occupations, such as farming, were more zero-sum than employment in modern sectors,[20] we explore whether households with recent formal employment, compared to those in agriculture or unemployment, report their environment as being more zero-sum. We create formal employment indicator variables for the respondent, their mother, and their father. Each is negatively associated with the zero-sumness of a respondent's environment (Table C1, columns 1–6). Alternative measures that capture recent employment (i.e., whether the respondent got a job in the past five years or whether any member of the nuclear family had a job in the past five years) also reveal a negative relationship between formal employment and zero-sum perceptions (columns 7–10).

Given potential concerns about the endogeneity of current or recent employment, we also examine the relationship between rainfall in respondents' village of origin during the first 20 (and

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[18]While the means differ, the standard deviations are fairly similar, although slightly higher in 2019. This is consistent with heterogeneous exposure to aid, which did not reach all residents equally, generating more variation in perceived zero-sumness.

[19]See Appendix S.III for the full text of the vignettes.

[20]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).

30) years of their lives and zero-sum perceptions. Higher rainfall is expected to benefit farming (the primary activity in villages), resulting in a less zero-sum environment. We expect this to matter for respondents even when they no longer live in the village due to enduring familial and social connections, along with norms of redistribution which are strong in the region. Indeed, respondents from villages with higher rainfall during their early years perceive the world as less zero-sum (Table C2). Overall, these different analyses reinforce that zero-sum perceptions tend to reflect the actual zero-sumness of a person's environment.

D. *Estimating Equations and Regression Estimates*

We now empirically examine Proposition 4, the relationship between the zero-sum index and demotivating beliefs, specifically envy and witchcraft.

In our model, we do not specify the definition of a group. Since our samples comprise 200 or 1,000 people drawn from a total population of 1.6 million, we assume 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 estimate the following individual-level equation:

$$y_i = \alpha_{e(i)} + \beta \, \text{Zero Sum}_i + \mathbf{X}_i \mathbf{\Omega} + \epsilon_i, \tag{8}$$

where i indexes individuals. The dependent variable y_i captures one of our demotivating beliefs of interest, either envy or indigenous religious beliefs. The term $\alpha_{e(i)}$ 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. Our baseline estimates use robust standard errors, while auxiliary estimates allow for various forms of non-independence. 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 sample (panel A), the 1,000-person sample (panel B), and the pooled sample combining both (panel C).[21] Our first outcome is envy, measured as the first principal component of four survey questions.[22] The first three questions inquire about feelings of frustration when people succeed easily, resentment towards

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[21]As we report in Tables E12, 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 ten-question zero-sum index available in the 200-person sample and introduced in Section 4.B.

[22]The precise wording of each question is provided in Appendix S.I, with factor loadings for the first principal component reported in Table E8.

a neighbor's success, and feelings of injustice towards those perceived as highly talented. The fourth question asks whether the respondent sometimes wishes that rich and powerful people would lose their advantage.[23]

We find a positive and statistically significant relationship between zero-sum perceptions and envy in both samples, with or without ethnicity fixed effects (columns 1 and 2). The magnitudes are also meaningful. Since both variables are measured in indices without natural units, we interpret effect sizes using a one-standard-deviation increase in the zero-sum index. In the 200-person sample, this yields $0.191 \times 0.333 = 0.064$, which is 20.2% of the mean ($0.064/0.317$) and 33.0% of the standard deviation ($0.064/0.194$). In the 1,000-person sample, the effect is $0.189 \times 0.156 = 0.029$, equal to 19.1% of the mean ($0.029/0.152$) and 19.1% of the standard deviation ($0.029/0.152$). While sizable in both samples, the estimated effects are consistently smaller in the 2019 data, a pattern that holds across specifications. This is consistent with our expectation. The evolutionary model generates predictions based on long-run differences in environmental zero-sumness. By contrast, the 2019 aid surge was temporary and likely distributed in ways that were idiosyncratic and uncorrelated with the underlying structure of the environment. As a result, classical measurement error in the key independent variable may attenuate the observed relationship.

We next examine 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 assessing belief in traditional religion, frequency of prayer to ancestors, participation in ancestor rituals, and feelings of closeness to non-Christians in Kananga.[24] Consistent with Proposition 4, we find a strong positive relationship between zero-sum perceptions and witchcraft beliefs in the 200-person sample. Again, we find a weaker association in the 1,000-person sample. The estimate is much smaller in magnitude and is statistically insignificant.

An empirical implication of Proposition 4 is that belief systems imposing less psychological tax on effort and success (i.e., low θ) should have a weaker hold in more zero-sum environments (i.e., high α). One such belief system is Christianity, which has gained prominence in recent

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[23]These variables capture respondents' feelings of envy rather than their belief about others' envy. We operate on the premise that a primary determinant of belief about others' behavior is one's own behavior. Therefore, we use respondents' feelings of envy as a proxy for their perceptions of others' envy.

[24]See Appendix S.I for the wording of the questions and Table E9 for the principal component factor loadings.

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 index, 0-1	0.333***	0.345***	0.320***	0.273***	-0.146**	-0.143**	0.466***	0.416***
	(0.064)	(0.077)	(0.093)	(0.091)	(0.064)	(0.067)	(0.123)	(0.123)
Mean dependent variable	0.317	0.317	0.223	0.223	0.750	0.750	-0.527	-0.527
Std. dev. dependent variable	0.194	0.194	0.264	0.264	0.192	0.192	0.385	0.385
Mean independent variable	0.371	0.371	0.373	0.373	0.373	0.373	0.373	0.373
Std. dev. independent variable	0.191	0.191	0.189	0.189	0.189	0.189	0.189	0.189
Observations	204	204	197	197	197	197	197	197
R squared	0.118	0.166	0.073	0.128	0.062	0.118	0.078	0.148
Panel B: 1,000 Person Sample (2019)								
Zero-sum index, 0-1	0.156***	0.154***	0.035	0.035	-0.051***	-0.051***	0.086***	0.087***
	(0.025)	(0.026)	(0.027)	(0.027)	(0.016)	(0.016)	(0.033)	(0.033)
Mean dependent variable	0.152	0.152	0.020	0.020	0.871	0.871	-0.851	-0.851
Std. dev. dependent variable	0.152	0.152	0.108	0.108	0.109	0.109	0.171	0.171
Mean independent variable	0.158	0.158	0.158	0.158	0.158	0.158	0.158	0.158
Std. dev. independent variable	0.189	0.189	0.189	0.189	0.189	0.189	0.189	0.189
Observations	984	984	984	984	984	984	984	984
R squared	0.049	0.055	0.025	0.029	0.009	0.017	0.019	0.025
Panel C: Pooled Sample with Survey-Wave FE								
Zero-sum index, 0-1	0.188***	0.184***	0.085***	0.080***	-0.066***	-0.066***	0.151***	0.146***
	(0.024)	(0.025)	(0.026)	(0.026)	(0.017)	(0.017)	(0.034)	(0.034)
Mean dependent variable	0.181	0.181	0.054	0.054	0.851	0.851	-0.797	-0.797
Std. dev. dependent variable	0.172	0.172	0.165	0.165	0.135	0.135	0.252	0.252
Mean independent variable	0.194	0.194	0.194	0.194	0.194	0.194	0.194	0.194
Std. dev. independent variable	0.205	0.205	0.205	0.205	0.205	0.205	0.205	0.205
Observations	1,188	1,188	1,181	1,181	1,181	1,181	1,181	1,181
R squared	0.180	0.188	0.232	0.249	0.126	0.137	0.251	0.267
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 (panel A), the sample of about 1,000 respondents collected in 2019 in Kananga, DRC (panel B), and the pooled sample with survey-wave fixed effects (panel C). 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 age, age squared, gender, and their interactions with age and age squared in all columns. Even columns also include ethnicity fixed effects. Coefficients are reported with robust standard errors in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent levels.

decades across Africa, challenging 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).[25] Moreover, many denominations promote versions of the gospel that encourage hard work and economic ambition (Ranger and Ranger, 2008, Freeman, 2012). Interestingly, the link between zero-sum perceptions and Christianity is also found in Foster's account of Tzintzuntzan, where an accepted source of income that did not generate envy was favors granted by saints (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, prayer frequency, church attendance, and feelings of closeness to Christians in Kananga.[26] In both samples, a more zero-sum view of the world correlates negatively with Christian beliefs (columns 5 and 6). Since most individuals in this setting tend to hold Christian and traditional beliefs simultaneously, we also examine the relative strength of such beliefs, measured as the strength of witchcraft beliefs minus the strength of Christianity beliefs. We find that zero-sum perceptions are associated with a stronger belief in witchcraft relative to Christianity (columns 7 and 8).

Finally, we examine whether the nature of one's beliefs within a single religion is altered by the zero-sumness of the environment. This is particularly relevant for Christianity, which teaches that blessings from God ought to be non-zero-sum, i.e., available to all who are faithful. By contrast, witchcraft beliefs in DRC do not have the same non-zero-sum logic. Examining blessings in traditional religion, therefore, provides an interesting contrast. We estimate variants of equation (2) where the outcome of interest is perceptions of how zero-sum blessings are within Christianity or traditional religion (full details provided in Appendix D.I). The zero-sum index is positively associated with a more zero-sum view of Christian blessings; no such relationship exists within traditional religion (Table D4). In other words, zero-sum perceptions are not only associated with (*i*) weaker Christian beliefs (in absolute and relative terms), but also (*ii*) more zero-sum perceptions of Christian blessings, even conditional on believing in Christianity in the first place.

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[25]We empirically validate this using two survey questions about the perception that blessings from "one's ancestors" and "God" are limited (see Appendix S.II for the exact wording of each question). Respondents were twice as likely to strongly agree that blessings are not limited when asked about "God" rather than "ancestors" (see Figure E5). The results align with qualitative evidence from focus groups, where gains from witchcraft were often described as limited, coming at the expense of someone, and likely to induce envy. In contrast, blessings from God were viewed as resulting from individual devotion and God's grace, which is abundant, does not come at the expense of others, and is less likely to induce envy.

[26]The survey questions and variable construction mimic those about traditional religious beliefs (i.e., witchcraft) and are reported in Appendix S.I. The factor loadings are reported in Table E10.

Robustness and Sensitivity Checks

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 varying levels of zero-sumness); neighborhood and gender (i.e., different genders in different neighborhoods encounter distinct environments); and neighborhoods only (i.e., different individuals in different neighborhoods face different environments). We also produce randomization inference p-values, which do not assume any specific error structure. These alternative approaches, summarized in Table E11, lead to very similar standard errors compared to our baseline (Table 2).

We also test the assumption that relegating the effect of σ to the regression residuals does not bias our estimates. To measure the extent of assortativity (σ), we use the degree of homophily in each respondent's social network. In our 1,000-person survey, we ask respondents to list individuals they would go to (or who would come to them) in nine different situations, collecting information about their links to these individuals. We then create five variables that measure the fraction of connections listed that are for someone in the respondent's: (1) nuclear family, (2) extended family, (3) church, (4) tribe, and (5) religion. We create an aggregate measure of homophily using the first principal component of the five measures.[27] We also create a second similar measure that uses the first principal component using the five variables, but measured as the share of people (rather than connections) listed in each category. Using either measure, we find that controlling for σ does not influence our estimated coefficients for zero-sum perceptions (Table E14). The point estimates and statistical significance remain very similar.

Lastly, we also check how similar our estimates are when only one of the six zero-sum measures is used. Estimates, reported in Table E15 for the pooled sample, show that in general, we come to the same conclusion if any one zero-sum measure is used. The one exception is the question that asks about trade, where the estimates for the religion outcomes become underpowered. This may reflect the fact that most respondents in the sample may have limited familiarity with trade.

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[27]Details about the survey questions are provided in Appendix S.IV, and the factor loadings for the first principal component are reported in Table E13.

E. *Experimental Evidence: Effects of a Zero-Sum Environment on Spiteful Behavior*

To this point, our analysis has been purely correlational. We have presumed that the association between the zero-sumness of a respondent's environment and their demotivating beliefs reflects the causal relationship. In this subsection, we study a lab experiment manipulating the zero-sumness of each participant's environment, which allows us to observe the causal effects of a zero-sum environment on envy and spiteful behavior.

We invited a subset of individuals in the 200-person sample to make two visits to an experimental lab. In all, 124 individuals made both visits and participated in the following activities. Participants arrived in (randomly assigned) groups of eight that were randomly assigned to one of two treatments, which determined how they were allocated an initial endowment.[28] In the zero-sum treatment, participants took a French test, and their endowment was based on their relative ranking within the group. The highest-scoring participant received 15,000 CF, the second-highest received 5,000 CF, and the remaining participants received 500 CF. In this arm, endowments were zero-sum: only one participant could obtain the largest endowment. In the non-zero-sum treatment, endowments were determined by drawing marbles from a basket with replacement. The basket contained 6 grey marbles worth 500 CF, one black marble worth 5,000 CF, and one red marble worth 15,000 CF, giving all participants an equal ex-ante probability of winning, independent of others' outcomes. In this arm, endowments were not zero-sum: all participants could obtain the largest endowment. The distribution of marbles was chosen to balance the share of winners (and average endowments) across the two treatment arms.

An alternative design would be to select marbles in both cases – once with replacement (non-zero-sum) and once without (zero-sum). However, this would diverge from Foster's theory, in which the image of limited good applies to *effortful* tasks but not necessarily to chance-based ones. As noted, Foster argued that "treasure" lies outside the zero-sum framework. If one person discovers treasure, it does not negatively impact others. Thus, our priors were that selecting marbles without replacement would be clearly seen as a non-zero-sum environment. (It is a chance event that does not involve personal effort.) By contrast, the zero-sum arm aligns closely with Foster's 'image of limited good' setting since it involves effort that directly competes with others' to determine outcomes.

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[28]Ultimately, 40 groups had 8 participants, and 8 groups had only 7 participants (because of no-shows).

To measure behaviors related to envy and spite, we administered the Joy of Destruction (JOD) game. The game was designed to measure individuals' willingness to harm others at a personal cost (Zizzo and Oswald, 2001). Each player went one at a time into a room with an enumerator and played several rounds of the game. In each round, participants received 1,000 CF and an envelope containing a form to mark their decision on and a photo of the other player.[29] When the enumerator left the room, the participant chose among three options: (*i*) do nothing, (*ii*) pay 100 CF to *increase* the payoff of the other player by 500 CF, or (*iii*) pay 100 CF to *decrease* the payoff of the other player by 500 CF. Participants played the game in a random order against five randomly selected other players from the group. This setup allows us to observe whether individuals engage in costly, spiteful actions, particularly against those with high endowments.

While not needed to test the relationship between zero-sum and envy, the "increase" option is important to have since otherwise the "decrease" option will tend to be chosen by individuals who simply prefer doing something rather than nothing. The symmetric design of the increase/decrease options helps ensure that choices to reduce others' payoffs can be interpreted as reflections of envy or spite. It also allows us to test whether a zero-sum environment affects altruism towards the other player as well.

The experimental results are summarized in Figure 1, which reports the proportion of decisions made of each type (decrease, do nothing, increase) depending on whether player 2 had won and whether the environment was zero-sum or not. The raw data show a clear pattern: when matched with another player who won, participants were more likely to decrease the other player's payoff in the zero-sum arm but not in the non-zero-sum arm (Figure 1a). The zero-sum endowment activity appears to cause a sizable share of participants to shift from doing nothing to decreasing winners' payoffs.

We also more formally test this relationship with the following equation:

$$I_{ij}^{\text{Reduce}} = \alpha\, I_{ij}^{\text{Zero Sum}} + \beta\, I_{j}^{\text{Winner}} + \delta\, I_{ij}^{\text{Zero Sum}} \times I_{j}^{\text{Winner}} + \mathbf{X}_i \mathbf{\Gamma} + \mathbf{X}_j \mathbf{\Omega} + \varepsilon_{ij}, \tag{9}$$

where i indexes participants and j their partner in the JOD. I_{ij}^{Reduce} is an indicator that equals 1 if player i (player 1) chose to reduce the payoff of player j (player 2). $I_{ij}^{\text{Zero Sum}}$ indicates whether players i and j were in the zero-sum treatment arm, and I_{j}^{Winner} indicates whether player j was a

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[29]We implemented both a symmetric version of the game (where both players made decisions and this was commonly known) and an asymmetric version where the other player did not make a decision about them. The results for both types are similar, so we pool them in the analysis and include a game-type indicator variable.

Figure 1: The Causal Effect of Zero-Sumness on Spiteful Behavior: Joy of Destruction Game – Raw Data

(a) Decrease player 2's payoff   **(b)** Do nothing   **(c)** Increase player 2's payoff
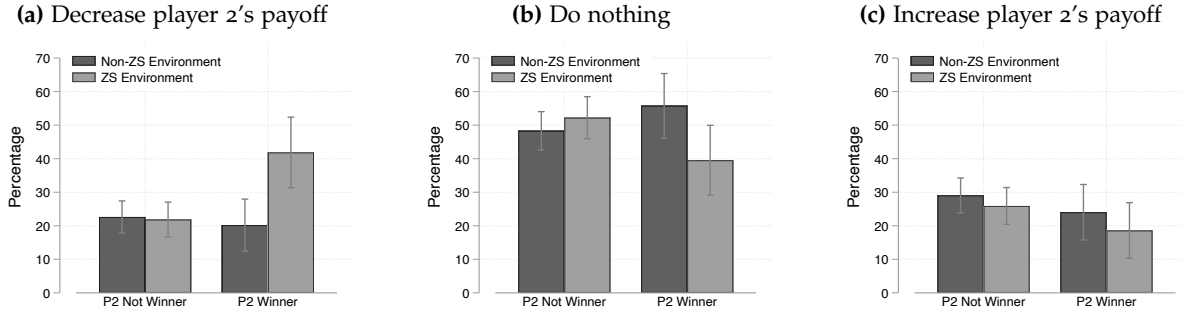
Notes: The figure reports the proportion of player 1's decisions (increase, do nothing, decrease) as a function of their endowment treatment and whether player 2 was a winner, $N = 733$. The x-axis indicates whether player 2 was a winner or not. The bar shading indicates the endowment treatment: i.e., whether the environment was zero-sum or not. Means are reported along with 95% confidence intervals.

"winner" in the endowment activity (i.e., received 15,000 CF or 5,000 CF). The vector $\mathbf{X}_i$ contains gender, age, age squared, and whether player i was a winner in the endowment activity, and $\mathbf{X}_j$ includes gender, age, age squared, education, an indicator for having a salaried job, a continuous measure of their success as perceived by anonymous others,[30] an indicator for the two players being coethnics, and an indicator for the symmetric version of the game (where both players know player 2 will face a symmetric decision about them). Our coefficient of interest is δ, which reflects whether winners are targeted more with spiteful behavior when the environment is zero-sum.

We estimate equation (9) using OLS, and the results are presented in Table 3. In the non-zero-sum environment, participants were not more likely to reduce the payoff of winners. However, in the zero-sum environment, participants reduced the payoff of winners significantly more often, even though they incurred a personal cost by doing so. Specifically, participants reduced winners' payoffs 22% of the time in the non-zero-sum treatment compared to 44% of the time in the zero-sum treatment – a 22 percentage point difference. The results are robust to including controls for characteristics of player 1 (column 2), player 2 (column 3), and the interaction between player 2 and the randomly assigned zero-sumness of the environment (column 4). The last two specifications are important because winning a French test could signal status, creating another potential motivation to reduce the payoff of player 2 (beyond their zero-sum gain in the endowment activity). Reassuringly, even when we control flexibly for the education level,

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[30]Specifically, during household surveys we asked respondents to evaluate the perceived success of ten randomly selected anonymous (but real) individuals based on their characteristics (sex, age, tribe, education level, job, and travel history). We then estimate the relationship between success and each of these characteristics and use the coefficients to predict the perceived success of every individual in our sample according to their characteristics.

Table 3: The Causal Effect of Zero-Sumness on Spiteful Behavior: Joy of Destruction Game – Full Results

	Dependent Variable: Chose to Decrease Player 2's Payoff, 0-1					
	(1)	(2)	(3)	(4)	(5)	(6)
Player 2 is Winner	-0.024	-0.056	-0.060	-0.061	0.004	0.004
	(0.045)	(0.046)	(0.046)	(0.046)	(0.045)	(0.045)
Player 2 is Winner × Zero Sum	0.224***	0.224***	0.266***	0.232**	0.210**	0.180**
	(0.081)	(0.081)	(0.088)	(0.090)	(0.086)	(0.089)
Zero Sum Environment	-0.008	-0.011	-0.022	-0.173	-0.015	-0.081
	(0.055)	(0.053)	(0.054)	(0.331)	(0.079)	(0.305)
Mean dependent variable (control)	0.22	0.22	0.22	0.22	0.22	0.22
Observations	733	733	733	733	733	733
Clusters (individuals)	124	124	124	124	124	124
R squared	0.023	0.063	0.074	0.078	0.465	0.467
Player 1 Controls	N	Y	Y	Y	N	N
Player 1 FE	N	N	N	N	Y	Y
Player 2 Controls	N	N	Y	Y	Y	Y
Player 2 Controls × Zero Sum	N	N	N	Y	N	Y

Notes: This table examines how random variation in the zero-sumness of the endowment creation activity shapes spiteful action in the "joy of destruction" game. This game was administered at a lab setting in 2015 in Kananga, DRC. The table reports estimates of equation (9). In all columns, the dependent variable is an indicator variable that equals one if the participant chose to reduce the payoff of the other player by 500 CF at a cost of 100 CF. The explanatory variables are indicator variables for (*i*) whether the player 2 was any kind of winner in the endowment activity, i.e., received 15,000 CF or 5,000 CF, (*ii*) the endowment activity was zero-sum, and (*iii*) the interaction of the two. An observation is a round of the JOD game, and a cluster is an individual participant who completed both lab visits. Player 1 controls include gender, age, age squared, and whether Player 1 was a winner in the endowment activity. Player 2 controls include gender, age, age squared, education, an indicator for having a salaried job, a measure of their success as perceived by anonymous others, an indicator for the symmetric version of the game, and an indicator for when the two players are coethnics. Standard errors are clustered at the respondent level. ***, **, and * indicate significance at the 1, 5, and 10 percent levels.

employment status, and perceived success level of player 2, there remains a large increase in the probability of reducing player 2's payoff caused by the zero-sum endowment activity.

Given that participants made two lab visits with different endowment creation activities, our most demanding specification includes individual fixed effects. The magnitude of the effect remains large and statistically significant, with and without player 2 characteristic $times$ zero-sum interactions (columns 5 and 6). The estimates are also robust to estimating the results using a multinomial logit with all three choice categories as the outcome (increase, reduce, do nothing) with do nothing as the omitted category (Table E5). The estimates show, reassuringly, that while a zero-sum environment affects the respondent's decision to reduce the payoff of winners, which we interpret as driven by jealousy, it does not affect the respondent's decision to increase the payoff of winners, a form of altruism outside of our model.

In all, the experimental results provide evidence that a zero-sum environment triggers envy and spiteful behavior toward those who succeed. This is consistent with Proposition 4 of the model, which predicts a positive relationship between the zero-sumness of an environment and the presence of demotivating beliefs.

F. *Effects on Material Welfare*

The model predicts that a more zero-sum environment, and the stronger demotivating beliefs that it generates, will lower material welfare (Propositions 5 and 7). In DRC, these outcomes exhibit little variation because most of the sample is living at or very near subsistence. They are also difficult to measure because most workers do not earn a reliable wage. Nonetheless, for completeness, we examine several proxies of material welfare, including education, employment, and self-reported relative wealth. The education variable takes a value of 0 if the respondent never attended school, 1 if they attended kindergarten, 2 if they attended primary school, 3 if they attended secondary school, and 4 if they attended university. The employment variable is a binary variable that takes the value of 1 if the respondent is employed. The perceived relative wealth variable takes a value of 1 to 5, corresponding to the step (i.e., quintile in the wealth distribution) the respondent perceives they are on.[31]

We examine an index based on the first principal component of education, employment, and perceived relative wealth (Table E6). Consistent with Proposition 5, we observe a negative relationship between zero-sum perceptions and material welfare (columns 1–2). Consistent with Proposition 7, there is a large and statistically significant negative relationship between envy of others' success and well-being in both samples (columns 3–4), and between witchcraft belief and well-being is also always negative (columns 5–6). For most relationships, the estimates are slightly underpowered affecting significance in some specifications. However, despite being slightly underpowered, the estimates are consistent with the predicted negative relationship between zero-sum perceptions or demotivating beliefs and material welfare.[32]

5. Global Evidence from the Integrated Values Surveys

The DRC samples allow us to empirically validate Propositions 4–7, which concern the relationships between the zero-sumness of the environment, demotivating beliefs, and material welfare in a pre-industrial society comparable to the one Foster studied. However, because of the limited cross-society variation, we could not test Propositions 2 and 3, which require analyzing subsets

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[31]The exact wording of the question was: "Imagine 5 steps, where on the bottom, the first step, stand the poorest people, and on the highest step, the fifth step, stand the richest. Which step are you on today?" Respondents are also shown a visual aid that illustrates the steps.

[32]Estimates using each component of the index separately reveal that the signs of nearly all estimates are as expected, although precision decreases slightly (Table E7).

Table 4: Zero-Sum Perceptions, Demotivating Beliefs, and Material Welfare in the DRC

	Dependent Variable: Principal Component-Based Measure of: Education, Employment, and Perceived Relative Wealth					
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: 200 Person Sample (2015)						
Zero-sum index, 0-1	-0.044	-0.047				
	(0.058)	(0.062)				
Envy of others' success, 0-1			-0.125**	-0.139**		
			(0.056)	(0.057)		
Witchcraft beliefs, 0-1					-0.184***	-0.200***
					(0.039)	(0.040)
Mean independent variable	0.372	0.315	0.315	0.315	0.217	0.217
Std. dev. independent variable	0.191	0.191	0.193	0.193	0.255	0.255
Mean dependent variable	0.606	0.606	0.606	0.606	0.606	0.606
Std. dev. dependent variable	0.173	0.173	0.172	0.172	0.173	0.173
Observations	205	205	224	224	217	217
R squared	0.203	0.239	0.239	0.279	0.286	0.324
Panel B: 1,000 Person Sample (2019)						
Zero-sum index, 0-1	-0.054*	-0.044				
	(0.029)	(0.029)				
Envy of others' success, 0-1			-0.178***	-0.161***		
			(0.034)	(0.035)		
Witchcraft beliefs, 0-1					-0.060	-0.054
					(0.050)	(0.050)
Mean independent variable	0.158	0.158	0.158	0.158	0.020	0.020
Std. dev. independent variable	0.189	0.189	0.156	0.156	0.107	0.107
Mean dependent variable	0.540	0.539	0.539	0.539	0.539	0.539
Std. dev. dependent variable	0.171	0.171	0.170	0.170	0.170	0.170
Observations	984	984	1,019	1,019	1,019	1,019
R squared	0.098	0.133	0.117	0.148	0.092	0.128
Panel C: Pooled Sample with Survey-Wave FE						
Zero-sum index, 0-1	-0.051*	-0.048*				
	(0.026)	(0.026)				
Envy of others' success, 0-1			-0.164***	-0.153***		
			(0.029)	(0.029)		
Witchcraft beliefs, 0-1					-0.124***	-0.120***
					(0.032)	(0.033)
Mean independent variable	0.195	0.187	0.187	0.187	0.054	0.054
Std. dev. independent variable	0.206	0.206	0.174	0.174	0.162	0.162
Mean dependent variable	0.551	0.551	0.551	0.551	0.551	0.551
Std. dev. dependent variable	0.173	0.173	0.172	0.172	0.173	0.173
Observations	1,189	1,189	1,243	1,243	1,236	1,236
R squared	0.129	0.149	0.150	0.168	0.135	0.156
Demographic Controls	Y	Y	Y	Y	Y	Y
Ethnicity FE	N	Y	N	Y	N	Y

Notes: This table examines the relationship between zero-sum views, envy of others, witchcraft beliefs, and material welfare in two samples in Kananga, DRC. The dependent variable is the first principal component of education, employment, and perceived relative wealth relative to others in Kananga. The first explanatory variable is the first principal component of the six zero-sum statements. The second and third are the same measures of envy and witchcraft beliefs studied in Table 2. We include controls for age, age squared, gender, and its interactions with age and age squared in all columns and fixed effects for the respondent's ethnicity in even columns. Coefficients are reported with robust standard errors in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent levels.

of observations that face the same zero-sumness of their environment and testing for a non-linear relationship between demotivating beliefs and material welfare and a monotonic relationship between subjective well-being. We now turn to the global analysis which has sufficient data to test all propositions. It also allows us to ask whether Foster's insights hold more generally and not only in small-scale pre-industrial societies.

A. *Data*

We measure the zero-sumness of a person's environment using a question from the World Values Survey (WVS) and European Values Study (EVS), 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 E6, 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 the measure reflects the true zero-sumness of individuals' environments. Because economic stagnation results in a fixed pie and a more zero-sum environment, we examine the relationship between respondents' zero-sum perceptions and the rate of economic growth in a respondent's country during the first 20 (or 30) years of their life (see Appendix C.III for full details). Conditional on country fixed effects, birth year fixed effects, and demographic controls, lower economic growth is associated with a more zero-sum view of the world (Table C3).

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 θ are beliefs about the importance of hard work, economic success, and individual achievement, which are available in the IVS.

We estimate the following equation:

$$Y_{i,c,t} = \alpha_{c,t} + \beta \operatorname{Zero Sum}_{i,c,t} + \mathbf{X}_{i,c,t}\mathbf{\Gamma} + \varepsilon_{i,c,t}, \tag{10}$$

where i indices individuals, c country of residence, and t the year of the survey. $\operatorname{Zero Sum}_{i,c,t}$ 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 beliefs about whether hard work brings success. Respondents report their answers on a 1-10 integer scale. We reorder and normalize the variable so 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."[33] The measure thus increases in the belief that hard work does not pay off. Consistent with Proposition 4, zero-sum perceptions are associated with a stronger belief that hard work is unlikely to bring success (Table 5, 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 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

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[33]The exact wording of this and all other WVS and EVS variables used in the paper are reported in Appendix S.VII.

Table 5: Zero-Sum Perceptions 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 index, 0-1	0.118***	0.077***	0.121***	0.023**	0.024***	0.034***
	(0.014)	(0.013)	(0.014)	(0.010)	(0.005)	(0.004)
Mean dependent variable	0.367	0.697	0.602	0.352	0.391	0.163
Std. dev. dependent variable	0.319	0.459	0.489	0.296	0.290	0.247
Mean independent variable	0.404	0.393	0.394	0.406	0.416	0.405
Std. dev. independent variable	0.307	0.317	0.315	0.297	0.305	0.307
Observations	277,798	55,871	59,052	60,856	151,270	273,803
Clusters	99	50	49	47	78	99
R squared	0.117	0.125	0.178	0.096	0.171	0.116
Demographic Controls	Y	Y	Y	Y	Y	Y
Wave-country FE	Y	Y	Y	Y	Y	Y

Notes: The table reports OLS estimates that are relevant for Proposition 4 of the model. 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 standard errors clustered at the level of country in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent levels.

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 their work.

C. *Zero-Sum Perceptions, Effort, and Economic Outcomes*

We next consider Proposition 5, which predicts that zero-sum environments, by creating demotivating beliefs, will result in less effort and lower material welfare. We consider multiple measures of material welfare. The first is self-reported income on a 1-10 integer scale. The second is the respondent's self-reported economic class: (1) Lower class; (2) Working class; (3) Lower middle class; (4) Upper middle class; and (5) Upper class. The measure takes on the reported integer values. The third is from a question about the net savings of the respondent's family. All three measures are normalized to lie between zero and one and to increase in material welfare. Individuals with more zero-sum perceptions also have lower incomes, lower self-reported socioeconomic class, and less savings (Table 6, columns 1–3). Consistent with the model's prediction, a more zero-sum environment is associated with lower material welfare.

We also examine education, an investment that requires effort but can enhance productivity.

Table 6: Zero-Sum Perceptions and Economic Welfare

	Dependent Variable: Measures of Economic Welfare:					
	Income decile, 0 = bottom decile to 1 = top decile	Class, 0 = lower class to to 1 = upper class	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
	(1)	(2)	(3)	(4)	(5)	(6)
Zero-sum index, 0-1	-0.038***	-0.045***	-0.032***	-0.030***	-0.049***	-0.046***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.007)	(0.007)
Mean dependent variable	0.410	0.421	0.625	0.522	0.446	0.327
Std. dev. dependent variable	0.258	0.245	0.309	0.337	0.346	0.469
Mean independent variable	0.403	0.409	0.406	0.405	0.416	0.415
Std. dev. independent variable	0.306	0.307	0.308	0.309	0.301	0.302
Observations	256,944	207,165	203,716	219,524	116,885	119,888
Clusters	99	90	90	91	79	79
R squared	0.163	0.111	0.091	0.175	0.087	0.109
Demographic Controls	Y	Y	Y	Y	Y	Y
Wave-country FE	Y	Y	Y	Y	Y	Y

Notes: The table reports OLS estimates that are relevant for Proposition 5 of the model 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 standard errors clustered at the level of country in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent levels.

Again, consistent with the model's predictions, respondents who view the world as more zero-sum have lower levels of education (column 4). We also observe a similar negative association with jobs that require investments in human capital accumulation. Stronger zero-sum perceptions are associated with being less likely to be employed in cognitively demanding occupations (column 5) and being less likely to supervise someone at work (column 6).

Finally, we test the prediction from *(i)* of Proposition 7: that demotivating beliefs should be associated with lower material welfare. Consistent with the prediction, we almost universally find a negative and statistically significant relationship between each of the six measures of demotivating beliefs and measures of material welfare (Tables E16 and E17). More zero-sum environments are associated with stronger demotivating beliefs and with lower material welfare, and stronger demotivating beliefs are associated with lower material welfare.

D. *Zero-Sum Perceptions, Demotivating Beliefs, and Happiness*

Proposition 6 predicts a negative relationship between the zero-sumness of an environment and 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 E7. There is a clear negative relationship between viewing the world as zero-sum and reported happiness and well-being, in line with Proposition 6. Estimates of equation (10) for both

Table 7: Zero-Sum Perceptions, Demotivating Beliefs, and Subjective Well-Being

	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 index, 0-1	-0.051***						
	(0.004)						
Demotivating belief, θ		-0.047***	-0.045***	-0.043***	-0.022***	-0.045***	-0.046***
		(0.004)	(0.004)	(0.004)	(0.003)	(0.004)	(0.005)
Mean dependent variable	0.686	0.693	0.653	0.653	0.687	0.707	0.688
Std. dev. dependent variable	0.247	0.245	0.255	0.254	0.237	0.244	0.243
Mean independent variable	0.404	0.370	0.701	0.599	0.366	0.394	0.169
Std. dev. independent variable	0.307	0.321	0.458	0.490	0.299	0.292	0.251
Observations	276,913	381,232	62,055	64,833	261,518	156,835	610,474
Clusters	99	110	53	51	86	78	116
R squared	0.149	0.138	0.187	0.181	0.122	0.123	0.135
Panel B: Subjective Life Satisfaction (1-10) as Dependent Variable							
Zero-sum index, 0-1	-0.641***						
	(0.039)						
Demotivating belief, θ		-0.482***	-0.620***	-0.549***	-0.239***	-0.522***	-0.340***
		(0.040)	(0.058)	(0.058)	(0.035)	(0.061)	(0.042)
Mean dependent variable	6.706	6.790	6.177	6.205	6.873	6.791	6.805
Std. dev. dependent variable	2.360	2.338	2.626	2.600	2.336	2.278	2.370
Mean independent variable	0.405	0.371	0.705	0.600	0.367	0.395	0.169
Std. dev. independent variable	0.307	0.321	0.456	0.490	0.299	0.292	0.251
Observations	277,456	382,023	60,594	64,415	263,495	157,059	615,058
Clusters	99	110	51	50	86	78	116
R squared	0.172	0.159	0.247	0.242	0.157	0.132	0.163
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 that are relevant for Propositions 6 and 7 of the model. This is the relationship between zero-sum perceptions or demotivating beliefs and happiness (panel A) or life satisfaction (panel B). 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 "All things considered, how satisfied are you with your life as a whole these days?," with 1 indicating "Completely dissatisfied" and 10 indicating "Completely satisfied." 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 country-wave fixed effects and demographic controls (age, age squared, gender, age interacted with gender, and age-squared interacted with gender). The estimates reported use all available data. Table E18 reports estimates but only using observations that have a non-missing zero-sum measure, which is relevant for the estimates of columns 2–7. ***, **, and * indicate significance at the 1, 5, and 10 percent levels.

measures of well-being as the outcome confirm this negative and significant relationship between zero-sum perceptions and life satisfaction (Table 7, column 1).

We also explore the relationship between demotivating beliefs and subjective well-being. Proposition 7 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 7, 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.[34]

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[34]The reported estimates use all available data. If one restricts the sample to observations for which we also have the zero-sum measure, the patterns are qualitatively identical (Table E18).

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 (α), we now explore the strength of demotivating beliefs, material welfare, and subjective well-being *within a group k* (with a fixed zero-sum environment).

Proposition 2 predicts an optimal strength of demotivating beliefs θ^* within a group k in an environment of zero-sumness α. Material welfare should be hump-shaped in the strength of demotivating beliefs θ. 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 α, 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" ($N = 254{,}693$) and "how important is work" ($N = 251{,}018$). Figures 2 and 3 report the estimated relationships between demotivating beliefs and income. Consistent with Proposition 2, we observe 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 E8 and E9) and when using alternative measures of demotivating beliefs only available in smaller samples (Figures E10 and E11).[35]

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 α. Figures E12 and E13 confirm that subjective well-being, measured by happiness, is highest for the least demotivating belief and mostly decreasing in demotivating beliefs. We obtain very similar estimates if we measure subjective well-being using life satisfaction (Figures E14 and E15), omit demographic controls or country-wave fixed effects when creating the zero-sum categories (Figures E16 and E17), or use alternative measures of demotivating beliefs (Figures E18 and E19).

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[35]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 2: Relationship Between Demotivating Beliefs (Work Is Not Important) and Income – Holding Constant Zero-Sumness
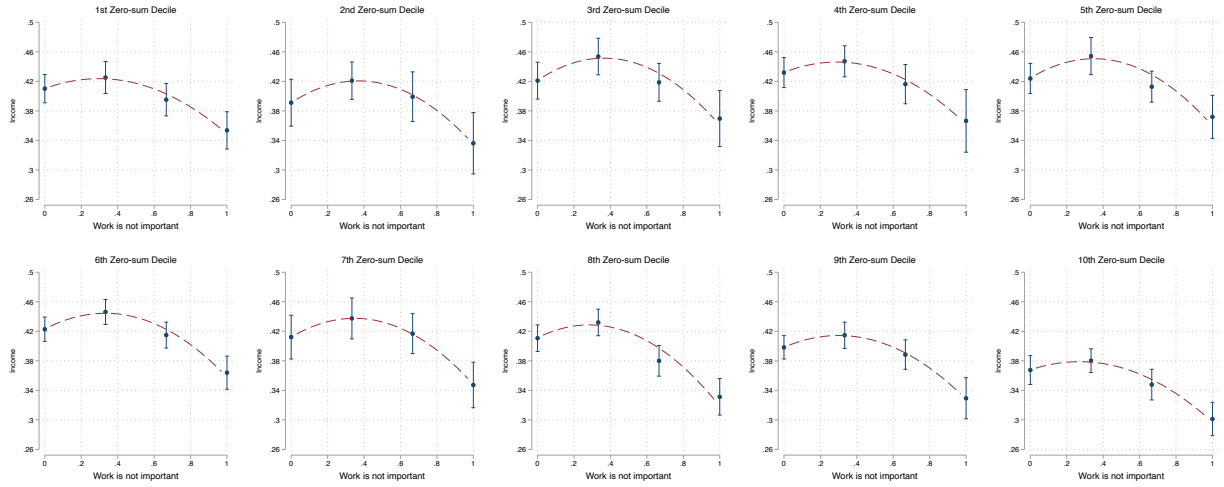
Notes: The figure reports estimated relationships relevant for Proposition 2 of the model. It shows the relationship between respondents' demotivating beliefs and level of income for each zero-sum decile. Also shown is a fitted quadratic and 95% confidence intervals (based on clustering at the level of country) for each point. 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 rescaled to range from zero and one to achieve the demotivating belief used in the figure "Work is not important at all." (N = 251,018).

Figure 3: Relationship Between Demotivating Beliefs (Hard Work Does Not Bring Success) and Income – Holding Constant Zero-Sumness
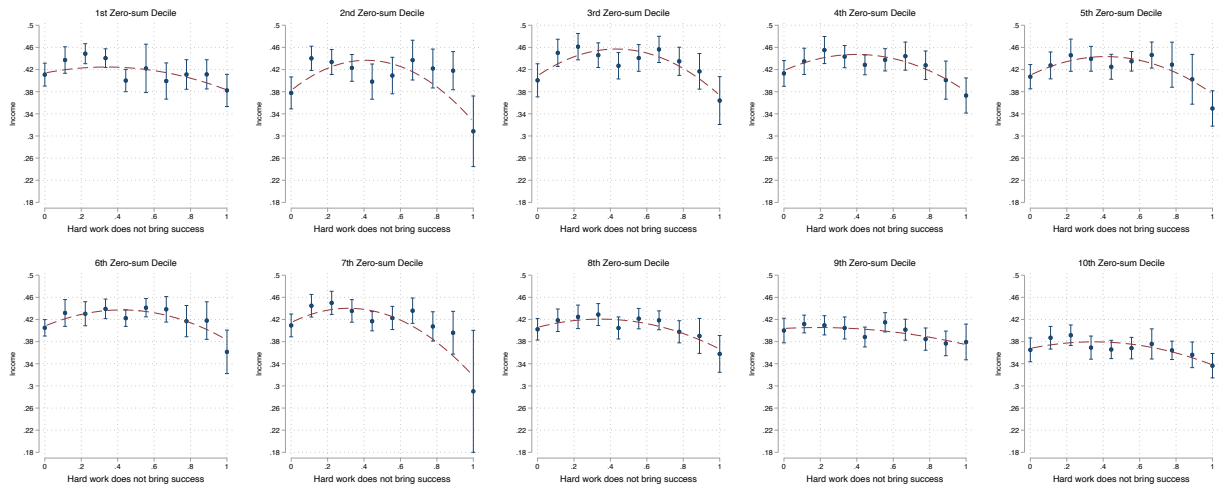
Notes: The figure reports estimated relationships relevant for Proposition 2 of the model. It shows the relationship between respondents' demotivating beliefs and level of income for each zero-sum decile. Also shown is a fitted quadratic and 95% confidence intervals (based on clustering at the level of country) for each point. 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 "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 rescaled to range from zero and one to achieve the demotivating belief used in the figure "Hard work does not bring success." (N = 254,693).

6. 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, respondents with a more zero-sum view of the world appear to hold stronger demotivating beliefs, including envy of the success of others and witchcraft beliefs that cast success as suspicious. In a lab experiment, we provided causal evidence that a more zero-sum environment causes more spiteful behavior toward more successful participants.

Turning to the global Integrated Values Survey sample, we checked the generality of our findings from the DRC and also tested the model's cross-societal predictions. We found 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.

The paper leaves many important questions unanswered regarding the evolution of demotivating belief systems and their interactions with economic development. Under what conditions do zero-sum perceptions over- or under-estimate the true degree of rivalry in the environment? 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

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, "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.

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.

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.

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 Differences," forthcoming. *American Economic Review*.

Ely, Jeffrey C. 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.

Gale, David and Lloyd S Shapley, "College admissions and the stability of marriage," *The American Mathematical Monthly*, 1962, *69* (1), 9–15.

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.

Heifetz, Aviad, Chris Shannon, and Yossi Spiegel, "What to Maximize if You Must," *Journal of Economic Theory*, 2007, *133* (1), 31–57.

Henrich, Joseph, "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.

— , "Human Cooperation: The Hunter-Gatherer Puzzle," *Current Biology*, 10 2018, *28* (19), R1143–R1145.

Mansour, Selima Ben, Elyès Jouini, and Clotilde Napp, "Is there a "pessimistic" bias in individual beliefs? Evidence from a simple survey," *Theory and Decision*, 2006, *61* (4), 345–362.

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 Dignity: Why Economics Can't Explain the Modern World*, Chicago: University of Chicago Press, 2010.

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 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.

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.

Smith, Kristopher M, Tomás Larroucau, Ibrahim A Mabulla, and Coren L Apicella, "Hunter-gatherers maintain assortativity in cooperation despite high levels of residential change and mixing," *Current Biology*, 2018, *28* (19), 3152–3157.

Spolaore, Enrico and Romain Wacziarg, "The Diffusion of Development," *Quarterly Journal of Economics*, 2009, *124* (2), 469–529.

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.

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.

Zizzo, Daniel John and Andrew J. Oswald, "Are People Willing to Pay to Reduce Others' Incomes?," *Annales d'Économie et de Statistique*, 2001, *63-64*, 39–65.