Zero-Sum Traps: The Evolution of Productivity-Stifling Beliefs and Economic Development*

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Abstract:

We study the evolution of beliefs that discourage productive effort. Such beliefs include concerns about the envy of others, beliefs in the importance of luck for success, disdain for competitive effort, and traditional supernatural beliefs in witchcraft or the evil eye. We introduce a model that shows that when interactions are zero-sum in nature, meaning that the gains for one individual tend to come at the expense of another, demotivating beliefs that reduce effort can arise and improve economic outcomes but reduce subjective well-being. Across societies, the model predicts a positive relationship between zero-sum thinking and demotivating beliefs and a negative relationship between zero-sum thinking and both material welfare and subjective well-being. We test the predictions of the model using data from two samples in the Democratic Republic of Congo and from the World Values Survey. We find a positive relationship between zero-sum thinking and the presence of demotivating beliefs, such as concerns about envy and beliefs in witchcraft (in the DRC) or less value placed on success and weaker beliefs in the importance of hard work for success (globally). We also find that zero-sum thinking is associated with lower incomes, less educational attainment, less financial security, and lower levels of life satisfaction.

Keywords: Cultural evolution, zero-sum, income, education, happiness.

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1. Introduction

Beliefs and values that discourage effort and productive activity are surprisingly common across time and space. They often take the form of warnings against, and even punishment for, personal ambition and success. In the Nordic countries, the laws of Jante state, 'Du skal ikke tro at du er noget,' which means 'don't think that you are anything'. In Australia and New Zealand, a 'tall poppy' syndrome is said to lead others to cut down those who stick out in terms of personal achievement. In Japan, a common phrase warns that 'the nail that sticks out will be hammered down'. In Ghana, the phrase 'PHD syndrome' is used, where PHD stands for 'pull him down'. 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, Balliol, for exhibiting "effortless superiority." Other forms of demotivating belief systems include pessimistic beliefs in an 'unjust world' (Benabou and Tirole, 2006), anti-materialistic beliefs that reduce the enjoyment of consumption (Flouri, 1999), and supernatural beliefs such as the evil eye and witchcraft beliefs that act as a kind of psychic tax on success (Gershman, 2014, 2015). But if such beliefs reduce productive effort, why are they so prevalent both historically as well as across the world today?

We study this question using a combination of theoretical and empirical analysis, in particular by building on new approaches in evolutionary game theory and ideas and insights from anthropology on the 'image of limited good,' first highlighted by George Foster (Foster, 1962, 1965, 1967, 1972). According to Foster, beliefs in the zero-sum nature of economic transactions create a sense of rivalry and envy that influences economic choices and overall performance. In the small-scale traditional societies he studied, Foster described that the dominant belief is that if one person does better, somebody else must do worse, or if someone gets ahead, someone else must fall behind. He hypothesized that this zero-sum worldview directly or indirectly inhibited entrepreneurial activity and economic development.

Modeling the cultural evolution of belief systems, we study the emergence and spread of demotivating beliefs in zero-sum environments, where some benefits to one person are obtained at the expense of others. We find that when there is a zero-sum component to economic interactions, demotivating beliefs can emerge and spread, reducing incentives for productive effort and thereby inhibiting economic development. The more zero-sum the economic environment, the

more intense the demotivating beliefs that evolve.

In the model, members of a population are matched and engage in production. While an individual's effort increases their output, a fraction α of their output comes at the cost of their partner. We refer to α as the degree to which the environment is zero-sum. This production function captures a range of economic interactions with different degrees of rivalry, ranging from merchants competing for the same fixed set of customers (a completely zero-sum situation) to business partners working together in an enterprise but ultimately dividing the profits from their joint endeavor (a partially zero-sum situation). In the model, individuals can hold one of many demotivating beliefs θ_i, each of which amounts to an incorrect perception about the return to efforts. They can also have a neutral belief system ($\theta_i = 0$) that conforms to the true return to efforts. While individuals choose effort based on subjective beliefs, cultural evolution is based on the (true) material payoffs.

Despite the distortion in behavior generated by (incorrect) demotivating beliefs, we show that such beliefs can survive and spread when there is positive assortativity and economic interactions are zero-sum. In such environments, the direct cost of holding a demotivating belief is overwhelmed by the benefit of being matched with other players who hold demotivating beliefs and do not compete aggressively against others. A similar logic applies to social efficiency. Where interactions are mainly zero-sum, effort primarily redistributes resources and is thus socially inefficient. Hence demotivating belief systems improve short-run efficiency by limiting excessive competition within groups. We also show that demotivating beliefs can reduce subjective well-being — despite improving welfare, which is based on the true (objective) payoffs — by making an individual's situation seem worse than it is. However, when looking across societies and environments with different degrees of zero-sumness, the model predicts a positive relationship between zero-sum thinking and demotivating beliefs and a negative relationship between zero-sum thinking and both material welfare and subjective well-being.

Having developed a theoretical understanding of Foster's arguments, we then turn to the data. We begin by analyzing a modern and less-industrialized population within the city of Kananga, located in the Democratic Republic of the Congo. We examine two samples: a 200-person sample collected in 2015 and a 1,000-person sample collected in 2019. The smaller 2015 sample is used to validate the measures of zero-sum thinking, traditional supernatural beliefs, and beliefs in Christianity used in our analysis by looking at a broader set of measurements. The 2019 sample,

which focuses on a more limited set of core variables but comprises a much larger sample, allow us to validate the findings from the earlier sample.

Using the two Congolese samples, we examine the link between zero-sum thinking and the emergence of the demotivating beliefs that were the focus of George Foster's research: beliefs about envy and traditional supernatural beliefs (which in the West is commonly called 'witchcraft'). We measure zero-sum thinking through survey questions that ask respondents their views of the link between those who are better off (in terms of wealth, income, business, trade, power, and happiness) and those who are worse off (in the same domains). We measure a person's belief in witchcraft through a series of survey questions. Using similar survey questions, we also measure belief in the competing belief system, Christianity.

In both samples, we find robust evidence that respondents with a more zero-sum view of the world report being more envious about the success of others, are more likely to hold traditional religious beliefs, and are less likely to hold Christian beliefs. Among these relationships, the strongest association is the negative correlation between zero-sum views and Christianity. Although Foster was initially motivated by rural pre-industrial society, given the presence of Christianity and other big god religions in contemporary industrialized societies, our findings suggest that his insights might also be applicable today in the developed world.

Motivated by this, we examine these same relationships globally using data from the World Values Survey (WVS), which contains measures of zero-sum thinking, religiosity, and demotivating beliefs. We first verify that the negative relationship between zero-sum thinking and beliefs in Christianity we found in the Congolese samples holds in the global WVS sample. We confirm that belief in Christianity is associated with less zero-sum thinking in the WVS. Other big god religions (Islam, Hinduism, etc.) are also associated with less zero-sum thinking. By contrast, beliefs in traditional indigenous religions or not having a religious belief are associated with more zero-sum thinking. In short, we find that the expanded WVS estimates are very much in line with our findings from the Congolese sample.

Because the WVS does not include information on envy, we cannot look at the relationship between envy and zero-sum thinking. Instead, we look at a broader set of demotivating beliefs, including those particularly relevant to the modern industrialized world. These include weaker beliefs in the value of work, the returns to effort (e.g., whether success is primarily determined by hard work), the importance of being successful, and that receiving money from others is

humiliating. We find a robust positive association between zero-sum thinking and these measures of demotivating beliefs.

The global WVS sample also allows us to test the comparative static predictions of our model in terms of economic outcomes and subjective well-being. Consistent with predictions, we find that more zero-sum thinking is associated with lower income, less educational attainment, fewer savings, and lower occupational status. It is also associated with lower life satisfaction and reported happiness. We also test the model's prediction that arises from the fact that for a given degree of zero-sumness, there is an optimal level of demotivating belief, which suggests that if one holds constant the zero-sumness of the environment, the relationship between demotivating beliefs and economic welfare should be hump-shaped. Our empirical analysis confirms this prediction in the data. We show that among individuals with the same measures of zero-sum thinking, those with an intermediate level of demotivating beliefs have the highest incomes. The model also predicts that while a hump-shaped relationship should be present for economic welfare, it should not exist for subjective well-being or self-reported happiness, which is confirmed by the data. Studying individuals with the same level of zero-sum thinking, we find a negative relationship between the demotivating beliefs one holds and their self-reported happiness.

In short, by providing a formal theory that builds on Foster's insights and testing the subsequent predictions, we find evidence for the link between zero-sum thinking, demotivating beliefs, and economic activity that he proposed – not only in small-scale societies with low levels of industrialization but also in more industrialized contemporary societies. Moreover, we identify an evolutionary mechanism linking zero-sum thinking, demotivating beliefs, and economic development.

Lastly, motivated by Foster's arguments, we connect demotivating beliefs to long-run innovation by adding technological innovation through learning by doing to our model. We find that demotivating beliefs can have harmful long-term consequences on innovation levels. Since technological innovation arises through productive effort, demotivating beliefs by discouraging this effort can trap a society in a low technological state. When this occurs, demotivating belief systems can act as a *kludge* – an adaptation that compensates for, but does not eliminate and even deepens, inefficiencies in a system (Ely, 2011).

The paper contributes to our understanding of the evolution of belief systems. It departs from the standard economic approach, which treats beliefs as a probability distribution over states

or opponents' types that is updated using Bayes' rule. In his foundational work on Bayesian decision theory, Savage (1951) explicitly limits the theory to 'small worlds' where the set of states and their consequences is known (see Binmore, 2008, King and Kay, 2020, Gigerenzer, 2021). In the large worlds in which economists are interested, individuals have to form working models of their environment. Our broad interest is in how these worldviews or belief systems are formed through cultural evolution, whether they are unbiased or distorted representations of reality, and how they shape economic development (see Collier, 2016, Nunn, 2020).

In modeling the evolution of demotivating beliefs, we draw upon the literature on the evolution of preferences (Alger and Weibull, 2019, Newton, 2018).[1] When preferences are private and individuals are matched uniformly at random in a population, evolution 'endows' individuals with subjective payoff functions that match the fitness function governing the reproduction of preferences (Ok and Vega-Redondo, 2001, Ely and Yilankaya, 2001, Robson and Samuelson, 2007). When preferences are observable, they create public *commitment* and thereby shape the behavior of one's partners in an interaction (Schelling, 1960, Becker, 1976, Frank, 1988). Due to this interactive effect, evolution may select subjective payoff functions that depart from the objective fitness function (Güth and Yaari, 1992, Heifetz, Shannon and Spiegel, 2007). Economists, however, do not typically consider preferences to be observable but rather revealed through behavior (Robson and Samuelson, 2011). Hence, we follow a more recent approach developed by Alger and Weibull (2013, 2016) in which preferences are private, but there is positive assortativity in matching.

Our theory is also related to a recent literature on games in which players have misspecified subjective models of the environment (Esponda and Pouzo, 2016). Massari and Newton (2020) provide an evolutionary analysis of such games. Misspecification is not assumed in our model, but (misspecified) demotivating beliefs arise endogenously even when the true beliefs can be learned. Unlike work on evolutionary implementation (Sandholm, 2005), negative externalities are internalized here not through pricing schemes but rather through changes in beliefs/preferences, akin to Akerlof, Matouschek and Rayo (2020). Our work is also connected to the literature on the evolution of cooperation, especially under cultural group selection (see Cooper and Wallace, 2004, and references therein).

Finally, and perhaps most importantly, our work is related to the economics literature on

[1] See also the related literature on the cultural transmission of preferences (Bisin and Verdier, 2000, 2017).

social institutions (e.g., Young, 1998, 2015). Gershman (2015, 2016, 2020)'s work is considered the seminal work on witchcraft beliefs in economics. On the theoretical front, Gershman (2015) develops a model in which evil-eye and witchcraft beliefs emerge to reduce an individual's output and thereby discourage envious destruction. The study fits into a larger literature on second-best institutions (e.g., Carvalho, 2013, Leeson, 2014, Nunn and Sanchez de la Sierra, 2017). Our findings also speak to Bowles (2006), who shows that sharing norms and other forms of reproductive leveling favor the evolution of cooperation by reducing the gains from defection. We show how a seemingly unproductive cultural trait – i.e., demotivating beliefs equivalent to *incorrect* beliefs that output will be confiscated and burned rather than redistributed – can improve short-run efficiency and proliferate when the economic environment is zero-sum.

Our analysis may help explain "puzzling" behaviors that have been highlighted by development economics, for example the reluctance to take up seemingly profitable investment opportunities. Duflo, Kremer and Robinson (2011) examine fertilizer use among farmers in contemporary Kenya. They document that farmers under-invest in fertilizer use, foregoing higher profits. Their explanation is that farmers are not sufficiently patient or forward-looking and, therefore, make sub-optimal decisions. Our line of inquiry does not assume that decision-makers behave suboptimally; they behave optimally given their beliefs, but these beliefs and the associated subjective payoffs do not necessarily conform to reality.

We now turn to the model and its predictions, followed by the empirical analysis. In the following section, we provide an overview of the hypothesis from anthropology about the importance of zero-sum thinking and the 'image of limited good.' In Section 3, we build on these arguments and insights and develop a formal model which generates predictions that, in Section 4, we then bring to the data, examining a contemporary pre-industrial population in the DRC. In Section 5, we examine the generality of the insights by expanding the empirical analysis to include countries worldwide. Section 7 concludes.

2. The 'Image of Limited Good'

In the introduction, we described examples of demotivating beliefs. At first glance, it is paradoxical that beliefs and value systems that depress productive effort could emerge and survive. To explain why demotivating beliefs have been so prevalent in human history, we start with the work of anthropologist George Foster, which arose from fieldwork in rural Mexico in the 1960s (Foster,

1967). Based on his observations, he concluded that people in most small-scale pre-industrial societies have a "zero-sum" view of the world, which he referred to as the "image of limited good". This model of the world suggests that if one person does better, somebody else must do worse and that if you get ahead, then someone else must fall behind.

This cognitive orientation (as Foster calls it) arises in a world where all essential resources and assets are in limited supply, so the world is literally zero-sum. The land is limited, so more land for one individual means less land for another. The same applies to livestock, wives, authority, and social status. In less-developed societies, markets and technological advances are limited, and the only way for an individual to get ahead is at the expense of others. Therefore, it is logical that this view of the world would arise in many parts of the world and particularly pre-industrial societies that have not yet experienced rapid economic growth.

Although Foster proposed this as a model of rural Mexican society specifically and the root cause of its development problems, the theory was believed to be more general, and he gave many examples from other parts of the world (Foster, 1962, 1967, 1972). Foster also informally connected a zero-sum world to demotivating beliefs and noted that zero-sum societies exhibit an apparent lack of what McClelland (2003) calls a "need for achievement" (Foster, 1965).

The paper's first goal is to combine these insights into a formal model that connects a zero-sum world, demotivating beliefs, effort, economic growth, and material well-being. The second is to take the assumptions of 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 or the evil eye, primarily because of his interest in smaller-scale pre-industrial societies.

Given this, our analysis begins by examining the types of beliefs that Foster had in mind, which continue to be prevalent, especially in the developing world. We analyze the relationship between zero-sum views and envy as well as indigenous supernatural beliefs in the Democratic Republic of the Congo. The latter bundle of beliefs is commonly labeled 'witchcraft,' particularly by those from Western European cultures. One common feature of such belief systems, which causes them to discourage effort, is that unfortunate events are often linked to the success of others. Success is perceived to be due to the use of witchcraft. Thus, if you are particularly successful, others may perceive this to have been achieved through witchcraft, which often also generates feelings of envy. In these cases, it is also believed that envious individuals can harm

others, even unintentionally through supernatural means, if they harbor sufficient greed or envy.

Holland (2001) explicitly draws a connection between the 'Image of Limited Good', zero-sum mentality, and the function of witchcraft, writing:

> The social purpose of witchcraft accusations is to apportion blame for misfortune and to ensure that each member of a community has an equal share in its prosperity – an anthropological concept known as the Image of Limited Good [...]
>
> Although expressed in different ways, the Image of Limited Good prevails throughout Africa and lies at the heart of witchcraft accusations. It is the belief that the pie is limited and one person's success is always at the expense of another's. If an individual prospers beyond the expectations of the others in his community, the success one may be labeled a witch because he is believed to have augmented personal progress via witchcraft and to have impoverished others in the process. (Victims of witchcraft are often relatively prosperous individuals.)
>
> This notion breeds constant envy in traditional communities. Africans believe the witch's damaging hatred comes from her remorseless jealousy of others. And ordinary people are assumed to run a greater risk of being attacked by witchcraft if they become more prosperous than their neighbors because they are inviting not only the jealousy of the village but also of the witch.

In contemporary post-industrial societies, the exact nature of the beliefs may differ. In particular, there are a range of beliefs that explicitly discourage personal ambition and success, such as the previously-noted laws of Jante in Nordic countries, the 'tall poppy syndrome' in Australia and New Zealand, and the belief that 'the nail that sticks out will be hammered down' in Japan. Therefore, we use data from the World Values Survey to examine the relationship between zero-sum views and beliefs that discourage ambition and effort globally.

3. The Model

As described in the introduction, there are a great variety of demotivating belief systems with the common feature being that they reduce incentives for productive effort. We turn to a model that examines the evolution of such beliefs in an environment that is more or less zero-sum in nature.

A. *Basic Set Up*

PLAYERS. Consider a population that is a continuum of mass one. The population could be a village, district, or whole society. 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 $\theta_i \in [0,1]$, $i = 1, 2, \ldots, n$. As we shall see, $\theta = 0$ is the true belief and any $\theta > 0$ is a demotivating belief. The share of each type 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 in production by type i is denoted by $x_i \in \mathbb{R}_+$. The production function is $A\sqrt{x_i}$, where $A > 0$ is the state of technology in the economy (we make this endogenous in Section 6). The cost of production is $\frac{1}{2}x_i$. A positive fraction of tasks $\alpha \in (0, 1]$ 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.[2]

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

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

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

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

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

That is, an individual with belief system i discounts the return to effort by a factor $(1-\theta_i) \in [0, 1]$. This specification captures various kinds of demotivating belief systems. For example, individuals may try to estimate the true return to effort in the economy, as in Benabou and Tirole (2006). In that case, we characterize conditions under which an incorrect belief $\theta_i > 0$, which underestimates the return to effort, can survive and spread. $\theta_i > 0$ could also be the product of a supernatural belief, such as belief in the evil eye, according to which envious individuals cause

[2] An alternative interpretation is that there is a probability α that the environment is zero-sum, and whatever type i gains through production, their partner j loses. With probability $1-\alpha$, i 's effort is truly productive and does not come at the expense of j. Under both interpretations, α measures the degree to which the environment is zero-sum.

harm to others through supernatural forces (Gershman, 2014, 2015). Hence, envy exacts a kind of supernatural tax on effort with believers expecting to lose a fraction θ_i of their output. These belief systems reduce perceived returns to effort and are thus demotivating. The higher is the belief intensity θ_i, the more demotivating is the belief i.

Maximizing (2) with respect to x_i, we get optimal production effort for each type i:

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

Match Payoffs. While individual choices are based on their subjective payoff functions given by (2), evolution is determined by the true payoff function (1). Denote the equilibrium (true) payoff to a type i individual matched with a type j individual by

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

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 highly demotivating belief.

Assortative Matching. The success of trait i is based on its '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 an index of assortativity σ such that a fraction σ of the population matches with its own type and a fraction $1-\sigma$ is matched uniformly at random with another member of the population. 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 so that the share of trait i in the population, q_i, is also the share of group 1. The index of assortativity σ is then the likelihood of a within-population match.

Given an index of assortativity σ, the fitness of trait i is

$$\begin{aligned} F_i(\mathbf{q}) &= \sigma U_{ii} + (1-\sigma)\sum_{j=1}^{n} q_j U_{ij} \\ &= (1-\theta_i)\left(1-\tfrac{1}{2}(1-\theta_i)\right) A^2 - \sigma\alpha(1-\theta_i)A^2 - (1-\sigma)\alpha A^2 \sum_{j=1}^{n} q_j(1-\theta_j). \end{aligned} \tag{3}$$

B. *Cultural Evolution*

The evolution of beliefs in the population is given by a dynamical system operating on the n-dimensional unit simplex. We place only a minimal restriction that the distribution of beliefs/types $\mathbf{q}$ evolves according to a deterministic payoff monotone dynamic. A leading example is the replicator dynamic, which can be the product of natural selection, imitation, or reinforcement learning (Sandholm, 2010). Specifically, for all i, j such that $q_i > 0$ and $q_j > 0$,

$$F_i(\mathbf{q}) \begin{array}{c} > \\ = \\ < \end{array} F_j(\mathbf{q}). \iff \frac{dq_i}{dt} \begin{array}{c} > \\ = \\ < \end{array} \frac{dq_j}{dt}$$

That is, if the payoff to type i is higher than the payoff to type j, then i's population share grows faster.

We focus on two belief intensities. The first is $\theta = 0$, which is the (true) non-demotivating belief. The second is $\theta^* = \sigma\alpha$, which is the belief intensity with the highest relative fitness vis-à-vis any other belief intensity. We denote the population shares of these beliefs at time t by $q^0(t)$ and $q^*(t)$, respectively.

Proposition 1. ***Evolution of Demotivating Beliefs.*** *Cultural evolution selects a belief system as follows:*

(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 the true belief is driven to extinction: $q^0(t)$ converges monotonically to zero. Otherwise, the true belief is driven to fixation: $\lim_{t\to\infty} q^0(t) = 1$.

(ii) If the set of beliefs Θ contains $\theta^* = \sigma\alpha$ and the initial state is such that $q^*(0) > 0$, then the belief θ^* is driven to fixation: $q^*(t)$ converges monotonically to one.

All proofs are in Appendix A.

Even though incorrect, demotivating belief systems, including the evil eye and witchcraft beliefs, 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. This result also helps us to understand part (i). Specifically, 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 $\theta^* = \sigma\alpha$. Note that these results do not depend on the specific form of payoff monotone cultural dynamic.

In addition, even when $q^*(0) = 0$, evolution will select a belief intensity in the support of $\mathbf{q}(0)$ that is approximately equal to θ^*. Defining an interior state $\mathbf{q}(t)$ as one with full support on Θ, we can state the following corollary:

Corollary 1 . ***Evolution of Optimal Demotivating Beliefs.*** *Let $\Theta = \{0, \frac{1}{\Delta}, \frac{2}{\Delta}, \dots 1\}$, where $\Delta \in \mathbb{N}$.*

From any interior initial state $\mathbf{q}(0)$ and for all Δ sufficiently large, $q_i(t)$ converges monotonically to one for some $\theta_i \in \left(\theta^* - \frac{1}{\Delta}, \theta^* + \frac{1}{\Delta}\right)$.

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

The intuition behind the survival of (incorrect) demotivating beliefs is as follows. By discounting the return to effort, the belief $\theta > 0$ depresses productive effort below the first-best level. The direct effect of this distortion is to reduce fitness. There is also a second effect that we call the 'interactive effect,' which is to increase the likelihood of being matched with another believer who exerts low effort. When interactions are primarily zero-sum (α large) and there is a high degree of assortative matching (σ large), the interactive effect dominates the direct effect. In this case, demotivating beliefs evolve to internalize part of the negative externalities in such an environment. Thus, while an individual's view of their world ends up being distorted, the nature of this distortion depends on the environment, incorporating the externalities present in the environment.

C. *Zero-Sum, Cultural Institutions, and Demotivating Beliefs*

Rather than being determined by cultural evolution, the distribution of demotivating beliefs could be directed by a community leader or cultural institutions. We examine this alternative formulation of our model in detail in Appendix B and sketch out its basic logic here.

Suppose the set of beliefs is binary, $\Theta = \{\theta_1, \theta_2\}$, with $\theta_1 = 0$ the correct belief and $\theta_2 = \theta(t)$ a demotivating belief. We assume that a community leader or some impersonal institutions

dynamically tune $\theta(t)$ in a way that maximize the spread of the demotivating belief. This is meant to capture the influence that political or religious leaders can have on beliefs $\theta(t)$ (e.g., Verdier and Zenou, 2018, Carvalho and Sacks, 2021). For religious beliefs, examples would be the church doctrine, such as the Marriage and Family Program of the Catholic Church dating back to the medieval period (Schulz, Bahrami-Rad, Beauchamp and Henrich, 2019). When considering supernatural beliefs, such as beliefs in the evil eye or witchcraft, they can be influenced by chiefs, shamans, and witchdoctors.

We find that the demotivating belief chosen by the leader each period is $\theta^* = \sigma\alpha$, precisely the belief intensity selected by cultural evolution. In addition, as with cultural evolution, the demotivating belief spreads from all interior initial states and achieves fixation. Once again, we find that a population in which interactions are more zero-sum (larger α) will have more intense demotivating beliefs on average.

D. *The Effect of Demotivating Beliefs on Material Welfare and Subjective Well-Being*

We have seen that demotivating beliefs produce interactive benefits at the individual level that enable them to spread through the population. We now turn to the social efficiency of such beliefs. We shall see that demotivating beliefs can improve efficiency by limiting excessive competition.

Our efficiency criterion, which we refer to as 'material welfare', is simply fitness. That is, 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:

$$W_i(t) \quad = \quad F_i\left(\mathbf{q}(t)\right) \quad = \quad \left[\sigma U(x_i^*, x_i^*) + (1-\sigma)\sum_{j=1}^{n} q_j(t) U(x_i^*, x_j^*)\right]. \tag{4}$$

Proposition 2 . ***Demotivating Beliefs and Material Welfare.*** *Regardless of the initial condition* $\mathbf{q}(0)$*, the material welfare at time* t *is highest for the holders of belief* $\theta^* = \sigma\alpha$ *and strictly concave in* θ*.*

Therefore, the demotivating belief θ^* improves welfare by internalizing the negative externalities from production in zero-sum environments. In addition, there is a hump-shaped relationship between material welfare and the intensity of demotivating beliefs.

We can also examine the effect of demotivating beliefs on perceived welfare, which we refer to as 'subjective well-being'. Let us define subjective well-being at time t for a person holding

belief 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:

$$\hat{W}_i(t) \quad = \quad \left[\sigma\hat{U}(x_i^*, x_i^*) + (1-\sigma)\sum_{j=1}^{n} q_j(t)\hat{U}(x_i^*, x_j^*)\right]. \tag{5}$$

Proposition 3 . ***Demotivating Beliefs and Subjective Well-Being.*** *Regardless of the initial condition* $\mathbf{q}(0)$*, subjective well-being at time* t *is strictly decreasing in the intensity of demotivating beliefs* θ *if* $\sigma\alpha < 1/2$ *and strictly increasing in the intensity of demotivating beliefs if* $\sigma\alpha > 1/2$*.*

Therefore, when the degree of zero-sumness and the degree of positive sorting are low, subjective well-being is highest for those holding the true belief ($\theta = 0$) and lowest for those with the most intense demotivating beliefs. When they are high, subjective well-being is always higher for those holding more intense demotivating beliefs. Note that a negative relationship holds for $\sigma < \frac{1}{\alpha}$, so $\sigma < \frac{1}{2}$ is sufficient. This is a fairly mild condition, because in the case of genetic evolution $\sigma = \frac{1}{2}$ means that all interactions are with siblings.

When the likelihood of an own-type match (σ) is less than one half, then subjective well-being is always strictly decreasing in the intensity of demotivating beliefs (regardless of α). In this case, demotivating beliefs emerge and spread (in particular $\theta^* = \sigma\alpha$), raising material welfare *but* reducing subjective well-being. That is, demotivating beliefs make individuals objectively better off, but make them feel worse off. The reason for the disconnect between material welfare and subjective well-being is that demotivating beliefs impose an additional "affective cost" on well-being by discounting the returns to effort by $1 - \theta^*$.

E. *Comparative Dynamics across Populations*

Thus far, we have considered a population interacting in a single environment characterized by a degree of zero-sumness α. In reality, even within a given society, there can be multiple socioeconomic and geographic niches, each with their own degree of zero-sumness. This is certainly true across societies. Thus, to match our empirical analysis, we now generate results for pooled populations of individuals interacting in environments that have different degrees of zero-sumness.

Consider a finite set of populations (or subpopulations) 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, the parameter of interest in the empirical analysis, we assume each population has the same index of assortativity σ and set of beliefs Θ.

Let us begin by analyzing the relationship between zero-sumness and demotivating beliefs 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 $\mathbf{q}^k(t)$. As before, an interior population k state is one with full support on Θ. In addition, define the mean demotivating belief in population k at time t as

$$\theta^k(t) = \sum_{i=1}^{n} q_i^k(t)\theta_i.$$

We can then state the following proposition.

Proposition 4 . ***Zero-Sum Environments and Demotivating Beliefs.*** *Let $\Theta = \{0, \frac{1}{\Delta}, \frac{2}{\Delta}, \ldots 1\}$, where $\Delta \in \mathbb{N}$. Suppose the initial state $\mathbf{q}^k(0)$ is interior for all k and there is positive assortativity, $\sigma > 0$.*

For Δ sufficiently large, there exists a finite time T such that for all $t \geq T$ the mean demotivating belief $\theta^k(t)$ is strictly increasing in α^k.

Therefore, where a population interacts in a more zero-sum environment, it will eventually hold more intense demotivating beliefs. Again, this applies independently of the initial conditions for each population, as long as they are interior. The result also does not depend on the precise form of payoff monotone cultural dynamic.

Let us now turn to the relationship between zero-sumness and economic outcomes across populations; namely, effort and material welfare.

The mean level of effort in population k at time t is

$$\begin{aligned} X^k(t) &= \sum_{i=1}^{n} q_i^k(t) x_i^* \\ &= A^2 \sum_{i=1}^{n} q_i^k(t)(1-\theta_i)^2. \end{aligned} \tag{6}$$

Mean material welfare in population k at time t is the mean (objective) payoff averaged over all interactions:

$$W^k(t) = \sum_{i=1}^{n} q_i^k(t) W_i(t), \tag{7}$$

where $W_i(t)$ is given by (4). We can now show how effort and material welfare vary with the degree to which the environment is zero-sum.

Proposition 5 . ***Zero-Sum Environments and Economic Outcomes.*** *Let* $\Theta = \left\{0, \frac{1}{\Delta}, \frac{2}{\Delta}, \ldots 1\right\}$, *where* $\Delta \in \mathbb{N}$. *Suppose the initial state* $\mathbf{q}^k(0)$ *is interior for all* k *and there is positive assortativity,* $\sigma > 0$.

For Δ *sufficiently large, there exists a finite time* T *such that for all* $t \geq T$ *mean effort* $X^k(t)$ *and mean material welfare* $W^k(t)$ *are strictly decreasing in* α^k.

Hence, worse economic outcomes are produced in more zero-sum environments.

We can also examine the effect of the environment on subjective well-being. Define subjective well-being in population k at time t as the mean subjective payoff given by (2) evaluated at the equilibrium effort levels and averaged over all interactions:

$$\hat{W}^k(t) \quad = \quad \sum_{i=1}^{n} q_i^k(t)\hat{W}_i(t), \tag{8}$$

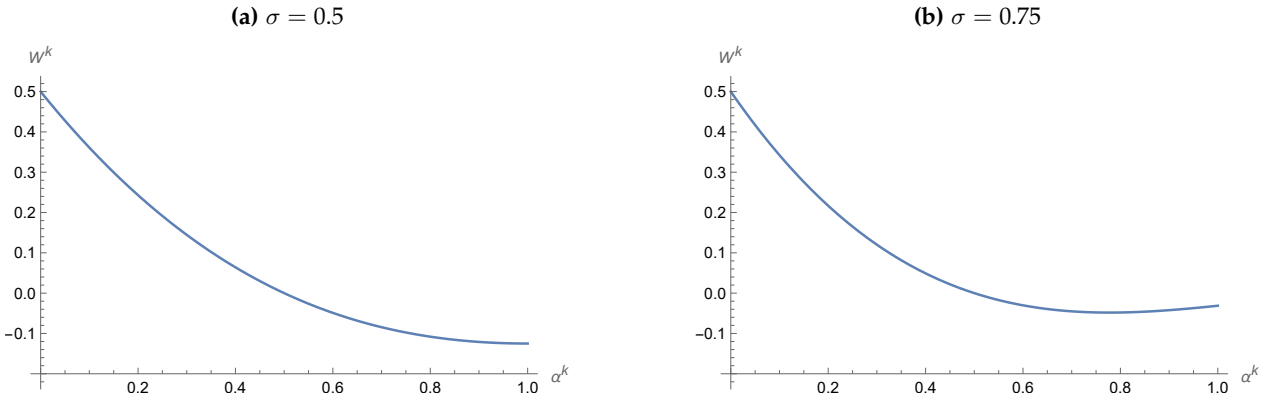
where $\hat{W}_i(t)$ is given by (5). Subjective well-being varies across populations as follows.

Proposition 6 . ***Zero-Sum Environments and Subjective Well-Being.*** *In addition to the conditions of Proposition 5, if* $\sigma \leq \frac{1}{2}$ *or* $\alpha^K \leq \frac{1+\sigma}{3\sigma}$, *then there exists a finite time* T *such that for all* $t \geq T$ *subjective well-being* $\hat{W}^k(t)$ *is strictly decreasing in* α^k.

The reason behind the qualification in Proposition 6 is as follows. There are three effects of a more zero-sum environment on subjective well-being. The first is obviously to increase negative externalities and thereby lower subjective well-being. The remaining two effects depend on the limiting demotivating belief, approximately $\theta^* = \sigma\alpha^k$, being increasing in zero-sumness. Specifically, the second effect is the additional 'affective cost' of demotivating beliefs, i.e., the discounting of 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 of higher zero-sumness is to raise 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. Again, this is unlikely because $\sigma = \frac{1}{2}$ is an implausibly high degree of positive sorting.

This is illustrated by Figure 1 in which we plot the limiting value of subjective well-being, when all individuals hold the belief $\theta^* = \sigma\alpha^k$, as a function of α^k. Panel (a) depicts a case in which subjective well-being $\hat{W}^k$ is strictly decreasing in α^k on [0,1]. Panel (b) shows that even when $\hat{W}^k$

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



is increasing in α^k over part of the domain, the curve does not change dramatically. In both cases, the subjective well-being curve becomes relatively flat for high degrees of zero-sumness, α^k.

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

Corollary 2 . ***Demotivating Beliefs, Economic Outcomes, and Subjective Well-being.***

(i) Under the conditions of Proposition 5, there exists a finite time T such that for all $t \geq T$ mean effort and material welfare are strictly decreasing in demotivating beliefs: $\theta^k(t) > \theta^{k'}(t)$ implies $X^k(t) < X^{k'}(t)$ and $W^k(t) < W^{k'}(t)$.

(ii) Under the conditions of Proposition 6, there exists a finite time T such that for all $t \geq T$ subjective well-being is strictly decreasing in demotivating beliefs: $\theta^k(t) > \theta^{k'}(t)$ implies $\hat{W}^k(t) < \hat{W}^{k'}(t)$.

The theory generates a subtle but important point. If we look within a society that has a given degree of zero-sumness, then demotivating beliefs can increase material welfare within a population (Proposition 2). However, if we look across societies with varying degrees of zero-sumness, then more intense demotivating beliefs are associated with lower material welfare. This is driven by the variation in zero-sumness across populations, which leads to more intense demotivating beliefs and lower material welfare.

Summary of the Theoretical Predictions

We now take the primary predictions that arise from our theory to the data. Propositions 2 and 3 examine the effect of demotivating beliefs on material welfare and subjective well-being when one holds constant the degree to which the environment is zero-sum.

The remaining propositions examine variation across environments with varying degrees of zero-sumness. Proposition 4 predicts that demotivating beliefs such as envy and witchcraft, which were the focus of Foster's original studies, are increasing in the degree of zero-sumness. Propositions 5 and 6 connect zero-sumness to economic outcomes and subjective well-being (or happiness).

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

A. *Data Collection*

Our empirical analysis studies two samples from the city of Kananga in the Democratic Republic of the Congo (DRC). The city is the capital of the Kasai-Central province and is situated at the center of the Kasai region. The first sample of our study is from 2015 and has a sample size of about 200 individuals. The second sample is from 2019 and has a sample size of about 1,000 individuals. While the first sample is smaller, it asks more extensive survey questions that measure respondent's zero-sum views. We use both samples to test Proposition 4 of the model, which links zero-sum thinking to demotivating beliefs.

2015 200-Person Sample

For the 200-person sample, the data were collected between June and September 2015. Sampling occurred in several steps. First, we conducted a screening survey in 85 neighborhoods across the city of Kananga: 60 were randomly sampled, and 25 were intentionally sampled because they were thought to contain ethnic minorities of interest for a different project. The randomly selected neighborhoods were chosen with probabilities proportional to their estimated populations. In each randomly selected neighborhood, enumerators sampled 33 households by walking along each street and counting houses according to a neighborhood-specific skip pattern. In non-randomly selected neighborhoods, enumerators similarly sampled households following a skip pattern. In total, enumerators conducted 2,496 screening surveys, of which 1,964 came from

the 60 randomly chosen neighborhoods ("random sample"), and the remaining 532 came from the non-randomly chosen neighborhoods ("targeted sample").

From this screening survey sample, we then selected the sub-sample for this project. We first excluded three types of individuals: (1) those who had participated in a previous study, (2) those who were planning to travel during the study period, and (3) ethnic groups with fewer than ten individuals in the random sample. We then randomly sampled up to 18 individuals per remaining ethnic group. We always prioritized the random sample, but if we did not reach 18 for a particular ethnic group, we supplemented the respondents from the random sample with those from the targeted sample. The final sample includes 225 individuals: 193 from the random sample and 34 from the targeted sample.

Each respondent was invited to participate in a set of activities at their home. Home activities were conducted during two enumerator visits. During the first visit, enumerators conducted a 90-minute survey. Our measures of zero-sum views and envy are based on this survey. In another home visit, respondents completed a short survey module about religious beliefs. Our measures of the strength of beliefs in witchcraft and Christianity are based on this survey. Of the 227 individuals we selected to participate, 224 completed the first survey and 213 completed the second survey.

2019 1,000-Person Sample

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

We then selected the sub-sample for the analysis from this screening survey sample by applying two criteria of interest for a different project: (1) the respondents' village of origin is in one of the five provinces of the Kasai region (Kasai Central, Kasai, Kasai Oriental, Sankuru or

Lomami), and (2) their ethnicity is one of the four main ethnicities in their province of origin.[3] The final sample includes 1,019 individuals. Each of these respondents was invited to participate in a survey at their home. Our measures of zero-sum views, envy, and strength of beliefs in witchcraft and Christianity are based on this survey.

B. *Zero-Sum Measures*

Central to our analysis is measuring the extent to which the world faced by an individual is zero-sum, which is the parameter α in the model. To measure the extent to which a person's world is zero sum, we rely on respondent's self-reported perceptions of how zero-sum their world is. Specifically, we ask individuals the extent to which gains achieved by an individual or group come at the expense of others, which we measure using survey questions asking respondents to what extent they agree with one of two contrasting statements (statements 1 and 2). Respondents choose one of the following options: 'agree strongly with statement 1', 'agree with statement 1', 'agree with statement 2', 'agree strongly with statement 2'.

Our baseline measure relies on a parsimonious set of six survey questions:

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

For each survey question, we create a variable that takes on an integer value from 1–4 and is increasing in how zero-sum the choice of the respondent is. We then use principal compo-

[3] Luluwa, Luntu, Bindi and Kete in Kasai-Central; Luluwa, Kete, Kuba, Lele in Kasai; and Luba, Tetela, Songe in Kasai-Oriental, Sankuru, and Lomami.

nents analysis to distill an index of a zero-sum mentality, which is based on the first principal component of the factor analysis.

The estimated weights for the first principal component in the 200-person and 1,000-person samples are reported in Columns 1–2 of Table 1. In the 2015 sample of 200 respondents, the first principal component loads positively on all six variables with the following coefficients: 0.46, 0.45, 0.33, 0.32, 0.40, 0.47 (Column 1). In the 2019 sample of 1,000 respondents, the first principal component also loads positively on all six variables with the following coefficients: 0.34, 0.36, 0.41, 0.38, 0.47, 0.47 (Column 2). The fact that the zero-sum measure loads positively and with similar weight on all questions is quite informative. Ex ante, it is not clear whether there is a generalized perception of zero-sum that applies similarly to happiness, power, trade, and income or wealth. The similar weights in the principal component estimates indicate that this underlying zero-sum view of the world applies to different domains in a similar manner.x

The fact that happiness is perceived as being zero-sum might be initially surprising. Surely, everyone can be happy. However, if happiness is derived from prestige, power, income, and wealth, which are viewed as being zero-sum, then it is perfectly logical that one would view happiness as being zero-sum. Beyond this, if preferences are Veblen and based on one's relative standing, then the respondents are right to perceive happiness as being zero-sum in this setting.

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

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

We create a measure of zero-sum views that includes these four additional questions. These are reported in column 3 of Table 1. They load in an expected manner, although the factor loadings

Table 1: Principal Component Analysis for Zero-Sum Indexes

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

Notes: The table reports the estimated factor loadings from four principal components analyses. Each set of estimates are reported in one column with the eigenvalue of the first principal component reported in the bottom panel. The questions used in the principal components analyses are respondent's self-reported perceptions of how zero-sum their world is, and respondents choose from one of four options: 'agree strongly with statement 1', 'agree with statement 1', 'agree with statement 2', 'agree strongly with statement 2'. The first two columns report the first principal components from the 6 question index using the 200 person and 1,000 person samples, respectively. The third and fourth columns report the principal components from 10 question and 12 question indexes for the 1,000 person sample.

are very close to zero for the question that uses that language of "created" versus "taking from others" and the question that uses the phrase "exploiting."

We also add two questions that asks about specific but important domains in this setting; namely, benefits that arise due to blessings from God or from one's ancestors.

- Statement 1: If God is looking out for my brother, he is less likely to be looking out for me.
  Statement 2: If God is looking out for my brother, he is more likely to also be looking out for me.
- Statement 1: If my ancestors' spirits are looking out for my brother, they are less likely to be looking out for me.
  Statement 2: If my ancestors' spirits are looking out for my brother, they are more likely to also be looking out for me.

The principal components analysis with these two additional measures added are reported in column 4 of Table 1. We find that the factor loads positively onto both questions and most strongly on the question that asks about 'God' than the question that asks about ancestors.

Figure 2 shows the bivariate relationships between the three zero-sum measures based on six, ten, or twelve questions. As shown, they are very highly correlated with correlation coefficients that range from 0.93 to 0.98.

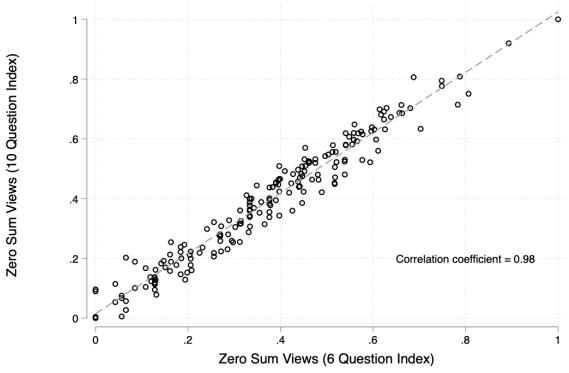
C. *Validating the Zero-Sum Measures in the 2015 Sample*

The zero-sum indexes that we use in the analysis are based on respondent's answers to questions that ask their view about whether certain situation are zero-sum. These ask about different outcomes (happiness, power, gains from trade, income, wealth, crop yields) and different individuals (individuals/people, trading parties, villagers, farmers, citizens in Kananga, and businesses in Kananga). Beyond the correlation between the different survey questions that constitute the zero-sum indexes, we can also validate these measures by examining their relationship with a revealed measure of whether individuals view the world as zero-sum.

In the 2015 sample of 200 respondents, we present the respondent with two situations described in a vignette. The exact text of the vignette questions are provided in Appendix C, but we outline the logic here. Each vignette use an image to help explain the situation. In one scenario, the respondent is asked about two women, named Kapinga and Tshilomba, who sell bananas (Figure 3a). On day 1, Kapinga sells 10 bananas and Tshilomba sells 20 bananas. This is shown in the first column of the vignette. On day 2, Kapinga sells 20 bananas (show in the second column

Figure 2: Correlation Plots of the Zero-Sum Indexes based on 6, 10, and 12 Survey Questions

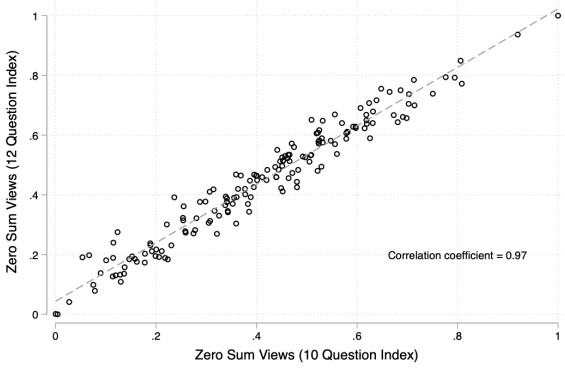
(a) Zero-Sum View Indexes: 6 Questions vs. 10 Questions



(b) Zero-Sum View Indexes: 6 Questions vs. 12 Questions



(c) Zero-Sum View Indexes: 10 Questions vs. 12 Questions



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

of the vignette). The respondent is then asked how many bananas they think Tshilomba sold on day 2. They can choose between 10 and 40 bananas. If one believed that the total amount sold is zero-sum, then one would believe that Tshilomba sold 10 bananas. If one believed that total sales are not zero-sum, then a natural presumption is that there was a demand shock and so everyone sold 100% more than the previous day. According to this (non-zero-sum) logic, Tshilomba would have sold 40 bananas. The second vignette presents an analogous scenario in the case where two farmers are cultivating corn (Figure 3b).

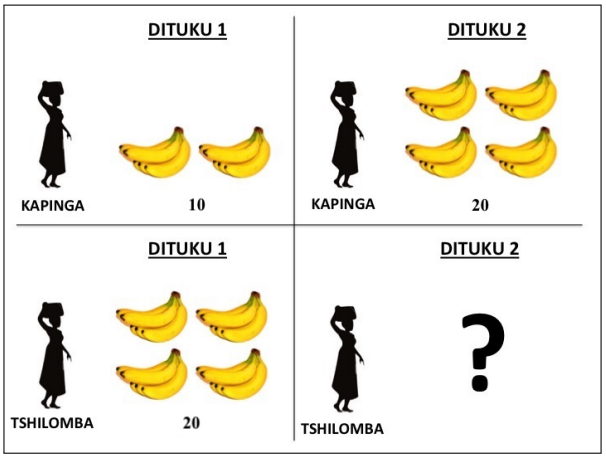
We first use the respondents' responses to the vignette questions as an alternative measure of the extent to which they view the world in zero-sum terms and compare these measures to the zero-sum index constructed from the respondents' answers to the six zero-sum questions. The relationship between the two measures is shown in Figures 3c and 3d, which provide the distribution of the zero-sum index for respondents who chose the zero-sum vignette response and those who chose the non-zero sum response. On average, individuals who chose the zero-sum response have a significantly higher zero-sum index. The vertical lines show the mean difference. Appendix Figures A3a, A3b, A4a and A4b, show robustness to using the alternative zero-sum indexes and that are based on ten (Figures A3a and A3b) and twelve (Figures A4a and A4b) survey questions.

George Foster's research offers an interesting comparison that we study here. In his research, Foster described situations that the Tzintzuntzan perceived as not zero-sum. These were instances in which individuals discovered treasure (e.g., gold and silver) outside the village. While relations within the village were zero-sum, discoveries of treasure outside the village were not. We explore this logic with our vignettes by providing the respondents with a vignette describing two individuals, Kalongji and Tshibuabua, who went to search for diamonds in Tshikapa, a city near Kananga where diamond mining is common.

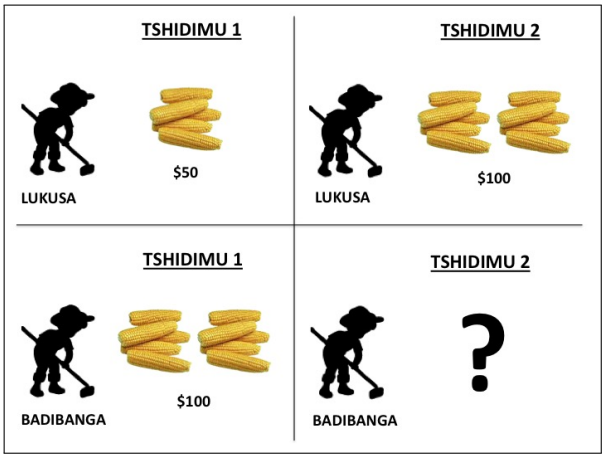
The image for the vignette is shown in Appendix Figure A2a, and the distribution of zero-sum indexes for respondents who chose the zero-sum and non zero-sum answers are reported in Appendix Figure A2b. In contrast to the patterns shown in Figures 3c and 3d and consistent with finding treasure not being perceived as zero-sum, we find that individuals who chose the zero-sum response on average do not have a higher zero-sum index. If anything, the relationship seems to be reversed. Appendix Figures A3c and A4c show robustness to using the alternative zero-sum indexes introduced in Section 4.B and that are based on ten and twelve survey questions,

Figure 3: Zero-Sum Index of Six Survey Questions and Zero-Sum Choice in the Banana and Maize Vignettes

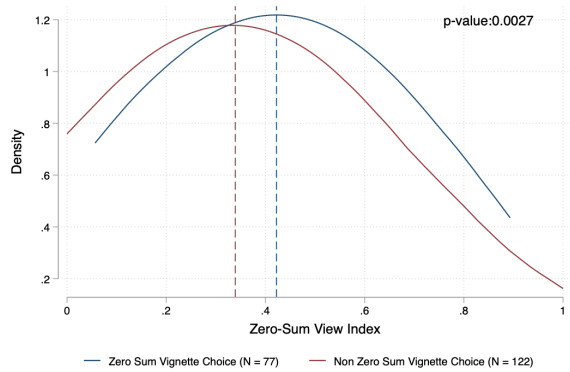
(a) Banana vignette: 10 or 40 bananas?



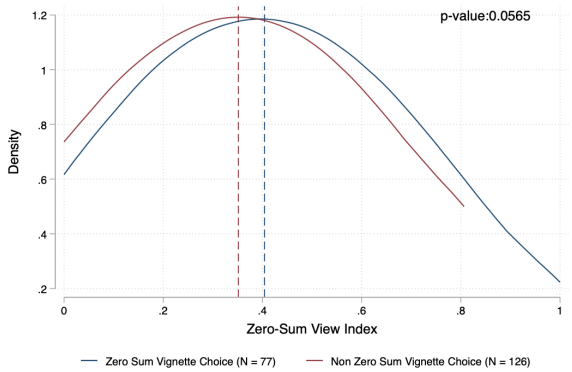
(b) Maize vignette: $50 or $200 of corn?



(c) Banana vignette



(d) Maize vignette



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

respectively.

D. *Findings*

We now examine the relationship between the zero-sum view index and individuals' envy and beliefs in witchcraft. This is motivated by Proposition 4 of the model, which predicts that zero-sum environments lead to more demotivating beliefs in the long-run. We do this by estimating the following equation:

$$y_i = \alpha_{e(i)} + \beta \, \text{Zero Sum}_i + \mathbf{X}_i \mathbf{\Omega} + \epsilon_i \tag{9}$$

where i indexes individuals. The dependent variable y_i captures one of our demotivating beliefs of interest, either envy or indigenous religious beliefs. $\alpha_{e(i)}$ denote ethnicity fixed effects. The vector $\mathbf{X}_i$ includes demographic controls for age, age squared, a gender indicator and its interaction with age and age squared. As theorized 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: $\beta > 0$.

Estimates of equation (9) are reported in Table 2 for the 200-person sample and in Table 3 for the 1,000-person sample. We begin by looking at envy as the outcome of interest, which we measure as the first principal component of four survey questions. 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. The precise wording of the questions is provided in Appendix C. In column 1, we control for age, age squared, gender, and gender interacted with age and age squared. In column 2, we also add ethnicity fixed effects. We find a strong positive relationship between zero-sum view and envy in both samples.

In columns 3 and 4, we look at the intensity of witchcraft beliefs as an outcome. These are measured as the first principal component of four 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. The exact wording of the questions is provided in Appendix C. We also find a positive relationship between zero-sum thinking and witchcraft beliefs in both samples. Within the context of the model, our interpretation of these relationships is that the extent to which individuals face a

Table 2: Zero-Sum Index of Six Survey Questions, Envy, and Witchcraft in the DRC: 200 Person Sample

	Dependent Variable: Principal-Component Based Measures of:							
	Envy of Others Success		Witchcraft Beliefs		Christianity Beliefs		Difference Between Witchcraft & Christianity	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Zero-sum thinking, 0-1	0.333***	0.349***	0.319***	0.276**	-0.146**	-0.147**	0.465***	0.423***
	(0.064)	(0.076)	(0.092)	(0.089)	(0.065)	(0.068)	(0.122)	(0.121)
Gender, age, age squared	Y	Y	Y	Y	Y	Y	Y	Y
Ethnicity FEs	N	Y	N	Y	N	Y	N	Y
Observations	204	204	197	197	197	197	197	197
R squared	0.117	0.164	0.072	0.127	0.034	0.096	0.067	0.140

Notes: This table examines the relationship between zero-sum views and an individual's self-reported envy of others, beliefs in witchcraft and beliefs in Christianity, for the sample of about 200 respondents collected in 2015 in Kananga, DRC. It reports estimates from equation (9). In all the 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 principal-component of 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 non-Christians who live in Kananga. In columns 7 and 8, the dependent variables are the difference in the principal-component based measure of beliefs in witchcraft and Christianity. We include controls for gender, age, and age squared in all columns. Coefficients are reported with robust standard errors in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent levels.

zero-sum environment (α) results in demotivating beliefs such as feelings of envy and beliefs in witchcraft (θ).

In the DRC, as is the case for the rest of Africa and also in much of the world outside of Africa, there has been a rapid rise in Christianity. Christianity provides a striking contrast to indigenous witchcraft beliefs. Compared to witchcraft, which tends to view any benefits as coming at the expense of others, Christianity teaches that everyone can receive blessings from God (which are thus not zero-sum) and that God rewards hard work and economic ambition. These beliefs are particularly strong from Pentecostal denominations which has spread rapidly in the past decades in the DRC and across the African continent in general.

Motivated by this, we also examine the relationship between zero-sum thinking and beliefs in Christianity. This is measured using four 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. Thus, the questions, and the variable

Table 3: Zero-Sum Index of Six Survey Questions, Envy, and Witchcraft in the DRC: 1,000 Person Sample

	Dependent Variable: Principal-Component Based Measures of:							
	Envy of Others Success		Witchcraft Beliefs		Christianity Beliefs		Difference Between Witchcraft & Christianity	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Zero-sum thinking, 0-1	0.158***	0.155***	0.038**	0.037**	-0.050**	-0.051**	0.088**	0.088**
	(0.026)	(0.026)	(0.018)	(0.018)	(0.016)	(0.016)	(0.033)	(0.034)
Gender, age, age squared	Y	Y	Y	Y	Y	Y	Y	Y
Ethnicity FEs	N	Y	N	Y	N	Y	N	Y
Observations	984	984	984	984	984	984	984	984
R squared	0.047	0.053	0.017	0.022	0.009	0.016	0.016	0.022

Notes: The 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 1,000 respondents collected in 2019 in Kananga, DRC. It reports estimates from equation (9). In all the 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 principal-component of 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 non-Christians who live in Kananga. In columns 7 and 8, the dependent variables are the differences in the principal-component based measure of beliefs in witchcraft and Christianity. We include controls for gender, age, and age squared in all columns. Coefficients are reported with robust standard errors in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent levels.

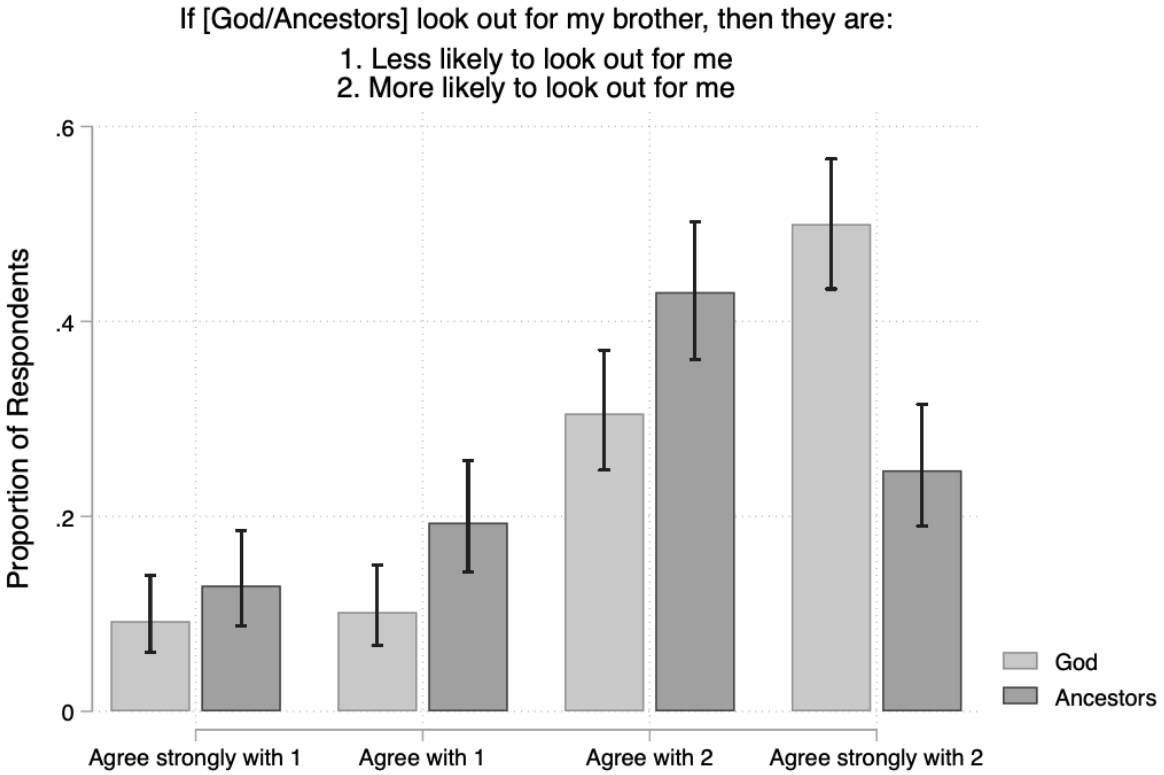
construction, mimic the questions asked about indigenous witchcraft beliefs. The precise wording of the questions is provided in Appendix C. The estimates are reported in columns 5 and 6. We find that in both samples, a zero-sum view is negatively associated with beliefs in Christianity. Given the divergent relationships between zero-sum thinking and witchcraft versus Christianity, we next create a measure that is the difference in the respondent's beliefs in witchcraft relative to Christianity. As reported in columns 7 and 8, zero-sum thinking is associated with a positive difference in these beliefs.

The estimates provide suggestive evidence that Christianity may be less zero-sum than traditional religion, at least in this context.[4] We probe this empirically by using the two zero-sum survey questions that ask about benefits that arise due to blessing from God or from one's ancestors that we described in Section 4.B. The patterns that we observe in the data are reported in Figure 4. Focusing on the extent to which individuals report strongly agreeing with the non-zero sum statement, we see that if the statement asks about God rather than Ancestors, respondents were twice as likely to choose this answer (50% of respondents versus 25%). For all other answers – weak agreement with the non-zero-sum statement or either form of disagreement – the respondent was more likely to choose the answer when the question asked about Ancestors rather than God (75% for ancestors and 50% for God). Thus, the data are consistent with Christianity and blessings from God being perceived as being less zero-sum than traditional religions and benefits from Ancestors.

Lastly, Appendix Tables A1 an A2 show that the relationship between zero-sum views and individual's envy, beliefs in witchcraft, and beliefs in Christianity are of similar magnitude and similarly significant when we use the alternative zero-sum indexes based on ten and twelve survey questions available in the 200-person sample and that we introduced in Section 4.B.

[4]This is consistent with our experience from focus groups, where gains obtained through witchcraft are described as coming at the expense of someone else (i.e., in zero-sum terms) but blessings from God are described as the result of individuals' devotion and God's grace and are not obtained at the expense of others (i.e., are not zero-sum).

Figure 4: Traditional religion, Christianity, and Zero-sum: 200 Person Sample



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

5. Testing Foster Globally: Evidence from the WVS

We now turn to a global analysis of the predictions of our model. The Congolese setting provides a nice first step for our analysis because it is a setting that is similar to the small-scale pre-industrial societies that Foster had in mind when he developed his thinking. A downside of the setting is its lack of economic opportunity and limited variation in economic well-being, which is determined primarily by factors outside of his theory, e.g., the provision of jobs and resources by foreign aid organizations.

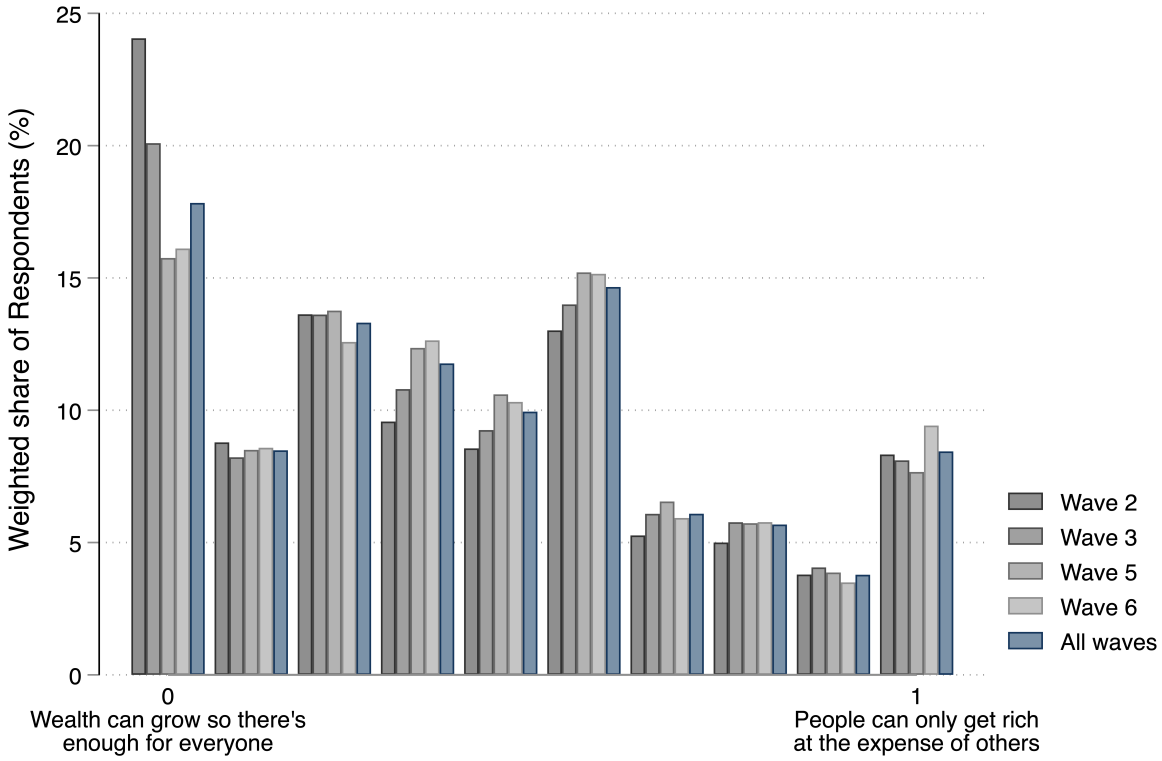
Given this, we now expand our analysis to consider a broader set of societies. As in Section 4, this allows us to test Proposition 4 of the model, which links zero-sum thinking across societies to demotivating beliefs. It also allows us to test Propositions 5 and 6, which link zero-sum thinking across societies to lower effort, lower incomes, and lower subjective well-being across societies, and Propositions 2 and 3, which make predictions on the relationship between the strength of a person's demotivating beliefs and their material welfare and subjective well-being. We now turn to these analyses.

A. *Data*

We measure zero-sum thinking using a question from the World Values Survey (WVS). Respondents are given two opposing statements, one that is zero-sum and the other positive sum. The zero-sum statement is: "People can only get rich at the expense of others." The positive sum statement is: "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 measure the variable so that it increases in how zero-sum the view is. We also normalize it to lie between zero and one for ease of interpretation.

The distribution of the zero-sum measure is shown in Figure 5. The figure shows the distribution of respondent answers for each of the four waves of the WVS, and for the aggregate sample. As shown, there is a fair amount of dispersion in the answers provided. The most common answer is for individuals to agree fully that "Wealth can grow so there's enough for everyone." The next most common is the intermediate position between the two statements. Beyond this, all other points on the ten point scale are fairly common and there's a substantial proportion of individuals who agree fully with the statement "People can only get rich at the expense of others."

Figure 5: Distribution of the Zero-Sum Measure across waves of the WVS



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

In short, there appears to be a rich amount of variation in the extent to which individuals view wealth as zero-sum.

B. *Zero-sum thinking and religious beliefs*

While the WVS has no information on envy and limited data on traditional beliefs, we do have information on religious beliefs with traditional religions being one category. When examining the DRC, consistent with the arguments of George Foster, we found that individuals who held stronger traditional beliefs tended to be more zero-sum and those who held stronger Christian beliefs tended be less zero-sum. We now test the generality of this finding using information from the WVS on the religious beliefs of the respondents.

$$\text{Zero Sum}_{i,c,v} = \alpha_{c,v} + \sum_{r \in R} \beta^r \, I^r_{i,c,v} + \mathbf{X}_{i,c,v}\mathbf{\Gamma} + \varepsilon_{i,c,v} \tag{10}$$

where i indexes individuals, c indexes countries, and v survey waves. The indicators $I^r_{i,c,v}$ equal one if individual i reports belonging to religion r among the set of all religions R. The omitted category is for no belief in a religion. We expect the coefficient, β^r to be larger for Christianity and other moralizing god religions that are also less zero-sum in nature, such as Islam or Hinduism, relative to traditional/indigenous religions, which are more zero-sum in nature.

The estimates are reported in Table 4. All specifications include country-by-survey wave fixed effects. In column 2, we also include our set of demographic covariates, and column 3 includes fixed effects for the respondent's income and education. While potentially endogenous to religion, they also may affect both zero-sum thinking and one's religious beliefs. The results indicate that the findings from the DRC are also present in the global sample (and are similar across the three specifications). Relative to individuals who do not believe in a religion, we see that Christians tend to hold beliefs that are less zero-sum. The same is also true for the other big god religions; namely, Islam and Hinduism, as well as Buddhism/Confucianism. We find that Indigenous beliefs, which would contain beliefs that the West would call 'witchcraft,' do not exhibit lower zero-sum thinking and actually tend to hold slightly higher zero-sum beliefs, although this is not statistically significant. Interestingly, we see no effect for Jewish beliefs. The estimate for the 'other' category, which primarily comprises unspecified religions, but also Jains, Sikhs, Zoroastrians, etc, is negative and statistically significant. A breakdown of the religions within the 'other' category is provided in Appendix Table A3.

Thus, consistent with our findings from the DRC, we see that traditional smaller-scale religious beliefs, like witchcraft, tend to be associated with more zero-sum thinking while big god religions, like Christianity, are associated with less zero-sum thinking. This provides some indication that the mechanisms highlighted by Foster may be more general. In addition, because of the prevalence of big god religions in the developed world, his theory may also be as applicable to those living in industrialized nations today not just those living in small-scale societies in the past.

Table 4: Religion and Zero-Sum Thinking in the WVS

	Dependent Variable: Zero-Sum Thinking, 0-1		
	(1)	(2)	(3)
Christian	-0.019***	-0.017***	-0.018***
	(0.002)	(0.002)	(0.003)
Muslim	-0.016***	-0.015***	-0.018***
	(0.005)	(0.005)	(0.005)
Hindu	-0.036***	-0.034***	-0.039***
	(0.008)	(0.008)	(0.009)
Buddhism/Confucianism	-0.032***	-0.030***	-0.032***
	(0.005)	(0.005)	(0.006)
Jewish	-0.007	-0.006	-0.011
	(0.011)	(0.010)	(0.012)
Native	0.027**	0.029**	0.011
	(0.013)	(0.013)	(0.014)
Other	-0.034***	-0.033***	-0.034***
	(0.006)	(0.006)	(0.007)
Income			-0.045***
			(0.004)
Education			-0.014***
			(0.003)
Demographic Controls	N	Y	Y
Wave-country FE	Y	Y	Y
Observations	157,089	156,636	121,849
R-squared	0.076	0.076	0.078
Mean dependent variable	0.402	0.402	0.398
Std. dev. dependent variable	0.309	0.309	0.307

Notes: The table reports OLS estimates. An observation is an individual. All specifications include wave-country fixed effects. The dependent 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." Education and income are categorical variables. Income measures an individual's (self-reported) household income decile. Education is the highest level of education completed. Coefficients are reported with robust standard errors in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent levels.

C. *Zero-sum thinking and demotivating beliefs*

When thinking about the contemporary setting, the most-relevant consequence of zero-sum thinking may be demotivating beliefs, which reduce industriousness and effort. Our analysis is guided by the model's predicted associations between an individual's zero-sum view and the presence of demotivating beliefs (Proposition 4). The model predicts that a zero-sum view of the world is associated with demotivating beliefs that serve to reduce effort. In different countries, the specifics of these beliefs will be different. In some countries, they may take the form of beliefs in witchcraft or the evil eye. In others, they may take the form of norms of sharing and a dislike for greed and individual accumulation. In others, it may take the form of a belief that hard work does not result in success.

To examine this, we use the WVS data and estimate the following equation:

$$Y_{i,c,t} = \alpha_{c,t} + \beta \, \text{Zero Sum}_{i,c,t} + \mathbf{X}_{i,c,t}\mathbf{\Gamma} + \varepsilon_{i,c,t} \tag{11}$$

where i indexes individuals, c country of residence, and t the year of the survey. $\text{Zero Sum}_{i,c,t}$ is our measure of zero-sum for individual i. $\alpha_{c,t}$ denote country and survey year fixed effects. $Y_{i,c,t}$ denotes a measure of the strength in which person i holds a particular demotivating belief.

We begin by first considering the belief of whether or not hard work brings success. Respondents report their answer on a 1 to 10 integer scale. We reorder and normalize the variable such that zero equals full agreement with "in the long run, hard work usually brings a better life" and one equals full agreement with "hard work doesn't generally bring success." (The exact wording of this and all other WVS questions from the analysis is provided in Appendix C.) Thus, the measure is increasing in the extent to which one believes that hard work does not pay off.

The estimates, which are reported in column 1 of Table 5 show that, consistent with Proposition 4, a zero-sum belief is associated with a stronger belief that hard work is unlikely to bring success. Within the context of the model, we interpret this as showing that a more zero-sum environment α (as reflected by a perception of the world as being more zero-sum) is positively associated with demotivating beliefs θ, which reduces the perceived returns to effort.

We next look at two closely-related measures that capture respondents' views of whether people's effort can keep them from poverty. The first variable captures the extent to which the respondent feels that it's not a lack of effort that explains why people are poor. The original survey question is: "Why, in your opinion, are there people in this country who live in need?" We create

Table 5: Zero-Sum and Demotivating Beliefs

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

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

a variable that takes on the value of 0 if they choose the answer "Poor because of laziness and lack of willpower," and the value of one if they choose the answer "Poor because of an unfair society." The second measure, similar to the first, captures the respondents' view about whether the poor can escape poverty through effort. This is based on the question: "In your opinion, do most poor people in this country have a chance of escaping from poverty, or is there very little of chance 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. The estimates with these two measures as the outcomes are reported in columns 2 and 3. We find that if an individual has a more zero-sum view of the world, then they tend to also believe that poverty does not arise from a lack of effort.

We next consider three additional measures of 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 be more motivated to exert effort to ensure that they can 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 be increasing in respondent's disagreement with the statement. The estimates, which are reported in column 4, show that a more zero-sum view of the world is associated with individuals feeling less humiliation when they receive money from others.

The last two questions measure individuals' self-reported importance of achievement and work. The first question asks the respondent whether they agree that it is important to be "very successful. . . to have people recognize one's achievement." The second question asks the respondent how important work is to them. Respondents choose responses ranging from not at all important to very important. Both measures are coded to be decreasing in the importance placed on achievement and work – i.e., increasing in the extent to which the beliefs are demotivating. The estimates, reported in columns 5 and 6, show that individuals with a more zero-sum worldview hold beliefs that place less importance on their success and on their work. Overall, across all six measures of demotivating beliefs, the estimates suggest that zero-sum thinking is consistently associated with beliefs that demotivate and lead to less economic effort.

D. *Zero-sum thinking, effort, and economic outcomes*

An additional prediction of the model, laid out in Proposition 5, is that a more zero-sum environment, due to the demotivating beliefs they engender, should also result in less effort and therefore lower income. We now turn to an examination of this prediction. We begin by first measuring income using the respondents' self-reported income on a 1-10 integer scale that we normalize to range from zero to one. We supplement this question with another that provides a measure of the net savings of the respondent's family. Details of the underlying survey question (and all others in the analysis) are provided in Appendix C. We normalize the variable to lie between zero and one and to be increasing in savings. As reported in columns 1 and 2 of Table 6, individuals with a more zero-sum view of the world, report having lower incomes and less savings. Thus, consistent with the model, zero-sum is associated with lower material payoffs.

An important form of productivity-enhancing effort is education. Consistent with the model's prediction that zero-sum is associated with less effort, as reported in column 3, we find that zero-sum thinking is associated with less educational attainment.

We next turn to an examination of aspects of one's career that is affected by education and also important for the income one earns. In column 4, we measure the extent to which the respondent is employed in a cognitively demanding occupation rather than a manually intensive occupation. The original question asks respondents to report this aspect of the task of their job on a 1-10 scale. Along similar lines, we also examine whether the respondent supervises someone at their

Table 6: Zero-Sum Thinking and Economic Wellfare

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

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

work. We find that individuals with more zero-sum thinking are less likely to be employed in cognitively demanding tasks and are less likely to have a supervisory role (columns 4 and 5).

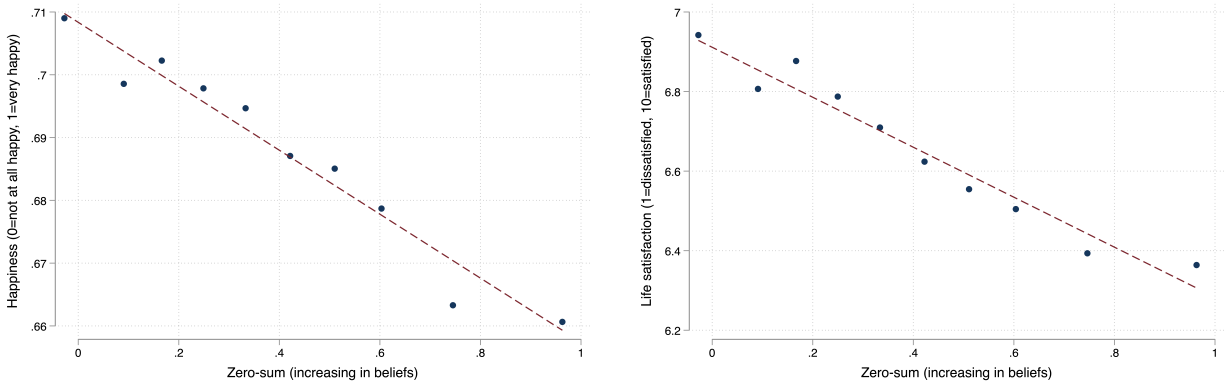
The last outcome we examine is a measure of the socioeconomic class that the respondent reports belonging to, either: (1) Lower class; (2) Working class; (3) Lower middle class; (4) Upper; (5) Upper class. We use integer values reported for each category and normalize the index to lie between 0 and 1. As reported in column 6, we find that zero-sum thinking is associated with a lower self-reported socioeconomic class.

E. *Zero-sum thinking, demotivating beliefs, and happiness*

The next prediction of the model that we consider is the prediction summarized by Proposition 6 regarding the relationship between a zero-sum environment and an individual's happiness and subjective well-being. We test Proposition 6 of the model by examining the relationship between zero-sum thinking and two measures of happiness and well-being. One measures 'happiness' and the other 'life satisfaction.'[5] The raw cross-individual relationship between zero-sum and either happiness or life satisfaction, conditional on country by survey wave fixed effects is reported in Figure 6, which shows a binscatter plot. In the raw data, one observes a clear negative relationship between zero-sum and the different measures of happiness and well-being.

[5]The exact questions are reported in the appendix. The happiness question is question A008 in the WVS and the life satisfaction question is A170.

Figure 6: Relationship between Zero-Sum thinking and Happiness or Life Satisfaction



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

Estimates of equation (5) for both measures of well-being as the outcome are reported in column 1 of Tables 7 and 8. Reflecting the relationships in the raw data, we continue to find a negative and significant relationship between zero-sum thinking and life satisfaction.

Having tested Proposition 6, which states the connection between zero-sum environments and subject well-being, we now turn to the relationship between demotivating beliefs and subjective well-being predicted by the model. A corollary of Proposition 4 (which links zero-sum environments and demotivating beliefs) and Proposition 6 (which links zero-sum environments and subjective well-being) is that, under the conditions of Proposition 6, subjective well-being should be decreasing in demotivating beliefs. We now check for this relationship.

The estimates, which are reported in columns 2–7 of Tables 7 and 8, show the negative relationship between six measures of demotivating beliefs and both measures of subjective well-being.

F. *Optimizing Behavior Within a Fixed Zero-Sum Setting*

We now turn to Propositions 2 and 3 of our model, which make predictions of the relationship between the strength of a person's demotivating beliefs and their 'material welfare' and subjective well-being. Because in the model, there is an optimal strength of demotivating beliefs θ^* for a

Table 7: Zero-Sum Thinking or Demotivating Beliefs and Self-Reported Happiness

	Dependent Variable: Self-Reported Happiness, 0-1						
	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)
Zero-sum thinking, 0-1	-0.051***						
	(0.002)						
Demotivating belief, θ		-0.046***	-0.045***	-0.043***	-0.019***	-0.045***	-0.038***
		(0.001)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)
Demographic controls	Y	Y	Y	Y	Y	Y	Y
Wave-country FE	Y	Y	Y	Y	Y	Y	Y
Observations	246,094	329,899	62,055	64,833	103,517	156,835	398,525
R-squared	0.145	0.136	0.187	0.181	0.105	0.123	0.134
Mean dependent variable	0.688	0.694	0.653	0.653	0.696	0.707	0.692
Std. dev. dependent variable	0.249	0.246	0.255	0.254	0.243	0.244	0.248
Mean independent variable	0.405	0.365	0.701	0.599	0.346	0.394	0.159
Std. dev. independent variable	0.309	0.323	0.458	0.490	0.296	0.292	0.247

Notes: The table reports OLS estimates. An observation is an individual. The dependent variable is a scale variable ranging from zero to one with zero representing "I'm not happy at all" and one representing "I'm very happy." 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" in 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") in columns 2–7. All specifications include wave-country fixed effects. Demographic controls include age, age squared, gender, and their interactions. Coefficients are reported with robust standard errors in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent levels.

Table 8: Zero-Sum Thinking or Demotivating Beliefs and Subjective Life Satisfaction

	Dependent Variable: Subjective Life Satisfaction, 1-10						
	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)
Zero-sum thinking, 0-1	-0.628***						
	(0.016)						
Demotivating belief, θ		-0.474***	-0.622***	-0.551***	-0.226***	-0.525***	-0.252***
		(0.013)	(0.022)	(0.020)	(0.025)	(0.021)	(0.015)
Demographic controls	Y	Y	Y	Y	Y	Y	Y
Wave-country FE	Y	Y	Y	Y	Y	Y	Y
Observations	245,792	329,770	60,594	64,415	103,372	157,059	400,198
R-squared	0.173	0.164	0.246	0.242	0.167	0.132	0.172
Mean dependent variable	6.656	6.746	6.177	6.205	6.582	6.791	6.667
Std. dev. dependent variable	2.382	2.360	2.626	2.600	2.400	2.278	2.416
Mean independent variable	0.406	0.366	0.705	0.600	0.347	0.395	0.159
Std. dev. independent variable	0.310	0.323	0.456	0.490	0.296	0.292	0.247

Notes: The table reports OLS estimates. An observation is an individual. Specifications include wave-country fixed effects. The dependent variable is a scale variable ranging from 1 to 10 with 1 representing "I'm dissatisfied with my life" and ten representing "I'm satisfied with my life". 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" in 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") in columns 2–7. Demographic controls include age, age squared, gender, and their interactions. Coefficients are reported with robust standard errors in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent levels.

given zero-sumness of the environment α, the material payoffs of individuals are predicted to be hump shaped.

We now test this prediction of the model. To do this we divide the sample in deciles based on their perception of how zero sum the world is. To account for differences in language, gender, and age, which potentially affect reporting, we first net out country-wave fixed effects and demographic controls before creating the zero-sum deciles. For each decile, we then examine the relationship between a person's demotivating belief and their level of income. Our interest is in whether this relationship is hump-shaped. We report estimates for the two measures of demotivating beliefs that have the largest sample, which is whether 'hard work brings success' (n = 228,356) and 'how important is work' (n = 224,534), although the other measures also exhibit a similar pattern.

The estimated relationships between demotivating beliefs and income are reported in Figures 7 and 8. As shown, for virtually all deciles we see strong evidence of a hump-shaped relationship between demotivating beliefs and material well-being as measured by income. This is strong evidence consistent with Proposition 2 of the model.

The results are similar if we do not account for demographic controls or country-wave fixed effects (Appendix Figures A5-A8) or if we use other measures of demotivating beliefs that are only available for much smaller samples[6] (see Appendix Figures A9-A12).

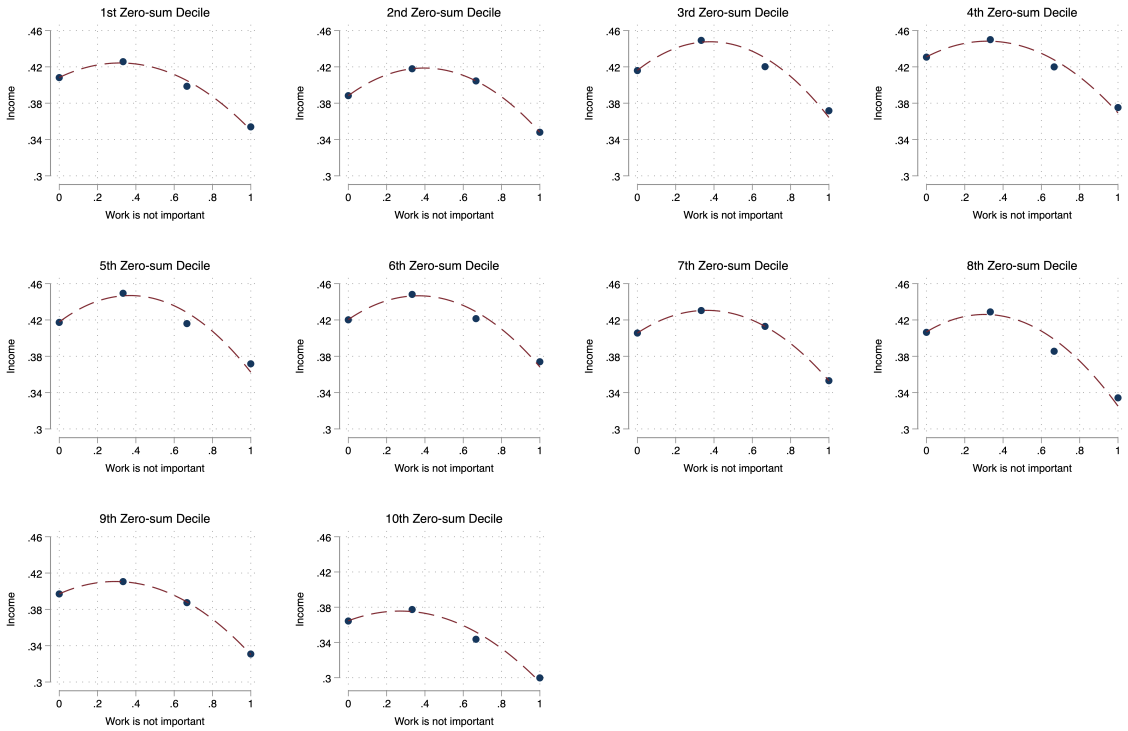
In contrast to this pattern, but consistent with Proposition 3, when we undertake the identical exercise but look at the relationship between demotivating beliefs and happiness (rather than income), we observe a negative relationship that is essentially linear. These are reported in Figures 10 and 9.

6. Long-Run Development: Beliefs and Innovation

We have documented that when interactions are zero-sum in nature, demotivating beliefs can spread. Moreover we have shown the relationships between demotivating beliefs and material welfare and subjective well-being, both when when one holds constant the degree to which the

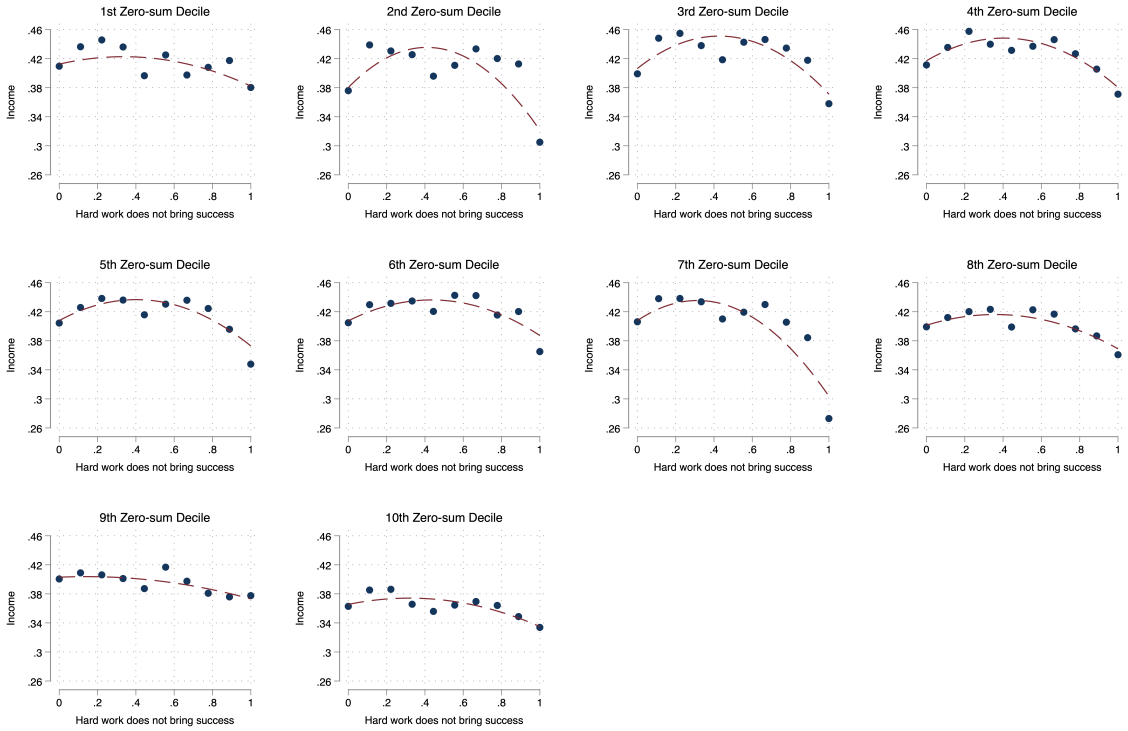
[6]In addition to the two demotivating beliefs reported for the smaller samples, we also possess data on respondents' answers to the demotivating beliefs "People have a chance to escape poverty" and "People are poor because of laziness." However, we do not report these since they were only measured across two options.

Figure 7: Relationship between demotivating beliefs and income, holding constant zero-sum thinking



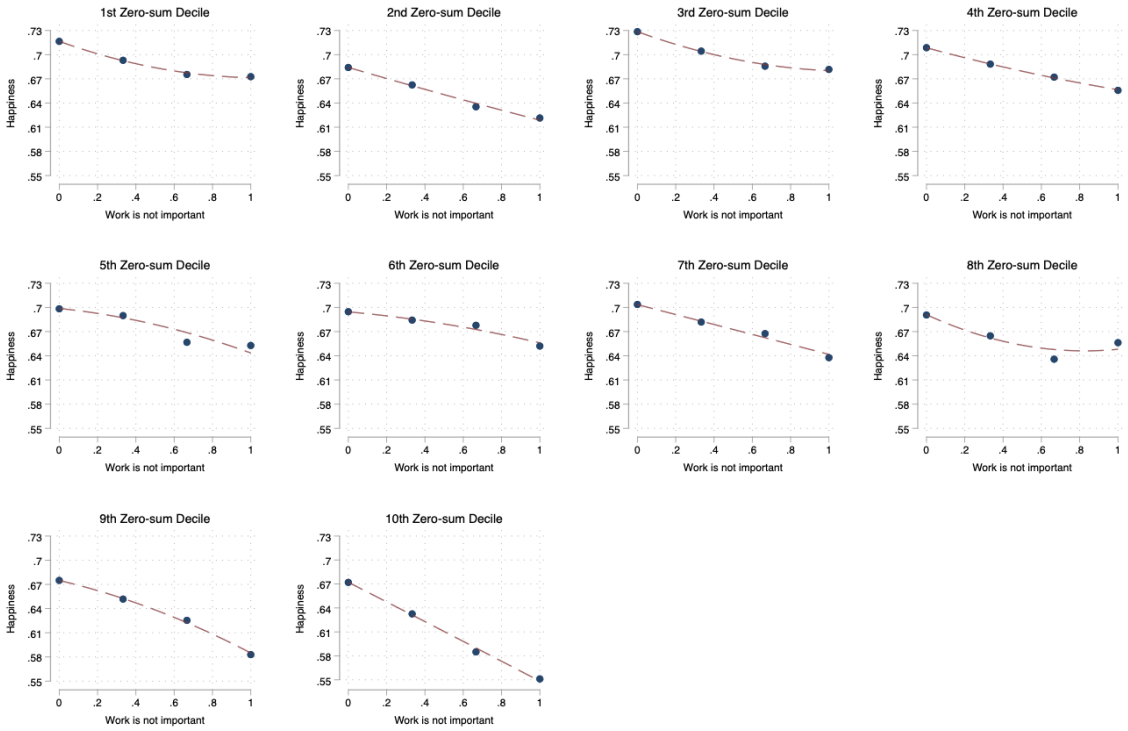
Notes: The figure reports the relationship between respondents' demotivating beliefs and level of income for each zero sum decile. Country-wave fixed effects and demographic controls are netted out before creating the zero-sum deciles. The demotivating belief in this figure, is reported based on respondents'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

Figure 8: Relationship between demotivating beliefs and income, holding constant zero-sum thinking



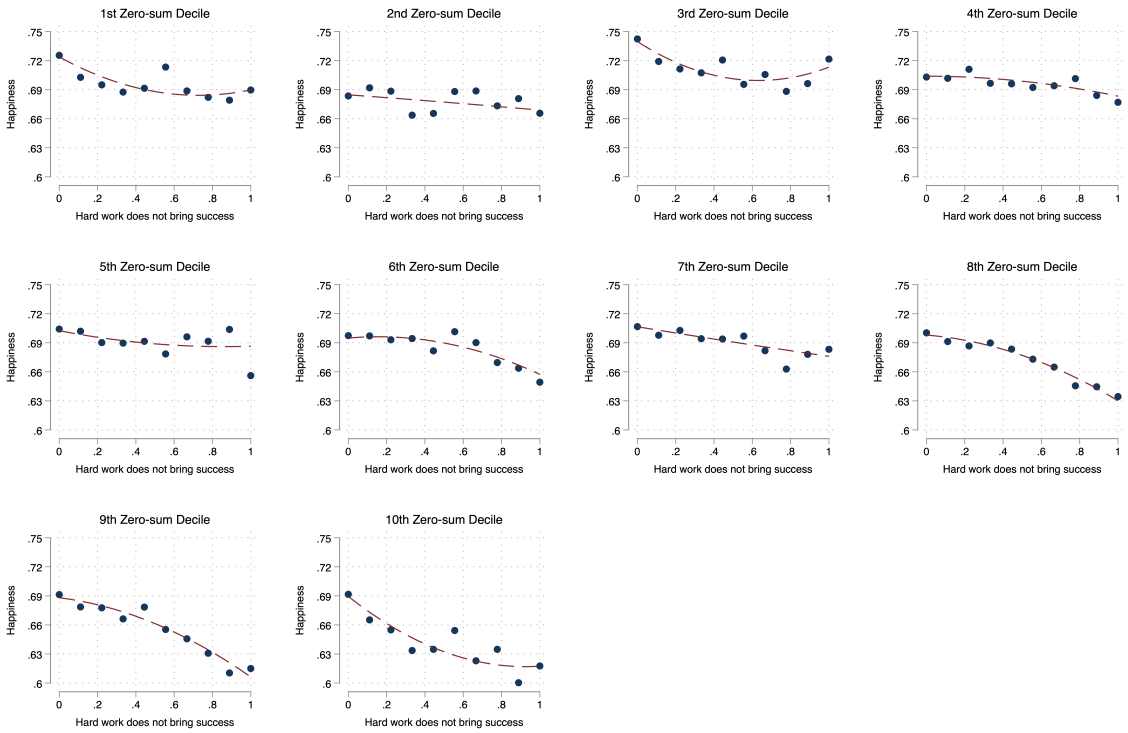
Notes: The figure reports the relationship between respondents' demotivating beliefs and level of income for each zero sum decile. Country-wave fixed effects and demographic controls are netted out before creating the zero-sum deciles. The demotivating belief in this figure, is reported based on how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

Figure 9: Relationship between demotivating beliefs and happiness, holding constant zero-sum thinking



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

Figure 10: Relationship between demotivating beliefs and happiness, holding constant zero-sum thinking



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

environment is zero sum and when the environment is characterized by varying degrees of zero-sumness.

In the long run, demotivating beliefs may also affect the environment and in particular inhibit innovation. Hence, we now revisit the model introduced in Section 3 making the state of technology, denoted by $A(t)$, endogenous and examine its co-evolution with the distribution of beliefs $\mathbf{q}$.[7] While demotivating beliefs reduce a negative *contemporaneous* externality by limiting zero-sum competition, we find that they could also reduce a positive *intertemporal* externality from knowledge accumulation, trapping the economy in a low-technology state.

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

$$\frac{dA}{dt} = X(\mathbf{q}, A) - \delta A, \tag{12}$$

where $\delta \in (0, 1)$ is the rate of technological depreciation and again $X(\mathbf{q}, A)$ is the mean level of effort in the population given by (6).[8]

The positive effect of effort on the rate of innovation could arise from learning-by-doing and knowledge spillovers from productive activity, as in Aghion, Caroli and Garcia-Penalosa (1999) and Gershman (2014).[9]

To examine the long-term effect of demotivating beliefs on development, substitute (6) into (12) to get:

$$\frac{dA}{dt} \begin{matrix} > \\ = \\ < \end{matrix} 0 \iff A \begin{matrix} > \\ = \\ < \end{matrix} \frac{\delta}{\sum_{i=1}^{n} q_i (1 - \theta_i)^2} \equiv D^*(\mathbf{q}, \Theta). \tag{13}$$

We call $D^*(\mathbf{q}, \Theta)$ the development barrier.

As a benchmark, consider a degenerate set of beliefs labeled Θ^0 in which $\theta_i = 0$ for all i. In this case, all beliefs are true and not demotivating. The development barrier is $D^*(\mathbf{q}, \Theta^0) = \delta$. Starting from $A(0) > \delta$, there is perpetual technological progress and growth. Starting from

[7] Note that Propositions 1 and 4 continue to hold when A is endogenous. The results in Proposition 5 can be tested empirically while controlling for the level of technology A.

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

[9] The effort choices characterized here continue to hold even with forward-looking agents, because agents are non-atomic and thus do not individually affect mean effort.

$A(0) < \delta$ there is technological regress and contraction of the economy until $A(t) = \underline{A}$, the subsistence level. Hence a technological shock of size greater than $\delta - \underline{A}$ is required to transition the economy from the $A = \underline{A}$ steady state to perpetual growth. Now consider a non-degenerate belief system Θ. In this case, the development barrier $D^*(\mathbf{q}, \Theta)$ depends on $\mathbf{q}$. In particular, $D^*(\mathbf{q}, \Theta) > D^*(\mathbf{q}, \Theta^0)$ whenever there exists a belief such that $\theta_i > 0$ and $q_i > 0$.

Now write $(\mathbf{q}, A) \in \Omega(\Theta)$ if starting from $(\mathbf{q}, A)$ and given the set of beliefs Θ, $dA/dt > 0$ for all $t > 0$ under a payoff monotone cultural dynamic and the technology dynamic (12). That is, $\Omega(\Theta)$ is the set of states from which the *co-evolution* of beliefs $\mathbf{q}$ and technology A leads to perpetual growth.

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

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

Proposition 7 . ***Demotivating Beliefs Undermine Technological Progress.*** *Suppose $\underline{A} < \delta$.*[10] *For any environment Θ that supports demotivating beliefs, the set of conditions from which there is perpetual growth is a strict subset of the set of conditions from which there is perpetual growth under the degenerate (non-demotivating) set of beliefs Θ^0:*

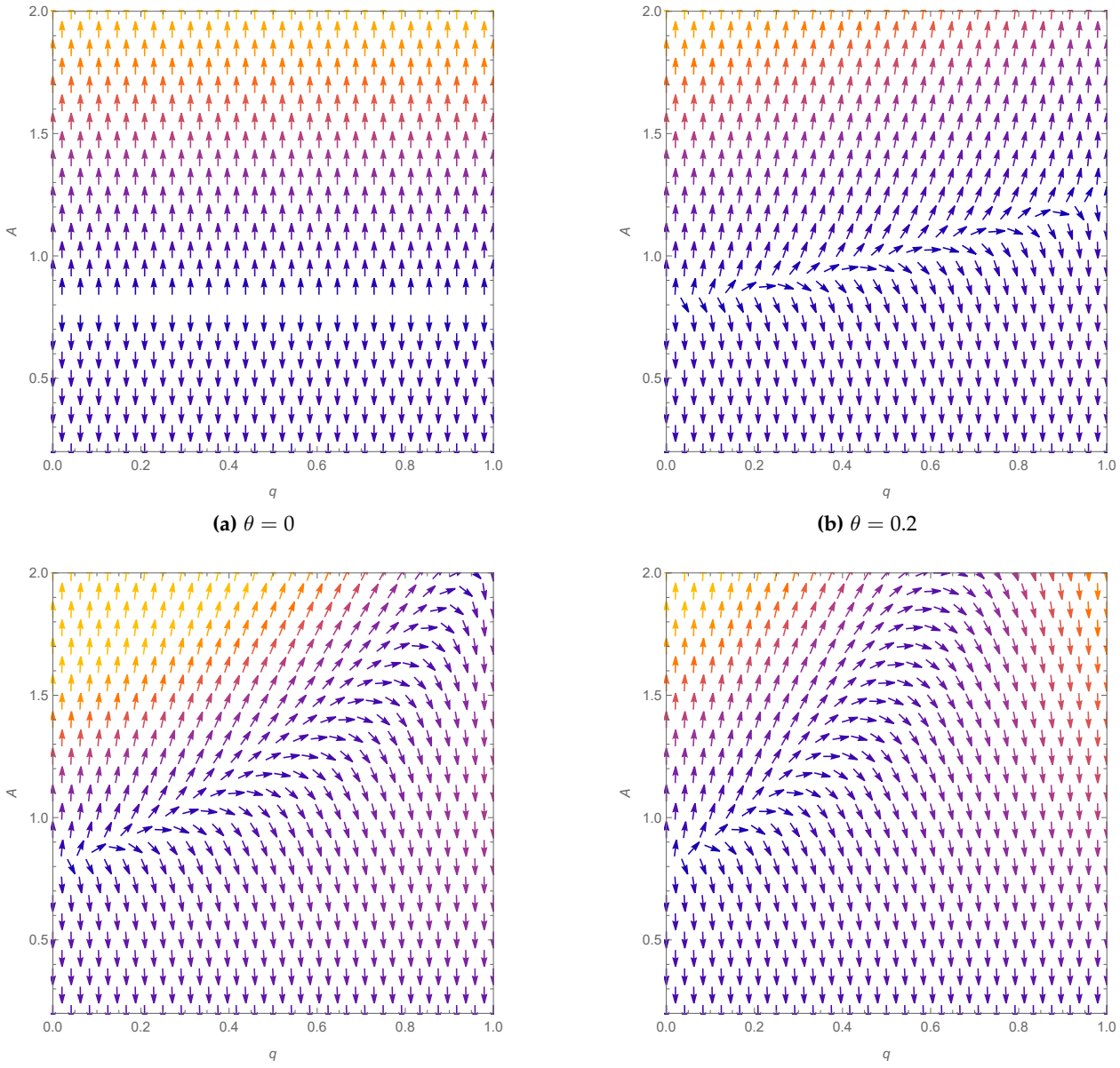
$$\Omega(\Theta) \subsetneq \Omega(\Theta^0).$$

That is, removing demotivating beliefs expands the set of conditions that lead to perpetual growth. In this sense, demotivating belief systems can be viewed as a kludge (Ely, 2011). While they reduce wasteful zero-sum competition, they also create productive inefficiencies that can trap the economy in a low-technology state.

To illustrate visually, consider the binary case $\Theta = \{0, \theta\}$. Let q be the population share of the demotivating belief θ and let the cultural dynamic dq/dt be the replicator dynamic. Vector plots are presented in Figure 11. Panel (a) depicts the case of the degenerate belief system Θ^0, i.e., with

[10]Note that $\underline{A} > \delta$ is a trivial case, in which there is perpetual technological progress from every initial condition regardless of θ.

$\theta = 0$. In this case, we know the development barrier is $D^*(q, \Theta^0) = \delta$ for all $q \in [0,1]$. An increase in the intensity of the demotivating belief θ in panels (b)-(d) shifts the development barrier up and to the right. Thus, it is harder for the economy to escape low levels of development in an environment that supports the demotivating belief.



(a) $\theta = 0$ **(b)** $\theta = 0.2$

(c) $\theta = 0.4$ **(d)** $\theta = 0.8$

Figure 11: Vector plot of (q, A) under belief set $\Theta = \{0, \theta\}$, where q is the population share of the demotivating belief θ. Parameter values: $\alpha = 0.9$, $\sigma = 0.75$, $\delta = 0.8$, $\underline{A} = 0.2$.

7. Conclusions

We have studied the evolution of demotivating belief systems, which can take a wide variety of forms: beliefs that success is primarily determined by luck rather than hard work, concerns about adverse consequences of envy from others, and witchcraft beliefs that cast suspicion on the origins of one's success. We have examined how these are formed and shaped by the nature of production and how they affect entrepreneurial activity, innovation, and ultimately economic development.

Motivated by the seminal work of George M. Foster and his 'image of limited good', we first formalized the effects of a zero-sum view of the world on demotivating beliefs. Our analysis showed that demotivating beliefs can spread in environments in which the production process and the resulting economic interactions tend to be zero-sum in nature, meaning that the gains from one individual tend to come at the expense of another.

The effects of zero-sum production are very different depending on whether one looks at their static or dynamic consequences. We find that, statically, demotivating beliefs reduce the negative externalities that arise from effort in a zero-sum environment. Dynamically, the belief systems inhibit learning-by-doing and can thereby trap an economy in a state of low innovation and underdevelopment. Thus, the demotivating beliefs that arise from a view of the world as zero-sum can be an important cultural barrier to long-run economic development.

Having developed a theoretical understanding of Foster's arguments, we then turn to the data, first examining two samples from the Democratic Republic of the Congo. We find strong and robust evidence that, in both samples, respondents who have a more zero-sum view of the world report more envy about the success of others, stronger traditional religious beliefs, and weaker Christian beliefs.

We then turned to a global analysis using data from the World Values Survey. We first verify that the same relationship between zero-sum thinking and Christian religious beliefs that we found in the Congolese samples applies to the global WVS sample. We find that beliefs in Christianity rather than traditional indigenous religions is associated with less zero-sum thinking and that other big god religions (like Islam, Hinduism, etc) are also associated with less zero-sum thinking.

We also estimate the relationship between zero-sum thinking and a range of demotivating

beliefs, including those that are particularly relevant to the modern industrialized world, such as weaker beliefs in the value of hard work, the return to effort, the importance of being successful, and that receiving money from others is humiliating. We find a very strong association between zero-sum thinking and all demotivating beliefs examined.

The broader sample also allowed us to test various predictions that emerge from our formalization of Foster's arguments. Consistent with the model's predictions, we find that an individual's strength of thinking is associated with lower incomes, less educational attainment, fewer savings, and lower occupational status. We also find that zero-sum thinking, and the resulting demotivating beliefs, are both associated with less happiness and lower life satisfaction.

Consistent with the model's prediction of an optimal demotivating belief for a particular zero-sum environment, we find that if we look at individuals with the same zero-sum measure, the relationship between their demotivating beliefs and incomes is hump-shaped. Also, consistent with the model, we find a negative relationship between demotivating beliefs and happiness. Thus, in a fixed environment, although there's a demotivating belief that maximizes income, a higher demotivating belief always results in less happiness.

By providing a formalization of Foster's insights and testing the resulting predictions, we were able to assess the validity of the mechanisms he proposed; namely, of relationships between zero-sum thinking, demotivating beliefs, and ultimately economic activity. Our findings suggest that zero-sum thinking is an important factor in understanding the causes and consequences of economic thinking and economic development.

References

Aghion, Philippe, Eve Caroli, and Cecilia Garcia-Penalosa, "Inequality and Economic Growth: The Perspective of the New Growth Theories," *Journal of Economic Literature*, 1999, *37* (4), 1615–1660.

Akerlof, Robert, Niko Matouschek, and Luis Rayo, "Stories at Work," *AEA Papers and Proceedings*, 2020, *110*, 199–204.

Alger, Ingela 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.

_ **and** _ , "Evolutionary models of preference formation," *Annual Review of Economics*, 2019, *11*, 329–354.

Becker, Gary S, "Altruism, egoism, and genetic fitness: Economics and sociobiology," *Journal of Economic Literature*, 1976, *14* (3), 817–826.

Benabou, Roland and Jean Tirole, "Belief in a Just World and Redistributive Politics," *Quarterly Journal of Economics*, 2006, *121* (2), 699–746.

Binmore, Ken, *Rational Decisions*, Princeton University Press, 2008.

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," NBER Working paper No. 23375 2017.

Bowles, Samuel, "Group competition, reproductive leveling, and the evolution of human altruism," *Science*, 2006, *314* (5805), 1569–1572.

Carvalho, Jean-Paul, "Veiling," *Quarterly Journal of Economics*, 2013, *128* (1), 337–370.

_ **and Michael Sacks**, "Radicalization," working paper 2021.

Cavalli-Sforza, Luigi Luca and Marcus W Feldman, *Cultural Transmission and Evolution: A Quantitative Approach*, Princeton: Princeton University Press, 1981.

Collier, Paul, "The cultural foundations of economic failure: A conceptual toolkit," *Journal of Economic Behavior & Organization*, 2016, *126*, 5–24.

Cooper, Ben and Chris Wallace, "Group selection and the evolution of altruism," *Oxford Economic Papers*, 2004, *56* (2), 307–330.

Duflo, Esther, Michael Kremer, and Jonathan Robinson, "Nudging Farmers to Use Fertilizer: Theory and Experimental Evidence from Kenya," *American Economic Review*, 2011, *101* (6), 2350–2390.

Ely, Jeffrey C, "Kludged," *American Economic Journal: Microeconomics*, 2011, *3* (3), 210–231.

_ **and Okan Yilankaya**, "Nash equilibrium and the evolution of preferences," *Journal of Economic Theory*, 2001, *97* (2), 255–272.

Esponda, Ignacio and Demian Pouzo, "Berk–Nashequilibrium: A framework for modeling agents with misspecified models," *Econometrica*, 2016, *84* (3), 1093–1130.

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, *Passions within Reason: The Strategic Role of the Emotions*, WW Norton & Co, 1988.

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.

Gigerenzer, Gerd, "Axiomatic rationality and ecological rationality," *Synthese*, 2021, *198*, 3547—-3564.

Güth, W. and M. Yaari, "An Evolutionary Approach to Explain Reciprocal Behavior in a Simple Strategic Game," in "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.

Holland, Heidi, *African Magic: Traditional Ideas that Heal a Continent*, Johannesburg: Penguin Books, 2001.

King, Mervyn and John Kay, *Radical Uncertainty: Decision-making for an unknowable future*, Hachette UK, 2020.

Leeson, Peter T, "Human sacrifice," *Review of Behavioral Economics*, 2014, *1* (1-2), 137–165.

Massari, Filippo and Jonathan Newton, "Learning and equilibrium in misspecified models," Available at SSRN 3473630 2020.

McClelland, David, *The Achieving Society*, New York: The Free Press, 2003.

McCloskey, Deirdre Nansen, *Bourgeois Dignity: Why Economics can't Explain the Modern World*, Chicago: University of Chicago Press, 2010.

Newton, Jonathan, "Evolutionary game theory: A renaissance," *Games*, 2018, *9* (2), 31.

Nunn, Nathan, "The historical roots of economic development," *Science*, 2020, *367* (6485), eaaz9986.

_ **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), 582–87.

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.

Robson, Arthur J and Larry Samuelson, "The evolution of intertemporal preferences," *American Economic Review*, 2007, *97* (2), 496–500.

_ **and** _ , "The evolutionary foundations of preferences," in Jess Benhabib, Alberto Bisin, and Matthew Jackson, eds., *Handbook of Social Economics*, Elsevier, 2011, pp. 221–310.

Sandholm, William H, "Negative externalities and evolutionary implementation," *Review of Economic Studies*, 2005, *72* (3), 885–915.

_ , *Population Games and Evolutionary Dynamics*, Cambridge, MA: MIT press, 2010.

Savage, Leonard J., *The Foundations of Statistics*, Wiley, 1951.

Schelling, Thomas C., *The Strategy of Conflict*, Harvard University Press, 1960.

Schulz, Jonathan, Duman Bahrami-Rad, Jonathan P. Beauchamp, and Joseph Henrich, "The Church, Intensive Kinship, and Global Psychological Variation," *Science*, 2019, *366*, eaau5141.

Verdier, Thierry and Yves Zenou, "Cultural leaders and the dynamics of assimilation," *Journal of Economic Theory*, 2018, *175*, 374–414.

Young, H. Peyton, *Individual strategy and social structure: An evolutionary theory of institutions*, Princeton University Press, 1998.

_ , "The Evolution of Social Norms," *Annual Review of Economics*, 2015, *7* (1), 359–387.

Online Appendix (Not for Publication)

Appendix A. Mathematical Proofs

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

The fitness of trait i is given by (3). Thus,

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

Recall that $A > 0$. Hence:

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

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

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

$$-\tfrac{1}{2}(\theta_i-\theta_j) + \tfrac{1}{2}\theta_i(1-\theta_i) - \tfrac{1}{2}\theta_j(1-\theta_j) + \sigma\alpha(\theta_i-\theta_j) > 0 \tag{A2}$$

$$\iff -\tfrac{1}{2}(\theta_i-\theta_j)(\theta_i+\theta_j) + \sigma\alpha(\theta_i-\theta_j) > 0 \tag{A3}$$

$$\iff \sigma\alpha > \tfrac{1}{2}(\theta_i+\theta_j). \tag{A4}$$

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

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

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

$$\hat{W}_i > \hat{W}_j \tag{A5}$$

$$\iff \tfrac{1}{2}(1-\theta_i)^2A^2 - \sigma\alpha(1-\theta_i)^2A^2 > \tfrac{1}{2}(1-\theta_j)^2A^2 - \sigma\alpha(1-\theta_j)^2A^2 \tag{A6}$$

$$\iff (\sigma\alpha - \tfrac{1}{2})[(1-\theta_j)^2 - (1-\theta_i)^2] > 0. \tag{A7}$$

The term in the square brackets is positive because $\theta_i > \theta_j$. Therefore, subjective well-being is strictly increasing in θ if $\sigma\alpha > \frac{1}{2}$ and strictly decreasing if $\sigma\alpha < \frac{1}{2}$. □

Proof of Proposition 4. By Corollary 1, for any interior initial state and Δ sufficiently large, $q_i^k(t)$ converges monotonically to one, where θ_i is approximately $\sigma\alpha^k$. Therefore, $\theta^k(t)$ converges to approximately $\sigma\alpha^k$. The result follows immediately. □

Proof of Proposition 5. Again, by Corollary 1, for any interior initial state and Δ sufficiently large, $q_i^k(t)$ converges monotonically to one, where θ_i is approximately $\sigma\alpha^k$.

Therefore, $W^k(t)$ given by (6) converges to approximately $\left(1-\sigma\alpha^k\right)^2 A^2$ and mean material welfare $W^k(t)$ given by (7) converges to approximately

$$(1-\sigma\alpha^k)^2A^2 - \alpha(1-\sigma\alpha^k)^2A^2 \tag{A8}$$

$$= \quad (1-\sigma\alpha^k)\left[\tfrac{1}{2} - \alpha^k\left(1-\tfrac{1}{2}\sigma\right)\right]A^2. \tag{A9}$$

Differentiating with respect to α^k yields

$$-\left[1-2\sigma\alpha^k\left(1-\tfrac{1}{2}\sigma\right)\right], \tag{A10}$$

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

Hence, each limit point is strictly decreasing in α^k, thus establishing the proposition for Δ sufficiently large, as hypothesized.

Proof of Proposition 6. Note that $\hat{W}^k(t)$ given by (8) converges to approximately $(\frac{1}{2} - \alpha^k)\left(1-\sigma\alpha^k\right)^2 A^2$. Differentiating with respect to α^k yields

$$-(1-\sigma\alpha^k)^2A^2 - 2\sigma(\tfrac{1}{2}-\alpha^k)(1-\sigma\alpha^k)A^2 \tag{A11}$$

$$= \quad -(1-\sigma\alpha^k)\left[1+\sigma-3\sigma\alpha^k\right]A^2. \tag{A12}$$

For $\alpha^k \in [0,1)$, this is negative if the term in square brackets is positive. For $\sigma \in (0,\frac{1}{2}]$, the term in the square brackets is positive for all $\alpha^k \in [0,1)$. Therefore, $\frac{d\hat{W}^k}{d\alpha^k} < 0$ is strictly decreasing in α^k on $[0,1]$. For $\sigma \in (\frac{1}{2},1]$, the term in the square brackets is positive if and only if $\alpha^k < \frac{1+\sigma}{3\sigma}$.

Hence, again, the limit point is strictly decreasing in α^k for $\sigma \leq \frac{1}{2}$ or $\alpha^k < \frac{1+\sigma}{3\sigma}$, thus establishing the proposition for Δ sufficiently large, as hypothesized. □

Proof of Proposition 7. By (13), for Θ^0, i.e., $\theta_i = 0$ for all i, the development barrier is $D^*(\mathbf{q},\Theta^0) = \delta$. As this is independent of $\mathbf{q}$,

$$\Omega(\Theta^0) = \{(\mathbf{q},A) \in [0,1] \times \mathbb{R}_+ : A > \delta\}. \tag{A13}$$

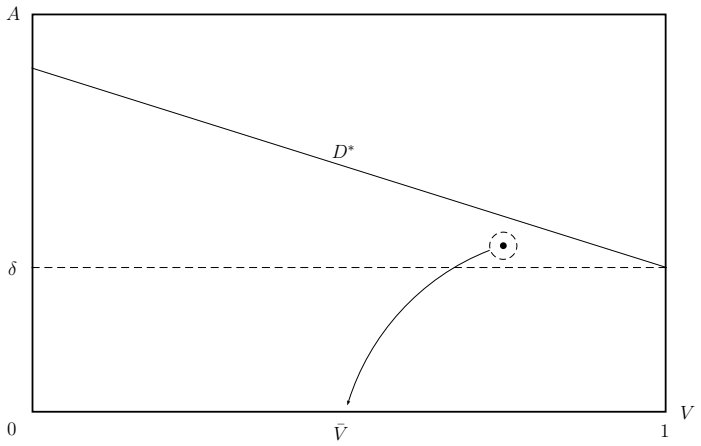


Figure A1: Plot of two-dimensional system (V,A), where D^* is the development barrier, δ is the technology depreciation rate, and $\bar{V}$ is the value of V under the limiting distribution of beliefs $\lim_{t\to\infty} q(t)$.

More generally, by (13), $\frac{dA}{dt} < 0$ in all states $(\mathbf{q},A)$ such that $A < D^*(\mathbf{q},\Theta)$. We have established $D^*(\mathbf{q},\Theta) \geq D^*(\mathbf{q},\Theta^0) = \delta$, and strictly so if there exists i such that θ_i and $q_i > 0$.

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

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

To establish the claim, plot the development barrier D^* as a function of $V \equiv \sum_{i=1}^n q_i(1-\theta_i)^2$ as in Figure A1. By (13), D^* is strictly decreasing in V on [0,1]. At $V = 1$, $D^* = \delta$, as in the degenerate set of beliefs. We know from Proposition 1(i) that $\mathbf{q}(t)$ converges to a state in which $\lim_{t\to\infty} q_i(t) > 0$ for some $\theta_i > 0$ as long as $\theta_i < 2\sigma\alpha$, i.e., in an environment that supports demotivating beliefs. Therefore, $V(t)$ converges to some value denoted by $\bar{V} < 1$ in an environment that supports demotivating beliefs.

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

Appendix B. Alternative Formulation: Leader-directed beliefs

Suppose the set of beliefs is binary, $\Theta = \{\theta_1, \theta_2\}$. Let $\theta_1 = 0$, i.e., the true belief, and $\theta_2 = \theta(t)$, which could be a demotivating belief. We assume a community leader or institution tunes $\theta(t)$ over time to maximize the spread of the demotivating belief. Given the binary case, we can rewrite $q(t) = q_2(t)$ and refer to it as the share of 'believers'. *We find that the demotivating belief chosen by the leader is the same as the belief selected by cultural evolution in a bottom-up manner.*

Proposition B1 *Consider a leader who sets $\theta(t)$ to maximize $q(t)$ at each time t.*

(i) The leader chooses belief intensity $\theta^* = \sigma\alpha$ for all t.

(ii) From every initial state $q(0) > 0$, if $\sigma\alpha > 0$, the share of believers $q(t)$ converges monotonically to one.

Proof. (i) Under a payoff monotone cultural dynamic, maximizing the spread of belief 2 from an interior state is equivalent to maximizing

$$\begin{aligned} F_2(q,A) - F_1(q,A) &= A^2\left\{[\sigma + (1-\sigma)q](1-\theta)\left(1-\alpha-\tfrac{1}{2}(1-\theta)\right) + (1-\sigma)(1-q)\left((1-\theta)-\tfrac{1}{2}(1-\theta)^2-\alpha\right)\right\} \\ &\quad -A^2\left\{[\sigma+(1-\sigma)(1-q)]\left(\tfrac{1}{2}-\alpha\right) + (1-\sigma)q\left(\tfrac{1}{2}-\alpha(1-\theta)\right)\right\} \\ &= A^2[\theta\sigma\alpha - \tfrac{1}{2}\theta^2]. \end{aligned} \tag{A14}$$

Hence the maximizer is $\theta^* = \sigma\alpha$.

(ii) Evaluating $F_2 - F_1 = A^2\left[\theta\sigma\alpha - \frac{1}{2}\theta^2\right]$ at θ^* yields

$$F_2(\theta^*) - F_1(\theta^*) = A^2\left[(\sigma\alpha)^2 - \tfrac{1}{2}(\sigma\alpha)^2\right] = \tfrac{1}{2}A^2(\sigma\alpha)^2, \tag{A15}$$

which is positive for $\sigma\alpha > 0$, independently of the state. Hence, in a payoff monotone cultural dynamic, $q(t)$ converges monotonically to one from any initial state $q(0) > 0$. □

First, the familiar belief $\theta^* = \sigma\alpha$ is independent of the state (q, A).[A1] Therefore, θ^* can be set by the leader once and for all at time $t = 0$ without having to be dynamically tuned as (q, A) evolves. Second, only a weak belief system (low θ^*) is optimal when the degree of zero-sumness α is low, because the negative externalities in the system are weak compared to the direct effect

[A1] Since $A(t)$ is a linear transformation of each player's payoffs, θ^* does not depend on the state of technology. In addition, θ^* also does not depend on the current population state because the negative externality imposed on player i from j's effort is independent of i's type.

of demotivating individuals. Third, the design of belief intensity by the leader guarantees the spread and eventual fixation of the demotivating belief system from all interior states, whenever $\sigma\alpha > 0$. All of this mirrors the results of bottom-up cultural evolution.

Appendix C. Data: Sources and Measurement

A. Surveys Conducted in Kananga, DRC

- Age: How old were you at your last birthday?
- Tribe: Bindi, Tshokwe, Kete, Kongo, Kuba, Lele, Luba, Luluwa, Luntu, Sala, Songe, Tetela.
- Zero-sum 1: Which Statement do you agree with? Statement 1: Gaining happiness requires taking it away from others. Statement 2: It is possible for everyone to be happy. 1 Agree strongly with statement 1; 2 Agree with statement 1; 3 Agree with statement 2; 4 Agree strongly with statement 2; 9999 Agree with neither statement; 8888 Don't want to say.
- Zero-sum 2: Which Statement do you agree with? Statement 1: A person can only gain power by taking it away from others. Statement 2: A person can gain power without taking it away from others. 1 Agree strongly with statement 1; 2 Agree with statement 1; 3 Agree with statement 2; 4 Agree strongly with statement 2; 9999 Agree with neither statement; 8888 Don't want to say.
- Zero-sum 3: Which Statement do you agree with? Statement 1: In trade, if one party gains the other party loses. Statement 2: In trade, it is possible for both parties to gain at the same time. 1 Agree strongly with statement 1; 2 Agree with statement 1; 3 Agree with statement 2; 4 Agree strongly with statement 2; 9999 Agree with neither statement; 8888 Don't want to say.
- Zero-sum 4: Which Statement do you agree with? Statement 1: If one person in a village gets very wealthy, other people in the village will become poorer. Statement 2: If one person in a village gets very wealthy, other people in the village will not necessarily become poorer. 1 Agree strongly with statement 1; 2 Agree with statement 1; 3 Agree with statement 2; 4 Agree strongly with statement 2; 9999 Agree with neither statement; 8888 Don't want to say.
- Zero-sum 5: Which Statement do you agree with? Statement 1: In Kananga, people only make money when others lose money. Statement 2: In Kananga, no one need lose money for others to make money. 1 Agree strongly with statement 1; 2 Agree with statement 1; 3 Agree with statement 2; 4 Agree strongly with statement 2; 9999 Agree with neither statement; 8888 Don't want to say.

- Zero-sum 6: Which Statement do you agree with? Statement 1: In Kananga, businesses only make money when others lose money. Statement 2: In Kananga, no one need lose money for businesses to make money. 1 Agree strongly with statement 1; 2 Agree with statement 1; 3 Agree with statement 2; 4 Agree strongly with statement 2; 9999 Agree with neither statement; 8888 Don't want to say.

- Zero-sum 7: Which Statement do you agree with? Statement 1: Most of the wealth of the rich was created without taking it from others. Statement 2: Most of the wealth of the rich was obtained by taking it from others. 1 Agree strongly with statement 1; 2 Agree with statement 1; 3 Agree with statement 2; 4 Agree strongly with statement 2; 9999 Agree with neither statement; 8888 Don't want to say.

- Zero-sum 8: Which Statement do you agree with? Statement 1: The success of the wealthy generally helps other people in the community. Statement 2: The success of the wealthy generally hurts other people in the community. 1 Agree strongly with statement 1; 2 Agree with statement 1; 3 Agree with statement 2; 4 Agree strongly with statement 2; 9999 Agree with neither statement; 8888 Don't want to say.

- Zero-sum 9: Which Statement do you agree with? Statement 1: Most wealth is created without exploiting others. Statement 2: Most wealth is obtained by exploiting others. 1 Agree strongly with statement 1; 2 Agree with statement 1; 3 Agree with statement 2; 4 Agree strongly with statement 2; 9999 Agree with neither statement; 8888 Don't want to say.

- Zero-sum 10: Which Statement do you agree with? Statement 1: If one farmer has a huge crop, his neighbor is likely to also have a huge crop. Statement 2: If one farmer has a huge crop, his neighbor is likely to have a small crop. 1 Agree strongly with statement 1; 2 Agree with statement 1; 3 Agree with statement 2; 4 Agree strongly with statement 2; 9999 Agree with neither statement; 8888 Don't want to say.

- Zero-sum 11: Which Statement do you agree with? Statement 1: If God is looking out for my brother, He is less likely to be looking out for me. Statement 2: If God is looking out for my brother, He is more likely to also be looking out for me. 1 Agree strongly with statement

1; 2 Agree with statement 1; 3 Agree with statement 2; 4 Agree strongly with statement 2; 9999 Agree with neither statement; 8888 Don't want to say.

- Zero-sum 12: Which Statement do you agree with? Statement 1: If my ancestors' spirits are looking out for my brother, they are less likely to be looking out for me. Statement 2: If my ancestors' spirits are looking out for my brother, they are more likely to also be looking out for me. 1 Agree strongly with statement 1; 2 Agree with statement 1; 3 Agree with statement 2; 4 Agree strongly with statement 2; 9999 Agree with neither statement; 8888 Don't want to say.

- Envy 1: It is so frustrating to see some people succeed so easily. 1 strongly disagree; 2 moderately disagree; 3 slightly disagree; 4 slightly agree; 5 moderately agree; 6 strongly agree.

- Envy 2: It somehow doesn't seem fair that some people seem to have all the talents. 1 strongly disagree; 2 moderately disagree; 3 slightly disagree; 4 slightly agree; 5 moderately agree; 6 strongly agree.

- Envy 3: Frankly, the success of my neighbors makes me resent them. 1 strongly disagree; 2 moderately disagree; 3 slightly disagree; 4 slightly agree; 5 moderately agree; 6 strongly agree.

- Envy 4: I sometimes wish that rich and powerful people lose their advantage. 1 strongly disagree; 2 moderately disagree; 3 slightly disagree; 4 slightly agree; 5 moderately agree; 6 strongly agree.

- Witchcraft beliefs 1: What is the strength of your belief in the existence of other gods and spirits, including ancestor spirits? 1 With no strength at all; 2: With a little bit of strength; 3 With strength; 4 With a lot of strength; 5 With all my heart.

- Witchcraft beliefs 2: How often do you pray other gods and spirits including ancestor spirits? 1 never; 2 very rarely; 3 a few times per year; 4 a few times per month; 5 a few times per week.

- Witchcraft beliefs 3: How often do you participate in rites devoted to other gods and spirits, including ancestor spirits? 1 never; 2 very rarely; 3 a few times per year; 4 a few times per month; 5 a few times per week.
- Witchcraft beliefs 4: Using the figures provided, which set of figures best represents how close you feel to non Christians in Kananga?
- Christian beliefs 1: What is the strength of your belief in the existence of the Christian God? 1 With no strength at all; 2: With a little bit of strength; 3 With strength; 4 With a lot of strength; 5 With all my heart.
- Christian beliefs 2: How often do you pray the Christian God or Jesus? 1 never; 2 very rarely; 3 a few times per year; 4 a few times per month; 5 a few times per week.
- Christian beliefs 3: How often do you attend church? 1 never; 2 very rarely; 3 a few times per year; 4 a few times per month; 5 a few times per week.
- Christian beliefs 4: Using the figures provided, which set of figures best represents how close you feel to Christians in Kananga?

B. Zero-Sum Vignette Questions Implemented in Kananga, DRC

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

a. Banana Retailers

Think of two women, Kapinga and Tshilomba, selling bananas on the side of the road. They sell bananas for two days. On the first day, Kapinga sells 10 bananas and Tshilomba sells 20 bananas. On the second day, Kapinga sells 20 bananas. How many bananas do you think Tshilomba sold on the second day?

- How many bananas do you think Tshilomba sold on the second day? [Integer]

- Imagine that Tshilomba sold either 10 bananas or 40 bananas. Which outcome do you think is more likely? 1 10 bananas; 2 40 bananas; 8888 doesn't know.
- Do you remember how many bananas Kapinga sold on the first day? 1 gives correct answer; 2 gives correct answer after a while; 3 gives wrong answer; 4 does not even try to answer

b. Maize Farmers

Think of two farmers, Lukusa and Badibanga, in a rural village far from Kananga. They grow crops each year. In one year, Lukusa harvests $50 worth of maize and Badibanga harvests $100 worth of maize. In the following year, Lukusa harvests $100 worth of maize. How much money do you think Badibanga made for the maize he harvested in the second year?

- How much money do you think Badibanga made for the maize he harvested in the second year? [Integer]
- Imagine that Badibanga harvested either $50 worth of maize or $200 worth of maize. Which outcome do you think is more likely? 1 $50 worth of maize; 2 $200 worth of maize; 8888 doesn't know.
- Do you remember how much money Badibanga earned for the maize he harvested in the first year? 1 gives correct answer; 2 gives correct answer after a while; 3 gives wrong answer; 4 does not even try to answer.

c. Diamond Miners

Think of two men, Kalonji and Tshibuabua, who go to Tchikapa to mine diamonds. They mine for diamonds for two years. During the first year, Kalonji finds $100 of diamonds and Tshibuabua finds $50 of diamonds. During the second year, Kalonji finds $50 of diamonds. How much money do you think Tshibuabua made from diamonds he found during the second year?

- How much money do you think Tshibuabua made from diamonds he found during the second year? [integer]
- Imagine that Tshibuabua found either $25 of diamonds or $100 of diamonds. Which outcome do you think is more likely? 1 $25 worth of diamonds; 2 $100 worth of diamonds; 8888 doesn't know.

- Do you remember how much money Kalonji got for his diamonds in the second year? 1 gives correct answer; 2 gives correct answer after a while; 3 gives wrong answer; 4 does not even try to answer.

C. World Values Survey

- Income decile: 0 = bottom decile to 1 = top decile [X047_WVS][A2] On this card is an income scale on which 1 indicates the lowest income group and 10 the highest income group in your country. We would like to know in what group your household is. Please, specify the appropriate number, counting all wages, salaries, pensions and other incomes that come in.

- Family savings: 0=borrowed to 1=saved [X044] During the past year, did your family: 1 Save money; 2 Just get by; 3 Spent some savings and borrowed money; 4 Spent savings and borrowed money; -1 Don't know; -2 No answer.

- Educational attainment: 0 = primary school or less to 1 = university or more [X025 and X025A_01][A3] 1 Inadequately completed elementary education; 2 Completed (compulsory) elementary education; 3 Incomplete secondary school: technical/vocational type/(Compulsory) elementary education and basic vocational qualificat; 4 Complete secondary school: technical/vocational type/Secondary, intermediate vocational qualification; 5 Incomplete secondary: university-preparatory type/Secondary, intermediate general qualification; 6 Complete secondary: university-preparatory type/Full secondary, maturity level certificate; 7 Some university without degree/Higher education - lower-level tertiary certificate; 8 University with degree/Higher education - upper-level tertiary certificate; -5 Missing; Unknown; -4 Not asked in survey; -3 Not applicable; No formal education; -2 No answer; -1 Don't know.

- Cognitive vs. manual work tasks: 0=manual to 1=cognitive [X053][A4] Are the tasks you perform at work mostly manual or mostly cognitive? If you do not work currently, characterize

[A2]In waves 1 through 4, the question text also instructed respondents to count income before taxes and other deductions.

[A3]These education codes changed noticeably in Wave 7 (not listed here). For analysis, we collapse the education groups into the smallest yet not overlapping groups as possible.

[A4]Wave 5 used the word "cognitive" while wave 6 used the word "intellectual."

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

- Supervising someone at work: 0=no to 1=yes [X031] Do you or did you supervise other people at work? 0 No; 1 Yes.

- Class: 0 = lower class to 1 = upper class [X045] People sometimes describe themselves as belonging to the working class, the middle class, or the upper or lower class. Would you describe yourself as belonging one of them? 1 Upper class; 2 Upper middle class; 3 Lower middle class; 4 Working class; 5 Lower class; -5 Missing or Unknown.

- Hard work brings success: 0 = complete agreement to 1 = complete disagreement [E040] Now I'd like you to tell me your views on various issues. How would you place your views on this scale? 1 means you agree completely with the statement on the left; 10 means you agree completely with the statement on the right; and if your views fall somewhere in between, you can choose any number in between. 1 In the long run, hard work usually brings a better life; 10 Hard work doesn't generally bring success - it's more a matter of luck and connections; -5 Missing or Unknown; -4 Not asked in survey; -3 Not applicable; -2 No answer; -1 Don't know.

- People are poor because of laziness: 0 = agreement to 1 = disagreement [E131] Why, in your opinion, are there people in this country who live in need? Here are two opinions: Which comes closest to your view? 1 Poor because of laziness and lack of will power; 2 Poor because society treats them unfairly; 3 Other answer; -1 Don't know; -2 No answer; -4 Not asked.

- People have a chance to escape poverty: 0 = have a chance to 1 = very little chance [E132] In your opinion, do most poor people in this country have a chance of escaping from poverty, or is there very little of chance escaping? 1 They have a chance; 2 There is very little chance; 3 Other answer; -1 Don't know; -2 No answer; -4 Not asked.

- Humiliating to receive money without working for it: 0 = strongly agree to 1 = strongly disagree [C037][A5] Do you agree with "Humiliating to receive money without having to

[A5]Wave 5 changed the wording to "It is humiliating to receive money without working for it."

work for it"? 1 Strongly agree; 2 Agree; 3 Neither agree or disagree; 4 Disagree; 5 Strongly disagree; -1 Don't know; -2 No answer; -4 Not asked; -5 Missing or Unknown.

- Important to me to be very successful and have achievements recognized: 0 = very much to 1 = not at all [A194] Now I will briefly describe some people. Using this card, would you please indicate for each description whether that person is very much like you, like you, somewhat like you, not like you, or not at all like you? "Being very successful is important to this person; to have people recognize one's achievements." 1 Not at all like me; 2 Not like me; 3 A little like me; 4 Somewhat like me; 5 Like me; 6 Very much like me; -1 Don't know; -2 No answer; -4 Not asked; -5 Missing or Unknown.

- How important is work: 0 = very important to 1 = not at all [A005][A6] For each of the following aspects, indicate how important it is in your life. Would you say it is very important, rather important, not very important or not important at all: Work. 1 Very important; 2 Rather important; 3 Not very important; 4 Not at all important; -1 Don't know; -2 No answer; -4 Not asked; -5 Missing or Not available.

- How satisfied are you with your life: 1 = completely dissatisfied to 10 = completely satisfied [A170] How satisfied are you with the financial situation of your household? If "1" means you are completely dissatisfied on this scale, and "10" means you are completely satisfied, where would you put your satisfaction with your household's financial situation? 1 Dissatisfied; 10 Satisfied; -1 Don't know; -2 No answer; -4 Not asked; -5 Missing or Unknown.

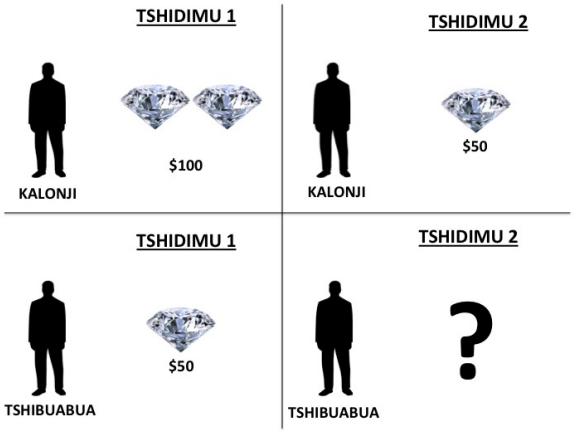
- How happy are you: 0 = Not at all happy to 1 = very happy [A008] Taking all things together, would you say you are: 1 Very happy; 2 Quite happy; 3 Not very happy; 4 Not at all happy; -1 Don't know; -2 No answer; -4 Not asked; -5 Missing or Not available.

Appendix D. Additional Figures and Tables

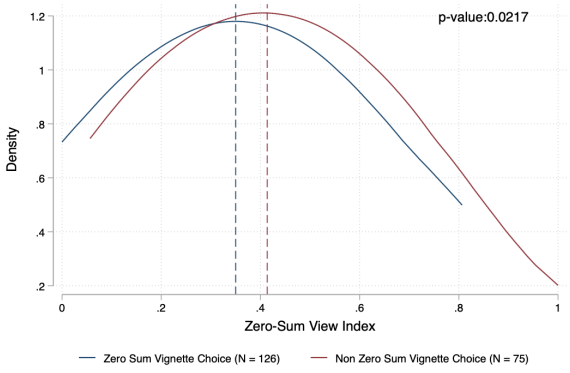
[A6] In wave 2, work was put as the first of a list of five things that people could rate as important. The ordering changed for the following waves, such that work was listed towards the end.

Figure A2: Zero-Sum Index of Six Survey Questions and Zero-Sum Choice in the Diamond Vignette

(a) Diamond vignette: $5 or $20 of diamonds?



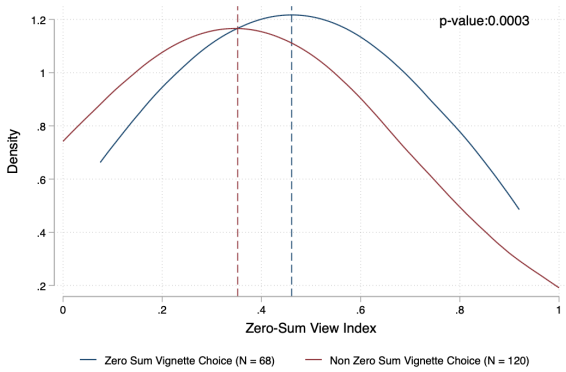
(b) Diamond vignette



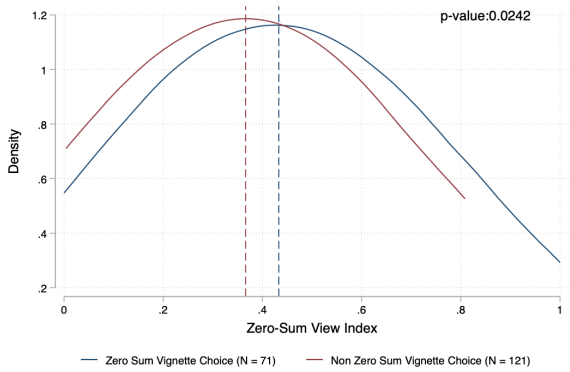
Notes: Figure A2a shows the image provided to respondents to illustrate the diamond vignette question. Figure A2b reports the distribution of the zero-sum view index, constructed as the first principal component of the six zero-sum statements, by respondents' choice in the diamond vignette questions. Specifically, it reports the Kernel Density of the zero-sum view index when the zero-sum answer is chosen in the vignette question (in blue) and when the non-zero-sum answer is chosen in the vignette question (in dark red). The Kernel densities use the default Epanechnikov kernel and bandwidth. Figure A2b reports the p-value associated with the t-test of equality of the zero-sum view index for respondents who chose the zero-sum response and those who chose the non zero-sum response.

Figure A3: Zero-sum Index of Ten Survey Questions and Zero-Sum Choice in the Banana and Maize Vignettes

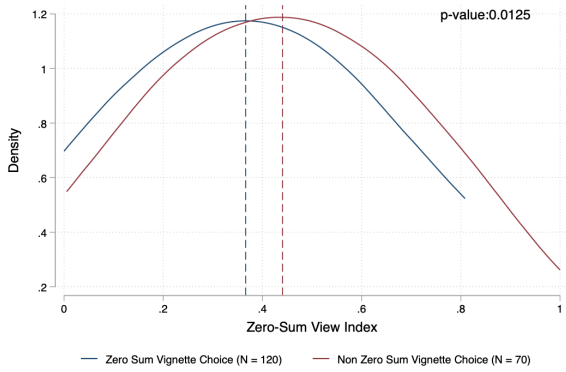
(a) Banana vignette



(b) Maize vignette



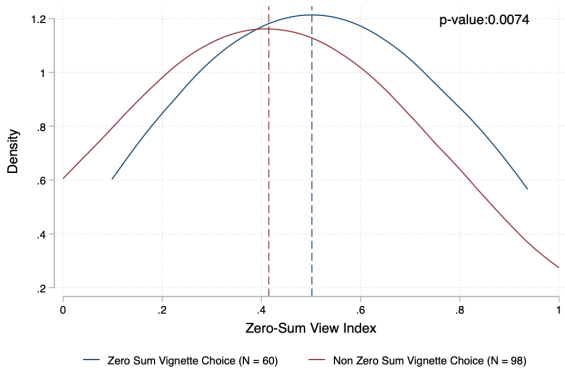
(c) Diamond vignette



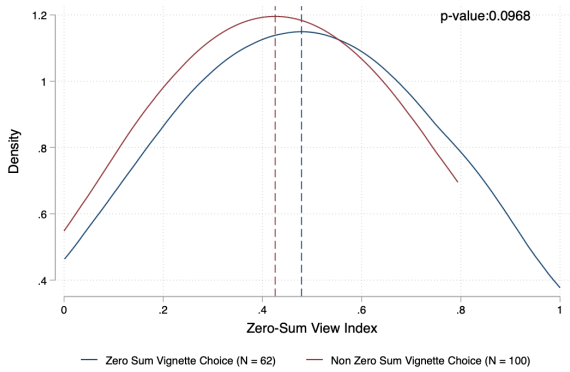
Notes: This figure reports the distribution of the zero-sum view index constructed as the first principal component of the ten zero-sum statements described in Section 4.B, by respondents' choice in the vignette questions. Specifically, it reports the Kernel Density of this zero-sum view index when the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

Figure A4: Zero-sum Index of Twelve Survey Questions and Zero-Sum Choice in the Banana and Maize Vignettes

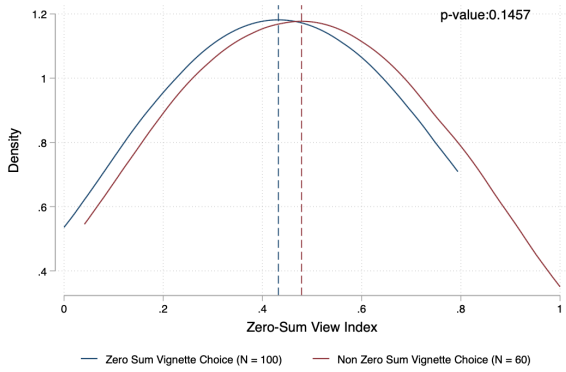
(a) Banana vignette



(b) Maize vignette

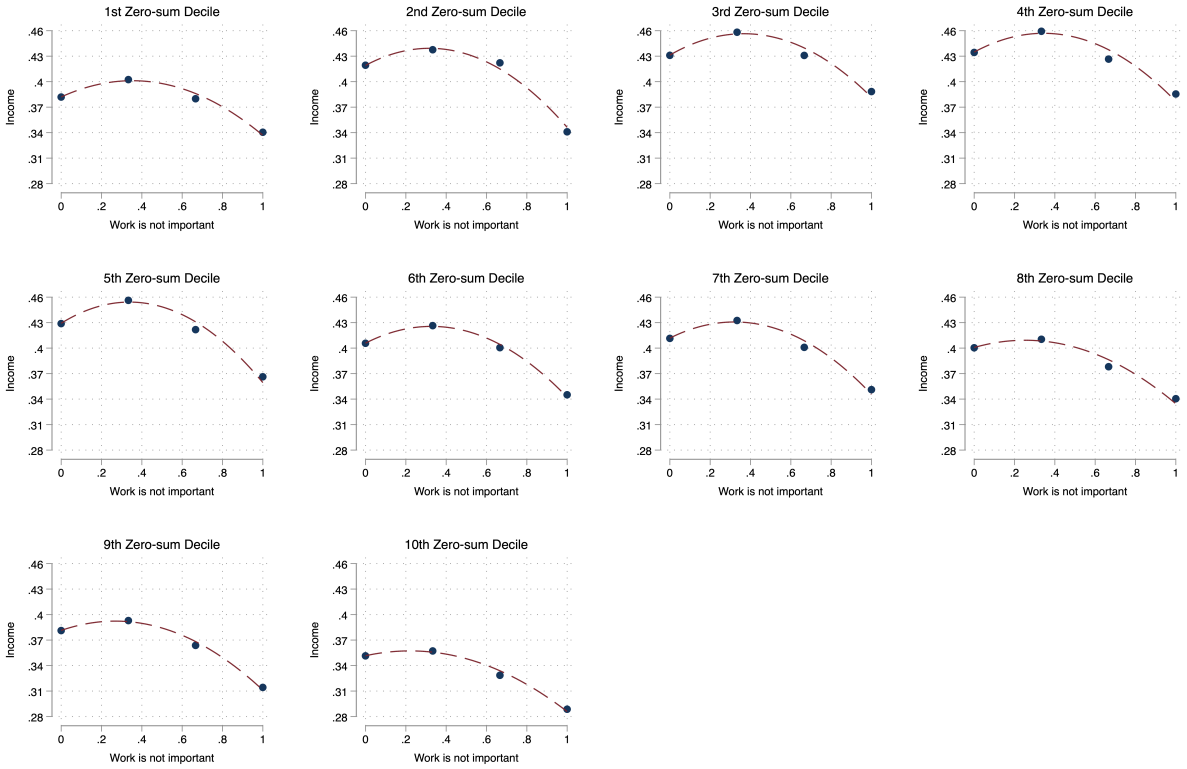


(c) Diamond vignette



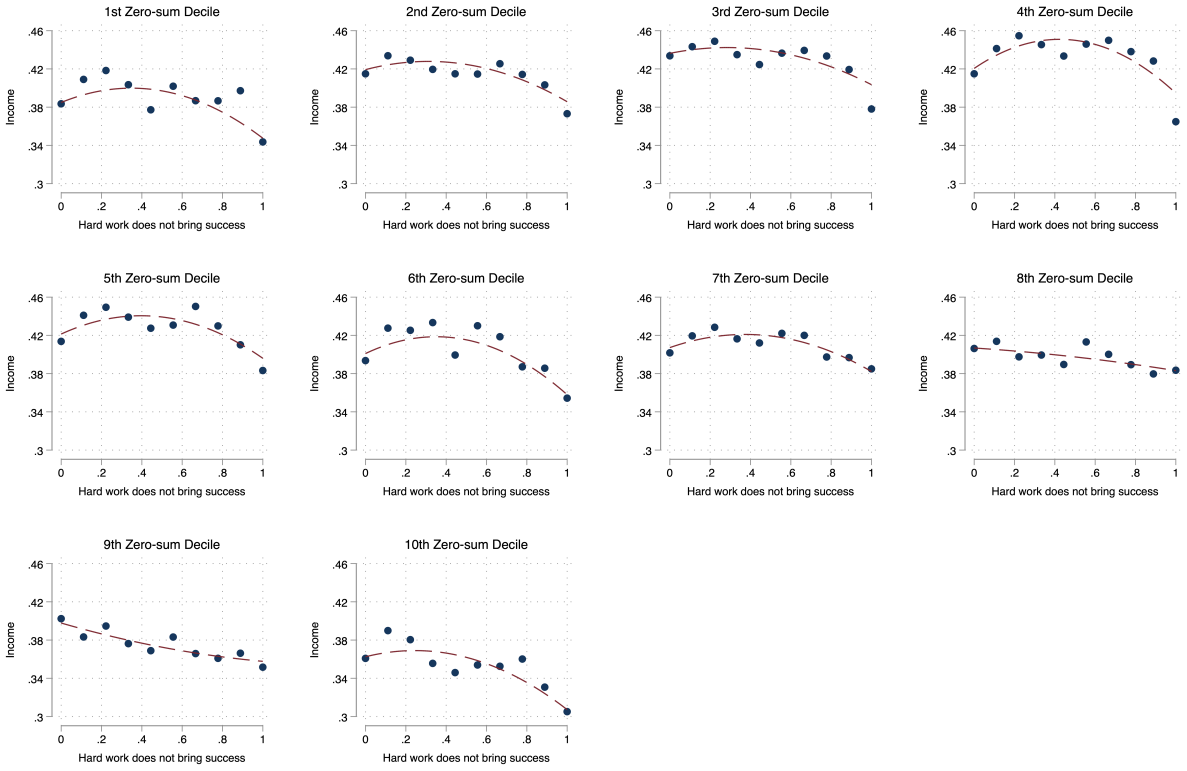
Notes: This figure reports the distribution of the zero-sum view index constructed as the first principal component of the twelve zero-sum statements described in Section 4.B, by respondents' choice in the vignette questions. Specifically, it reports the Kernel Density of this zero-sum view index when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

Figure A5: Relationship between demotivating beliefs and income, holding constant zero-sum thinking: No demographic controls and country-wave fixed effects



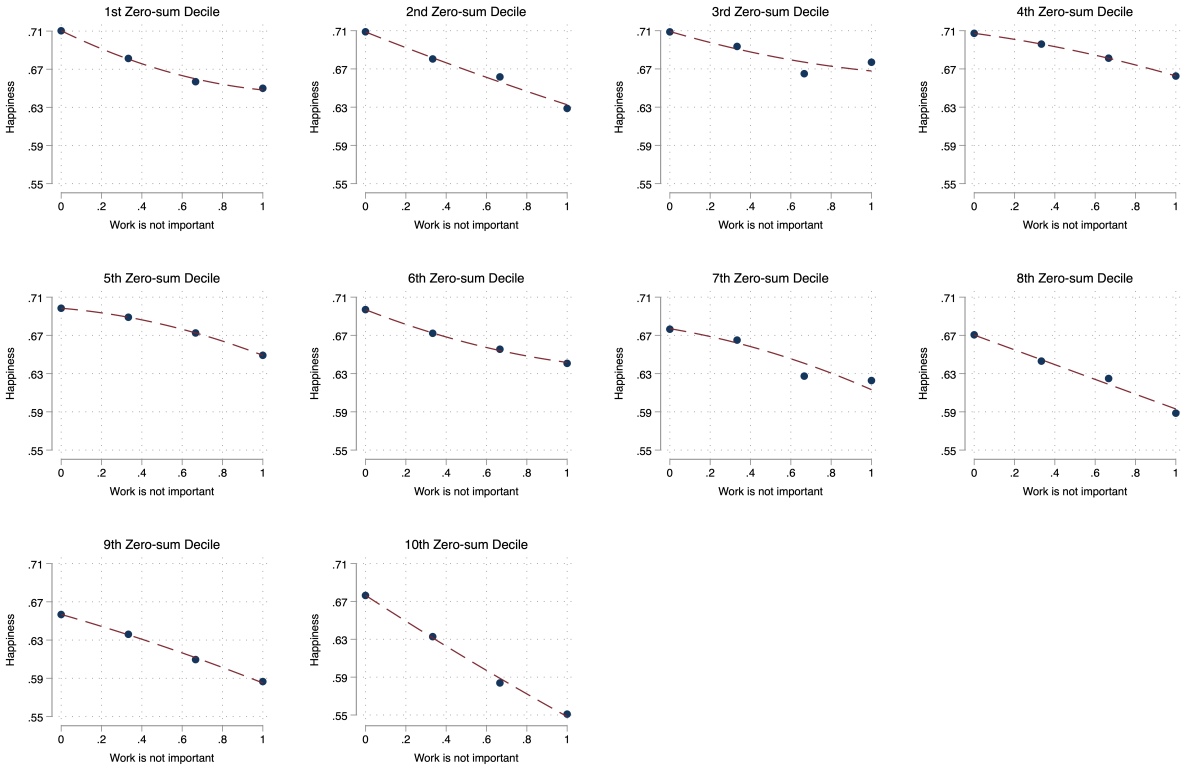
Notes: The figure reports the relationship between respondents' demotivating beliefs and level of income for each zero sum decile. The demotivating belief in this figure, is reported based on respondents' answer to the question (with work being the aspect respondents were asked the question about) "For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

Figure A6: Relationship between demotivating beliefs and income, holding constant zero-sum thinking: No demographic controls and country-wave fixed effects



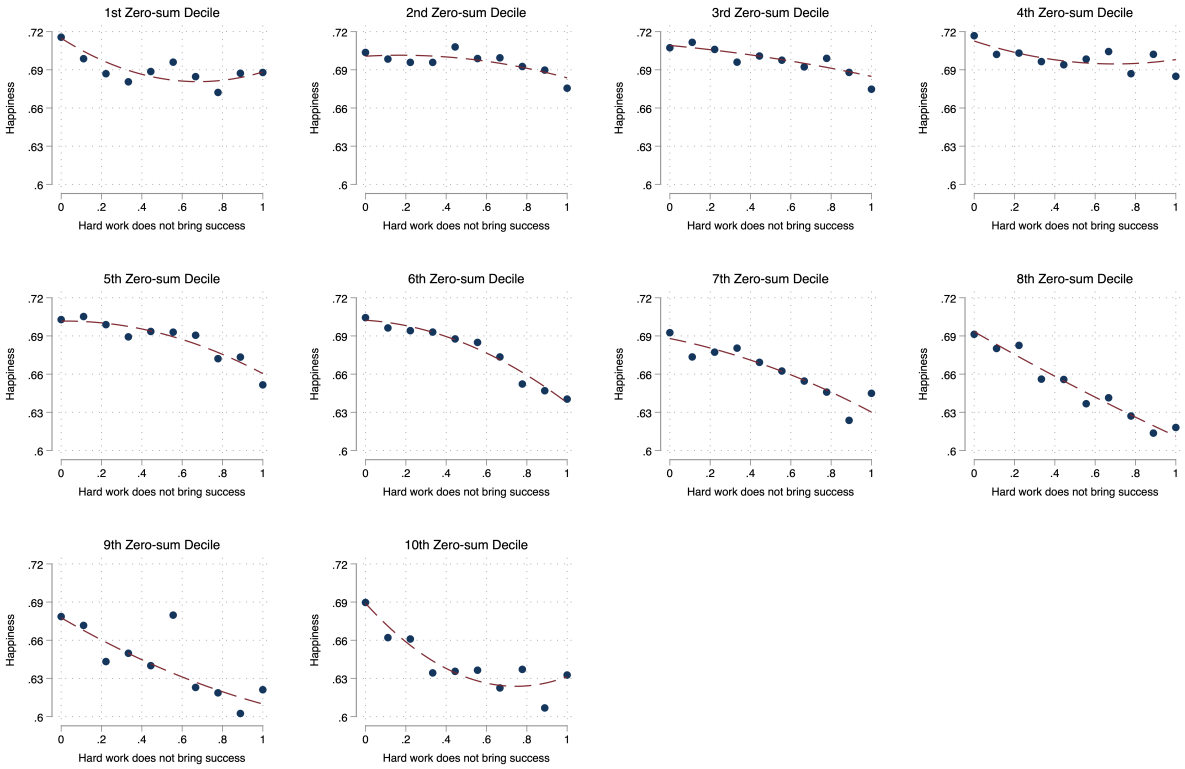
Notes: The figure reports the relationship between respondents' demotivating beliefs and level of income for each zero sum decile. The demotivating belief in this figure, is reported based on how much respondents agreed with the statement "In the long run, hard work usually brings a better life" on a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

Figure A7: Relationship between demotivating beliefs and happiness, holding constant zero-sum thinking: No demographic controls and country-wave fixed effects



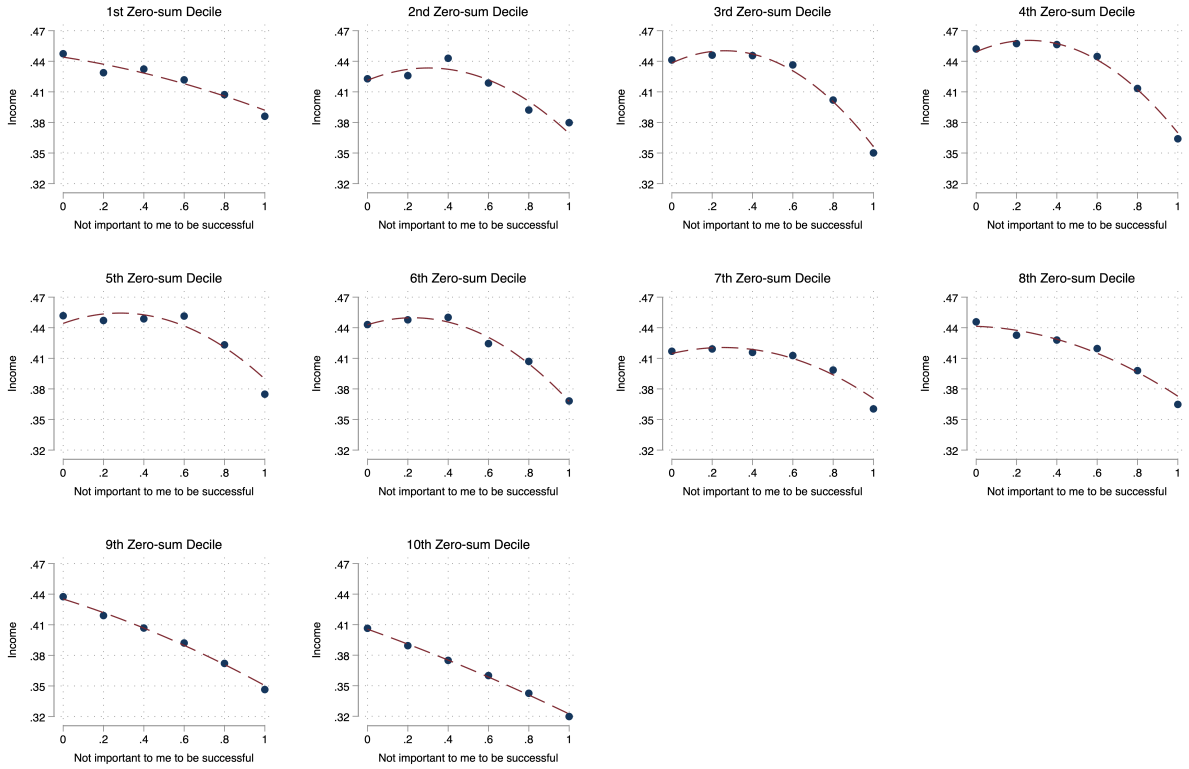
Notes: The figure reports the relationship between respondents' demotivating beliefs and level of happiness for each zero sum decile. The demotivating belief in this figure, is reported based on respondents' answer to the question (with work being the aspect respondents were asked the question about)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

Figure A8: Relationship between demotivating beliefs and happiness, holding constant zero-sum thinking: No demographic controls and country-wave fixed effects



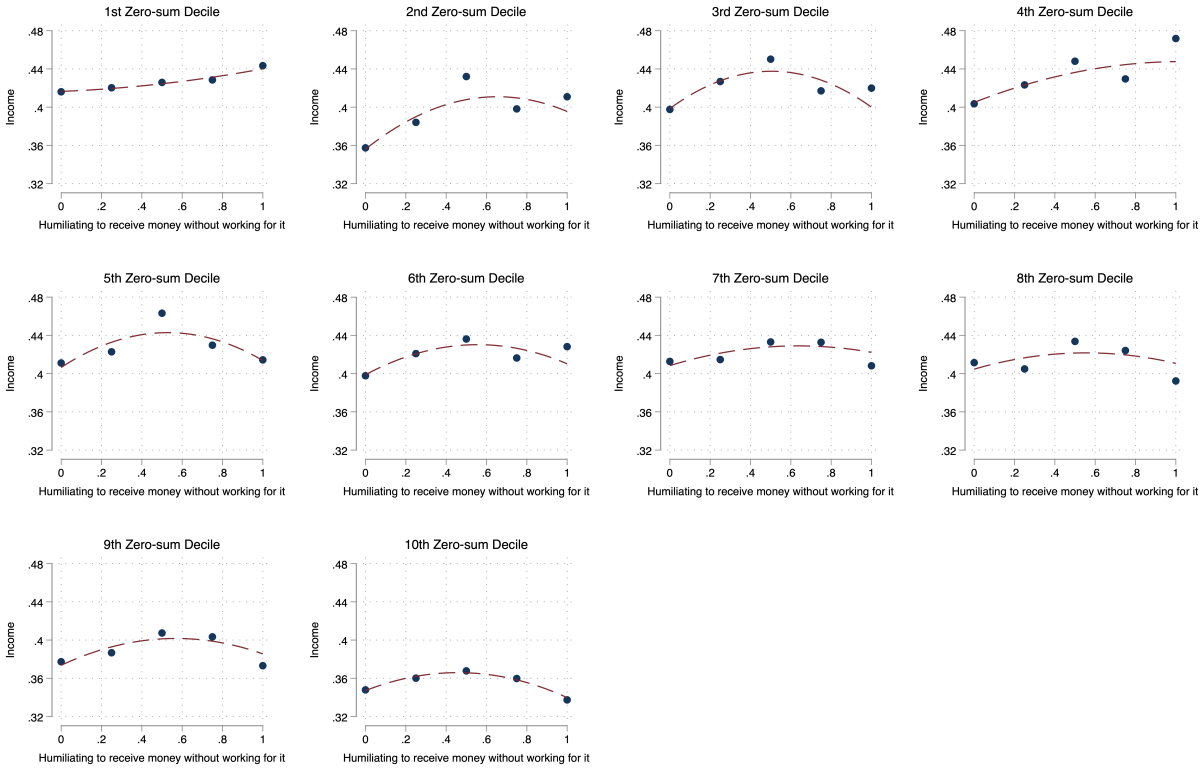
Notes: The figure reports the relationship between respondents' demotivating beliefs and level of happiness for each zero sum decile. Country-wave fixed effects and demographic controls are netted out before creating the zero-sum deciles. The demotivating belief in this figure, is reported based on how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

Figure A9: Relationship between demotivating beliefs and income, holding constant zero-sum thinking



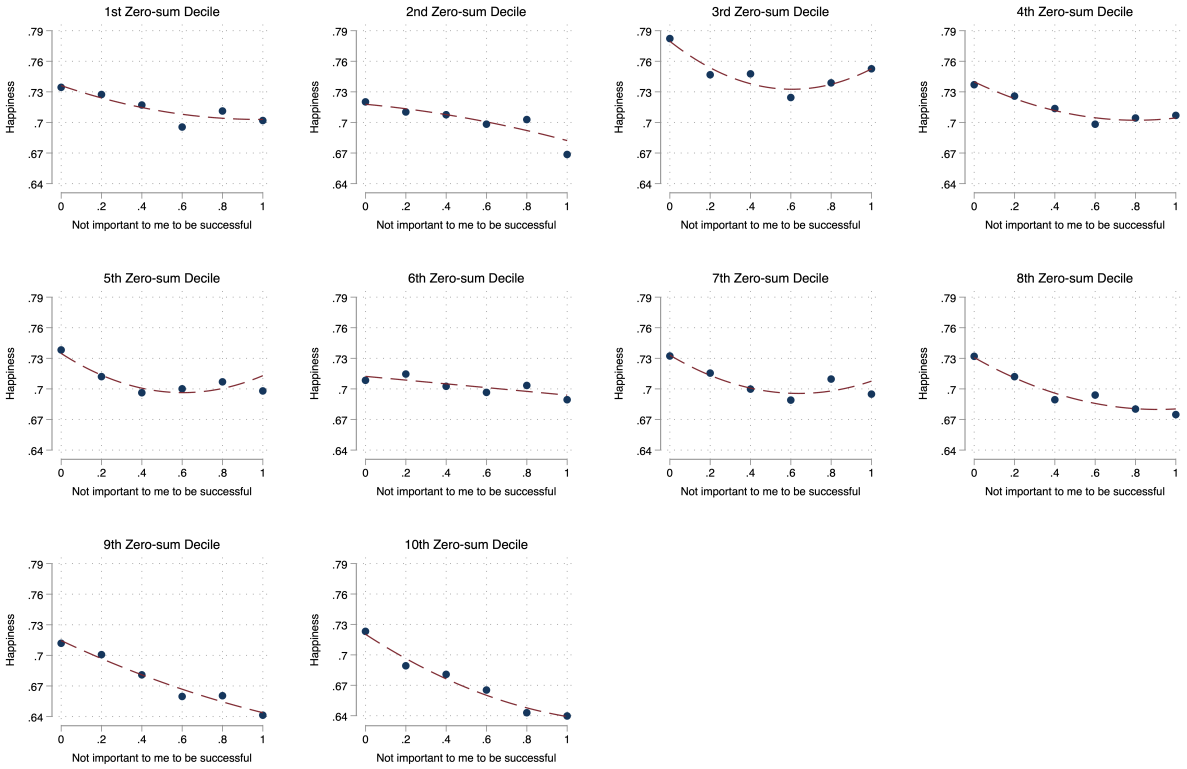
Notes: The figure reports the relationship between respondents' demotivating beliefs and level of income for each zero sum decile. Country-wave fixed effects and demographic controls are netted out before creating the zero-sum deciles. The demotivating belief in this figure, is reported based on respondents'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

Figure A10: Relationship between demotivating beliefs and income, holding constant zero-sum thinking



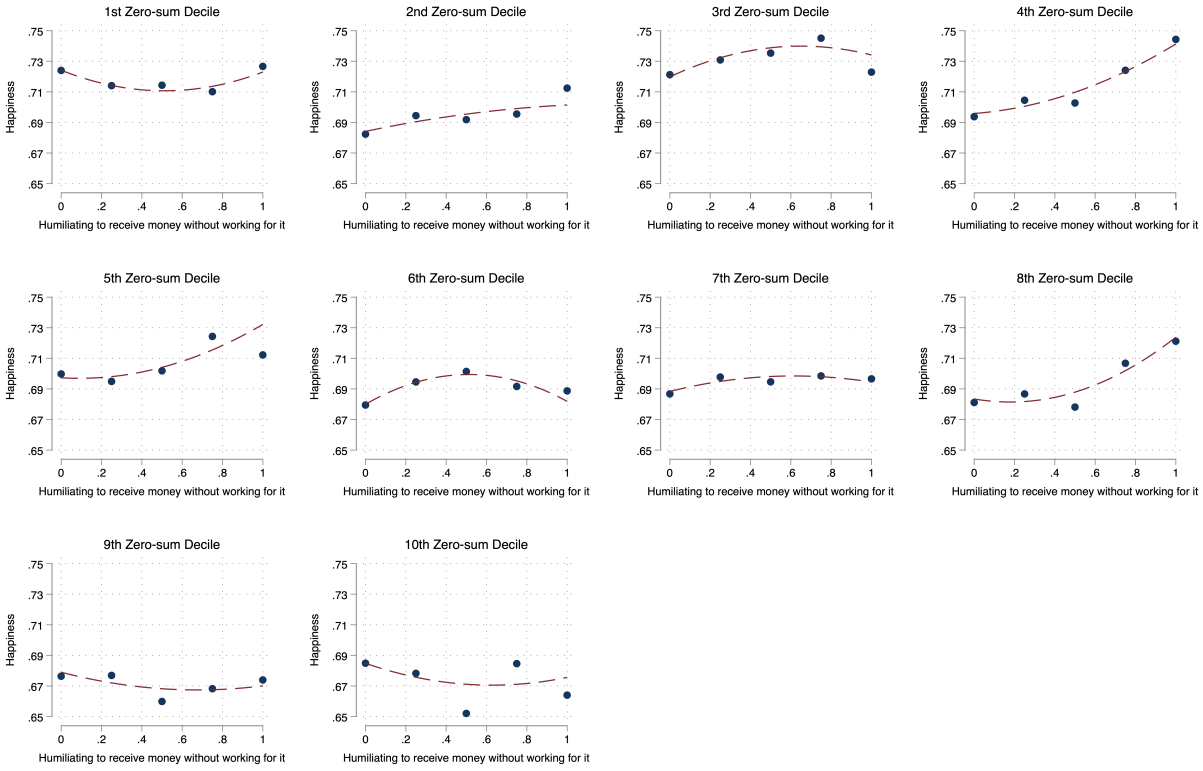
Notes: The figure reports the relationship between respondents' demotivating beliefs and level of income for each zero sum decile. Country-wave fixed effects and demographic controls are netted out before creating the zero-sum deciles. The demotivating belief in this figure, is reported based on how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

Figure A11: Relationship between demotivating beliefs and happiness, holding constant zero-sum thinking



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

Figure A12: Relationship between demotivating beliefs and happiness, holding constant zero-sum thinking



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

Table A1: Zero-Sum Index of Ten Survey Questions, Envy, and Witchcraft in the DRC: 200 Person Sample

	Principal-Component Based Measures							
	Jealousy Of Others		Witchcraft Beliefs		Christianity Beliefs		Difference btw Witchcraft and Chrstianity	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Zero Sum	0.343***	0.349***	0.310**	0.268**	-0.120**	-0.131**	0.430***	0.399**
	(0.061)	(0.074)	(0.094)	(0.088)	(0.058)	(0.062)	(0.122)	(0.120)
Gender, age, age squared	Y	Y	Y	Y	Y	Y	Y	Y
Ethnicity FEs	N	Y	N	Y	N	Y	N	Y
Observations	192	192	186	186	186	186	186	186
R squared	0.132	0.184	0.075	0.145	0.032	0.099	0.061	0.147

Notes: This table examines the relationship between zero-sum views and an individual's self-reported envy of others, beliefs in witchcraft and beliefs in Christianity, for the sample of about 200 respondents collected in 2015 in Kananga, DRC. It reports estimates from Equation (9). In all the Columns, the explanatory variable is the first principal component of the ten zero-sum statements described in section 4.B. In columns 1 and 2, the dependent variable is the principal-component of four survey questions measuring self-reported envy of others. The first three questions ask about experiencing frustration when people succeed in life easily, resentment when neighbors are successful, or feelings of injustice when some people seem to have all the talents. The fourth question asks if the respondent sometimes wishes that rich and powerful people lose their advantage. In columns 3 and 4, it is the principal-component based measure of beliefs in witchcraft using four survey questions that ask about the strength of belief in traditional religion, frequency of prayer to ancestors, frequency of participation in rituals devoted to ancestors, and how close they feel to non-Christians who live in Kananga. In columns 5 and 6, it is a principal-component based measure of beliefs in Christianity using four survey questions that ask about the strength of one's belief in the Christian God, frequency of prayer, frequency of attending church, and how close the respondent feels to non-Christians who live in Kananga. In columns 7 and 8, it is a the differences in the principal-component based measure of beliefs in witchcraft and Christianity. We include controls for gender, age, and age squared in all columns. In columns 2, 4, 6, and 8, we also include ethnicity fixed effects. We report robust standard errors in parentheses.

Table A2: Zero-Sum Index of Twelve Survey Questions, Envy, and Witchcraft in the DRC: 200 Person Sample

	Principal-Component Based Measures							
	Jealousy Of Others		Witchcraft Beliefs		Christianity Beliefs		Difference btw Witchcraft and Chrstianity	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Zero Sum	0.375***	0.378***	0.371***	0.327**	-0.151**	-0.157**	0.522***	0.484***
	(0.069)	(0.086)	(0.109)	(0.109)	(0.061)	(0.069)	(0.138)	(0.141)
Gender, age, age squared	Y	Y	Y	Y	Y	Y	Y	Y
Ethnicity FEs	N	Y	N	Y	N	Y	N	Y
Observations	162	162	157	157	157	157	157	157
R squared	0.142	0.213	0.092	0.173	0.043	0.120	0.082	0.177

Notes: This table examines the relationship between zero-sum views and an individual's self-reported envy of others, beliefs in witchcraft and beliefs in Christianity, for the sample of about 200 respondents collected in 2015 in Kananga, DRC. It reports estimates from Equation (9). In all the Columns, the explanatory variable is the first principal component of the twelve zero-sum statements described in section 4.B. In columns 1 and 2, the dependent variable is the principal-component of four survey questions measuring self-reported envy of others. The first three questions ask about experiencing frustration when people succeed in life easily, resentment when neighbors are successful, or feelings of injustice when some people seem to have all the talents. The fourth question asks if the respondent sometimes wishes that rich and powerful people lose their advantage. In columns 3 and 4, it is the principal-component based measure of beliefs in witchcraft using four survey questions that ask about the strength of belief in traditional religion, frequency of prayer to ancestors, frequency of participation in rituals devoted to ancestors, and how close they feel to non-Christians who live in Kananga. In columns 5 and 6, it is a principal-component based measure of beliefs in Christianity using four survey questions that ask about the strength of one's belief in the Christian God, frequency of prayer, frequency of attending church, and how close the respondent feels to non-Christians who live in Kananga. In columns 7 and 8, it is a the differences in the principal-component based measure of beliefs in witchcraft and Christianity. We include controls for gender, age, and age squared in all columns. In columns 2, 4, 6, and 8, we also include ethnicity fixed effects. We report robust standard errors in parentheses.

Table A3: Religions in the WVS 'other' category

Religion	**N**
Bahai	10
Cao Dai	11
Essid	4
Jain	55
Other	2,557
Other: Brasil: Espirit,candomblé,umbanda	3
Other: Oriental	12
Other: Philippines (less 0.5%)	19
Sikh	49
Spiritista	33
Spiritualists	4
Zoroastrian	8
Yiguan Dao	39
Total	2,804