

DISSERTATION

THREE ESSAYS ON THE BEHAVIORAL ECOLOGY OF MARKETS AND CAPITALISM

Submitted by

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ABSTRACT

THREE ESSAYS ON THE BEHAVIORAL ECOLOGY OF MARKETS AND CAPITALISM

In this dissertation, I employ theoretical evolutionary models and empirical evidence from folklore, ethnography, and economic experiments to explore the evolutionary and contextual effects of markets and capitalism on behavior.

In the first chapter, I use evolutionary game theory to examine how empathy evolves in various social-economic ecologies. I situate the evolutionary game on a network with distinct social and economic layers (where strategy transmission and game interactions occur, respectively), and I define empathy as cooperating conditional on social proximity. The results reveal that when interactions occur among both familiars and strangers, discriminatory empathy outperforms unconditional cooperation, but when interactions occur only among strangers, empathy produces no cooperation. The results illustrate that if behaviors spread among familiars, familiarity serves as a proxy for behavioral relatedness; in this way, conditioning cooperation on familiarity concentrates the benefits of cooperation among cooperators, allowing this behavior to persist and spread.

In the second chapter, I employ global folklore and ethnographic text as data to analyze the social and cultural effects of markets and capitalism. I construct indices for social, cultural, and economic characteristics based on the textual prevalence of relevant words and apply regression analysis to these indices. The results suggest that markets and capitalism are associated with decreased ecocentrism and increased stratification and that, in folklore, markets are associated with increased moral content. While markets are weakly associated with increased prosociality, capital-

ism is associated with decreased prosociality. I also estimate the markets coefficients using distance from historic trade route as an instrument, providing some support for a causal interpretation.

In the third chapter, I seek to clarify the ambiguities and resolve the apparent contradictions on the relationship between markets and prosociality by assembling a theoretical framework and conducting a meta-analysis of the experimental evidence. Using a theoretical synthesis of evolutionary theory, game theory, and political economy, I argue that markets represent social, psychological, and economic situations that influence both the evolution and the behavioral expression of social preferences. I apply the technique of meta-regression to the findings of 242 experiments to analyze the within-study effects of anonymity, ephemerality, market framing, and country-level market exposure on prosociality. The meta-data reveal a negative effect of market-related contexts on prosociality but no effect of market exposure.

Taken together, these essays analyze empirically and theoretically the behavioral ecology of markets and capitalism.

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Introduction

Mainstream economic theory tends to assume that the preferences that drive human behavior are exogenous, static, context-independent, and purely self-regarding. In these models, social and economic environments influence behavior only as constraints on the expression of fixed universal preferences. Yet evidence from anthropology, psychology, and experimental economics shows that human behavior varies widely across cultures and contexts and that the complex repertoire of motivations extends beyond selfishness to include prosociality and antagonism. Environments shape behavior through both culture and context. Individuals from different societies may behave differently in a given context, and any given individual may act differently in different contexts. For example, in economic experiments, prosociality between subjects tends to increase with familiarity, regardless of subjects' cultural backgrounds (Chapters 1 and 3), but prosociality among strangers varies widely across cultures (Chapter 3).

Traditional economic theory thus fails to capture the nuance, dynamism, and diversity of human behavior. The flawed assumptions embodied by *homo economicus* limit both the explanatory power of the discipline and the effectiveness of its prescriptive conclusions. Models based on these assumptions do not account for the impact of social context, norms, and identity on economic behavior nor the impact of economic institutions and structures on preferences and beliefs. Consequently, the economic policy prescriptions derived from such models consider only the effects of the policy on the incentives and constraints and miss the effects on preferences. More broadly, these assumptions severely restrict the set of potential solutions to social and economic problems. Economics needs a better foundational theory of human behavior, a theory that includes the evolutionary and contextual effects of environments on behavior—i.e. a theory of human behavioral ecology. The most promising candidate is the theory of cultural evolution.

Cultural evolution emphasizes the role of cumulative, adaptive social learning in explaining human behavior. In this framework, individuals selectively emulate the behaviors of successful social neighbors, modify and add to the behaviors, and are in turn emulated if they are successful. Culture (the sum of socially learned traits) accumulates across generations and adapts to social, economic, built, and natural environments. This can be modelled with evolutionary game theory, where individuals interact in games and play strategies that they learned by emulating the players with higher payoffs. Environments determine the topology of the interaction networks and the rules and incentives of the game, which in turn dictate the spread and persistence of preferences and the behavioral expression of those preferences.

In pursuit of an economics based on cultural evolution, we must develop models of evolutionary games on networks and test and calibrate these models using cross-cultural, cross-contextual data. In this dissertation, I advance this line of research theoretically—by constructing a model that situates an evolutionary game on a social-economic network—and empirically—by analyzing folklore, ethnography, and economic experiments. In particular, I examine the behavioral ecology of markets and capitalism. I focus on markets and capitalism because of their descriptive dominance in modern economies and their prescriptive dominance in modern economics. Markets appear in a diverse array of forms and societal roles throughout history and across the ethnographic record. For example, markets under capitalism take on a historically specific role at the center of societal subsistence and reproduction. Different social, psychological, and economic characteristics of market interactions and different societal niches may shape the evolution and behavioral expression of preferences in different ways (Chapter 3).

In the first chapter, I develop an evolutionary game model on a multilayer network to explore the impact of social context on the evolution and behavioral expression of empathy. The

numerical and analytical results show that if behavioral strategies spread among familiars, conditioning prosociality on familiarity—i.e. empathy—is adaptive. Since familiars tend to behave similarly, the strategy of empathy concentrates the benefits of prosociality among empathizers, allowing it to persist and spread. But as anonymity increases, empathy results in less prosociality. In this way, asocial economic ecologies may undermine prosociality, either by selecting for unconditional defection or by rendering empathy nonfunctional.

In the second chapter, I employ global folklore text and ethnographic text as data to analyze the social and cultural effects of markets and capitalism. I construct indices for social, cultural, and economic characteristics based on the textual prevalence of relevant words and themes and apply regression analysis to these indices. The results suggest that markets and capitalism are associated with decreased ecocentrism and increased stratification and that, in folklore, markets are associated with increased moral content. While markets are weakly associated with increased prosociality, capitalism is associated with decreased prosociality. I also estimate the markets coefficients using distance from historic trade route as an instrument, providing partial evidence of causal effects.

In the third chapter, I seek to clarify the ambiguities and resolve the apparent contradictions on the relationship between markets and prosociality. I develop a theoretical framework, synthesizing across insights and models from evolutionary theory, game theory, and political economy. I then compile the evidence from economic experiments and conduct a meta-analysis to identify the effects of anonymity, ephemerality, market framing, and societal market exposure on prosociality. The results show that prosociality decreases in anonymous and ephemeral environments and when the interaction is framed in market-related terms. However, no cross-country relationship between market exposure and prosociality is apparent.

These three essays show how cross-cultural and cross-contextual data and evolutionary game models can be used to study the behavioral ecology of economic systems. Overall, the effects of markets on prosociality appear to depend on the social, psychological, and economic characteristics of markets and their role in society. Whereas market exposure on aggregate may be unrelated to prosociality (Chapters 2 and 3), anonymous and ephemeral market exchange (Chapters 1, 3) and exposure to capitalism (Chapter 2) are associated with less prosociality. Beyond prosociality, social organization and worldview also appear to correlate with markets and capitalism (Chapter 2).

The evidence from folklore, ethnography, and experimental games invalidates the traditional assumptions of static, homogeneous, context-independent, self-interested preferences, and the evolutionary model illustrates how prosocial preferences and behavior are shaped by the social context of economic interactions. This implies that economic institutions may have social, cultural, and behavioral consequences which must be considered when designing policies. More broadly, models of endogenous preferences and cross-cultural analyses illuminate multiple equilibria produced by the coevolution of social-economic structure and individual preferences. This precludes the traditional method of implementing economic knowledge by maximizing a social welfare function because if the utility function is endogenous, then no unambiguous optimum exists. Instead, economists must engage diverse stakeholders to choose among the equilibria. Thus, endogenizing preferences necessitates a democratization of the implementation of economics knowledge.

1. SOCIAL CONTEXT AND THE EVOLUTION OF EMPATHY¹

1. Introduction

We are a social species. Our aptitude for cooperation and social learning has enabled us to adapt to a wide variety of ecosystems and organize into diverse sociocultural configurations. This array of human ecologies gives rise to cooperation problems that range in scale and scope from mammoth hunts to climate change. Simultaneously, human ecology shapes the evolution and expression of cooperative behaviors such as empathy. In this paper, ecology refers to the pattern of relationships between individuals and their environments (Gonzalez & Rice, 2024), cooperation refers to any action that is individually costly but collectively beneficial (Rand & Nowak, 2013),² and empathy refers to an internal state that motivates cooperative action contingent on social proximity (Davis, 2015). The social context of economic interactions constitutes an important dimension of human ecology that varies across different societies. Whereas hunter-gatherers know most of those whom they depend upon for subsistence, the constituents of market societies depend primarily on strangers. In this paper, I explore the effects of social context on the evolution and behavioral expression of empathy.

Empirical evidence indicates that cooperation increases with the sociality of the interaction context. Game theoretic experiments have demonstrated this effect by manipulating social context in various ways. Reducing anonymity by identifying subjects by name or photograph or by conducting the game in a face-to-face setting tends to promote cooperation (Ariely et al., 2009; Bohnet & Frey, 1999; Burnham, 2003; Charness & Gneezy, 2008; Choi & Storr, 2020; de Oliveira et al., 2014; Frey & Bohnet, 1997; Kryszowski & Tremewan, 2021; Leider et al., 2008; Ligon &

¹ This chapter is published in *Evolution and Human Behavior*, Volume 47, Issue 3, 2026 (106838).

² Throughout this dissertation, I use the terms “cooperation” and “prosociality” interchangeably. I favor the term “cooperation” in this chapter due to its prominence in the literature of evolutionary game theory and the term “prosociality” in Chapters 2 and 3 due to its prominence in the literatures of cultural economics and experimental economics.

Schechter, 2012; List et al., 2004; Rankin, 2006; Rege & Telle, 2004; Schram & Charness, 2015), and so does permitting discussion among subjects before the game (Andreoni & Rao, 2011; Batson & Ahmad, 2001; Batson & Moran, 1999; Bochet et al., 2006; Frey & Bohnet, 1997; Ostrom & Walker, 1997; Sally, 1995). Revealing the group identities of subjects tends to prompt in-group cooperation (Bicchieri et al., 2022; Glaeser et al., 2000; Habyarimana et al., 2007; Howe et al., 2023). Most notably, in non-anonymous games, social distance between interaction partners in their real-world social networks correlates negatively with cooperation (Apicella et al., 2012; Brañas-Garza et al., 2010; Chandrasekhar et al., 2018; Goeree et al., 2010; Leider et al., 2008). Similarly, questionnaires of hypothetical choices suggest that cooperation increases with subjective relational closeness (Jones, 2022; Jones & Rachlin, 2009; Jones & Rachlin, 2006; Kardos et al., 2023.; Locey et al., 2011, 2013; Osiński, 2009; Rachlin & Jones, 2008; Vekaria et al., 2017).

Psychologists also expound the importance of relational context in understanding cooperative behavior (Clark et al., 2015; Kardos et al., 2023), especially in the literature on empathy. Although empathy has been defined in a number of ways (Batson, 2009; Davis, 2015), the concept generally refers to a cognitive, affective, and/or behavioral response of one individual to the state of another (Davis, 2015; de Waal & Preston, 2017). Empathic responses are mediated by psychological and social context (Cialdini et al., 1997; Davis, 2015; Hoffman, 2008; Preston & Waal, 2002; Singer & Lamm, 2009; Singer & Tusche, 2014). Namely, empathy increases with familiarity, similarity, past experience, and salience (de Waal, 2009; de Waal & Preston, 2017; Hoffman, 2008; Loewenstein & Small, 2007; Preston & Waal, 2002; Singer & Tusche, 2014). These effects of “psychological distance” (Davis, 2015) or “relationship closeness” (Cialdini et al., 1997) encapsulate the general observation that the strongest empathic responses occur between close friends or family and the weakest between out-group strangers (Davis, 2015). The internal cogni-

tive and affective aspects are often associated with cooperative behavior (Batson et al., 1981; Batson, 2009, 2010; Batson & Ahmad, 2001; Batson & Moran, 1999; Cialdini et al., 1997; Davis, 2015; de Waal, 2009; de Waal, 2008; de Waal & Preston, 2017; Hoffman, 2008; Kamas & Preston, 2021; Preston & Waal, 2002; Rumble et al., 2010; Singer & Lamm, 2009). In game theoretic experiments, encouraging perspective-taking in the game instructions increases cooperation (Andreoni & Rao, 2011; Batson & Ahmad, 2001; Batson & Moran, 1999, p. 199; E. Hoffman et al., 2000; Rumble et al., 2010). Measures of dispositional empathy sometimes correlate with cooperation (Edele et al., 2013; Kamas & Preston, 2021; Takagishi et al., 2010), and sometimes do not (Artinger et al., 2014; Büchner et al., 2007; de Oliveira et al., 2014; Edele et al., 2013; Pelligra, 2011; Sautter et al., 2007), but notably, all those experiments that did not demonstrate an effect were conducted in anonymous settings.

These experimental findings suggest we are more prone to empathize and cooperate in situations that are more saliently social and with individuals who are socially closer to us. How might this strategy of cooperating conditional on social proximity have evolved? And how does the social context of interactions influence its evolution?

Whereas situational effects of sociality on cooperation are readily observable in experimental settings, evolutionary effects are not. Evolutionary game theory provides a framework for analyzing evolutionary dynamics by modelling the persistence and spread of behavioral strategies in a population as a function of the relative payoffs the strategies yield in intrapopulation game interactions. The human behavioral repertoire (including cooperation) is a product of interacting genetic and cultural evolution (Boyd & Richerson, 1988, 2005; Henrich & Muthukrishna, 2021). Genes persist and spread via survival and reproduction of the carrier. Cultural traits spread via social learning. Given the long history of misuse and misinterpretation of evolutionary concepts

applied to humans (Gonzalez & Rice, 2024), it is important to distinguish between explanation and justification: evolution is not synonymous with progress nor is fitness synonymous with desirability.

Cooperation poses an evolutionary puzzle given the separation of the actor from the benefits of their action. If individuals interact randomly with each other and employ unconditional strategies (always cooperate or never cooperate), those who never cooperate inevitably accumulate a higher payoff than those who always cooperate. Cooperation can only evolve if the benefits of cooperation are sufficiently concentrated among cooperators, such that the average cooperation benefits received by cooperators exceed the cooperation costs they pay. This logic applies to both cultural and genetic evolution and can thus produce both learned and innate cooperative traits. Hamilton's rule expresses this logic in mathematical form: $rb > c$, where b and c represent, respectively, the benefits and costs of cooperation and r , the relatedness coefficient, represents the proportion of cooperation benefits received by cooperators (Bowles & Gintis, 2011; Hamilton, 1964; Henrich, 2018; Smaldino, 2023). This concentration of benefits among cooperators can occur through assortment due to the coincidence of behavioral transmission and interaction ecologies as in the cases of kin selection (Hamilton, 1964), group selection (Bowles & Gintis, 2011), and static networks (Rand et al., 2014), or it can arise through conditional behavior as in the cases of direct and indirect reciprocity (Nowak & Sigmund, 2005; Schmid et al., 2021; Trivers, 1971), parochial altruism (Bowles & Gintis, 2011), altruistic punishment (Boyd & Richerson, 2005), and choice of interaction partners (which results in assortment) (Rand et al., 2011). These evolutionary mechanisms may manifest in a variety of proximate behavioral motives including social emotions (Batson, 2010; Bowles & Gintis, 2011; Davis, 2015; de Waal & Preston, 2017; Hoffman, 2008)

and internalized or externally enforced social and moral norms (Akçay & Van Cleve, 2021; Bowles & Gintis, 2011; Boyd & Richerson, 2005; Ohtsuki & Iwasa, 2006; Ostrom, 2000).

Models of evolutionary games situated on networks illuminate the effects of population structure on the evolution of cooperation (e.g. Allen et al., 2017; Débarre et al., 2014; Lieberman et al., 2005; Nowak et al., 2010; Nowak & May, 1992; Ohtsuki et al., 2006; Sheng et al., 2024; Su et al., 2019, 2022, 2023; Su & Stewart, 2025). A groundbreaking paper by Ohtsuki, Hauert, Lieberman, and Nowak (2006) demonstrates that, in the case of a single-layer network where both game interactions and strategy transmission occur, unconditional cooperation can persist and spread if the gains from cooperation are larger than the number of interaction and transmission neighbors. The network structure results in strategy assortment, thereby promoting the evolution of cooperation. A number of subsequent studies have shown that separating the loci of strategy transmission and game interactions can undermine the evolution of unconditional cooperation by lessening the assortment of strategies (Allen & Nowak, 2014; Dong et al., 2023; Ohtsuki et al., 2007; Su et al., 2019). Since genetic transmission occurs between kin and cultural transmission (social learning) occurs among both kith and kin, the transmission network might best be thought of as a network of kith and kin—i.e. a social network. This, in turn, suggests that unconditional cooperation can evolve only when the interaction context is highly social. But what if cooperation is conditioned on social proximity?

To explore the effect of social context on the evolution of empathy, I develop a model consisting of an evolutionary game situated on a network with distinct social and economic layers (Figures 1, 2). The game interactions occur on the economic layer, and the strategy transmission occurs on the social layer. In this way, I can vary the social context of the evolutionary game by varying the social-economic overlap of the network. I define empathy as the strategy of cooperat-

ing with those within a certain range in a social network and defecting against everyone further away. While several others have operationalized empathy in a utility function or as a game theoretic strategy (Binmore, 2005; Grohn et al., 2014), the social distance conditionality is novel. Each of the situational and relational mediating factors associated with increased empathy in the psychology literature (Preston & Waal, 2002) can be related to proximity in a social network: familiarity by the definition of a social relation, similarity due to network homophily (McPherson et al., 2001), past experience from durable social relationships, and salience in the context of face-to-face interactions. To analyze the evolutionary viability and stability of empathy, I estimate fixation probabilities numerically by running simulations of the evolutionary game model, and I employ a novel method involving pair approximation (Baalen, 2000; Ohtsuki et al., 2006, 2007) to obtain an analytical rule for the evolution of empathy.

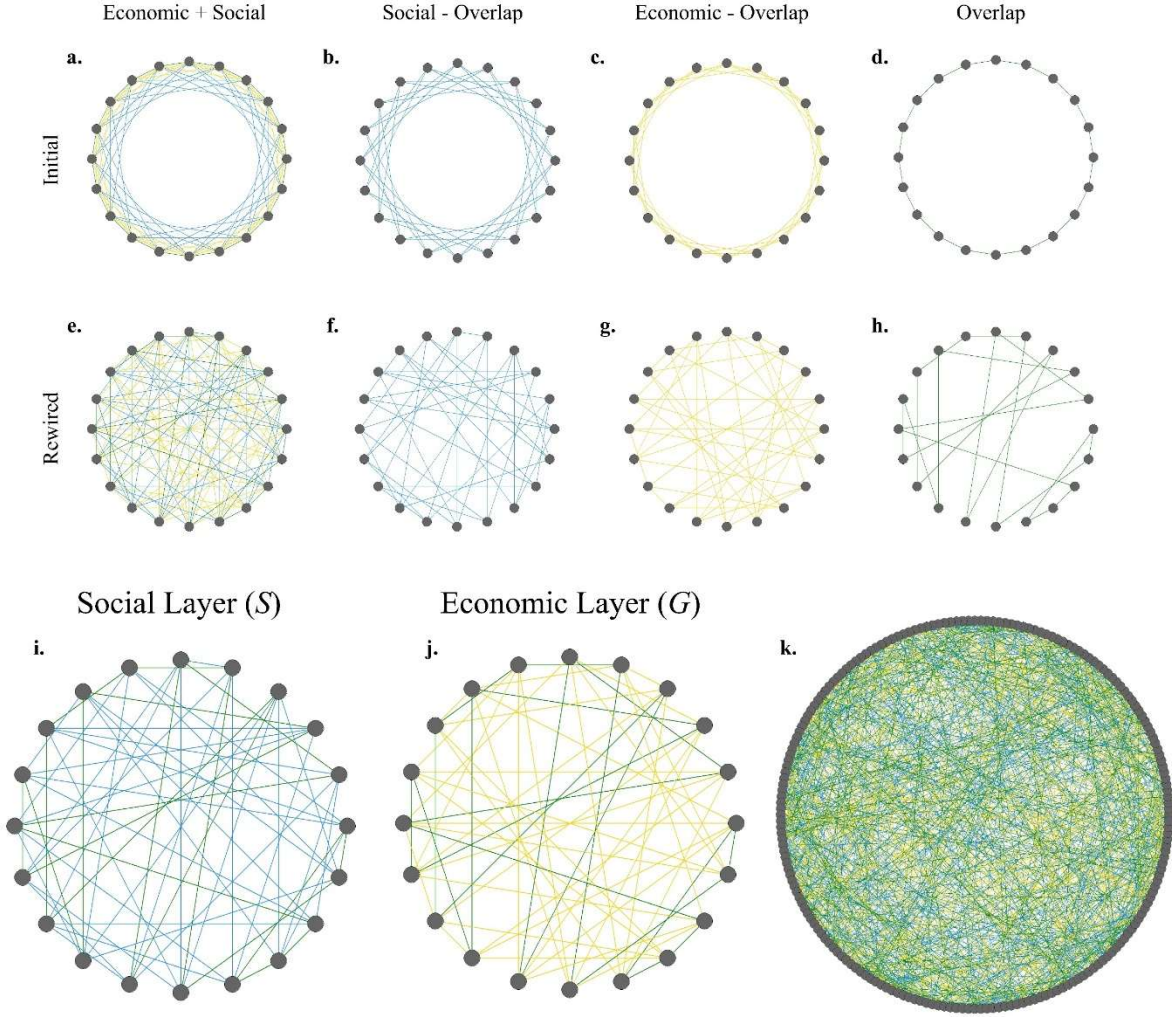
2. Model

The model I develop consists of a prisoner’s dilemma game, the competing strategies for playing the game, the fitness function dictating how strategies spread, and the multilayer network on which the evolutionary game dynamics occur. I run evolutionary game simulations and apply a technique called pair approximation to derive numerical and analytical results describing the impact of social context on the evolution of empathy.

The two-layer network structures the interactions among the population of N nodes. The game occurs on the economic layer (G), and the strategy updating occurs on the social layer (S). The overlap network (O) is obtained from the intersection of the edge sets of G and S . The economic, social, and overlap networks are all regular degree: Every node has g economic neighbors and s social neighbors, o of which are both social and economic neighbors. (The term “regular”

refers to the constant number of neighbors or “degree”.) The sociality of the interaction context is represented by the overlap degree divided by the economic degree o/g , which indicates the proportion of interactions which occur among familiars. To generate a random regular multilayer network from the set of all possible regular multilayer networks given the parameters N , g , s , and o , I construct a circulant network of degree $g + s - o$, partition the edges into $(G' - O')$, $(S' - O')$, and O' ; stochastically rewire the edges of each partitioned edge set, $G - O = R(G' - O')$, $S - O = R(S' - O')$, and $O = R(O')$; and reconstruct $G = (G - O) + O$ and $S = (S - O) + O$. Figure 1 illustrates this network generation algorithm, which I developed by modifying the Watts-Strogatz model (Watts & Strogatz, 1998). A detailed description can be found in Appendix A.

Figure 1: Generating a multilayer network



The evolutionary game takes place on a random regular N -node multilayer network with distinct social and economic layers. Both layers are random regular networks, and the intersection of the layers is also a random regular network, so every node has the same number of economic neighbors (g), the same number of social neighbors (s), and the same number of social-economic neighbors (o). The random regular multilayer networks used in the simulations are constructed by partitioning and rewiring circulant networks. **a.–h.** depict the rewiring of the circulant union network, $S \cup G = R(S' \cup G')$, and each of its partitioned subsets: $S - O = R(S' - O')$, $G - O = R(G' - O')$, and $O = R(O')$ ($N = 20$, $g = s = 4$, $o = 2$). **i.** depicts the social layer obtained from $S = (S - O) + O$ (i.e. from the union of **f.** and **h.**). **j.** depicts the economic layer obtained from $G = (G - O) + O$ (i.e. from the union of **g.** and **h.**). **k.** depicts an example of a multilayer network used in the actual simulations ($N = 200$, $g = s = 8$, $o = 4$) with the edges of $S - O$, $G - O$, and O colored blue, yellow, and green, respectively.

The nodes of this network interact and update their strategies in a series of rounds. During each round, every node plays a one-shot game with each of their economic neighbors. In these

games, each player chooses to either cooperate or defect (Figure 2). The act of cooperation consists of paying a cost c to convey a benefit b to the other player, where $c > 0$ and $b > c$. The act of defection is costless and conveys no benefit to the other. The game defined by these actions and payoffs is an example of a prisoner's dilemma.

Figure 2: Game payoffs

		Cooperate	Defect
Cooperate	Cooperate	$b - c$	b
	Defect	$b - c$	$-c$
Defect	Cooperate	$-c$	0
	Defect	b	0

Each round, every node plays a one-shot prisoner's dilemma with each of its economic neighbors, accumulating payoffs according to the payoff matrix shown. b and c denote the benefits and costs of cooperation, respectively.

Each node plays the game according to their inherited or learned behavioral strategy. This strategy is defined by an empathic range variable, $x_i \in \mathbb{N}$, which indicates that node i will cooperate with every economic neighbor who is x_i or fewer social edges away and defect against all others. In other words, i will cooperate with j if and only if $d_{i,j} \leq x_i$, where $d_{i,j}$ is the distance between i and j in the social layer of the multilayer network. If $x_i = 0$, node i defects unconditionally. If $x_i \geq \text{diameter}(S)$, node i cooperates unconditionally. If $x_i \in (0, \text{diameter}(S))$, node i cooperates conditional on social proximity. Throughout this paper, I refer to these three types as defectors, unconditional cooperators, and empathizers, respectively. Note that empathizers who

cooperate only with social neighbors ($x_i = 1$) behave identically to unconditional cooperators in the context of full sociality ($o/g = 1$) but behave identically to defectors in the absence of sociality ($o/g = 0$). The prevalence of cooperation in a population of empathizers thus depends directly on the sociality of the interaction context. I demonstrate in Appendix B how this behavioral strategy defined by x_i can be obtained from a utility function with an other-regarding component that decays with social distance.

Each round, each node, i , accumulates a total payoff from the games played with their economic neighbors:

$$\Pi_i = \sum_{m \in N_i(G)} \pi_{i,m} \quad (1)$$

$N_i(G)$ denotes the set of economic neighbors of i . The fitness of node i (i.e. i 's propensity to spread its behavioral strategy) is then calculated from this total payoff according to the following equation (Ohtsuki et al., 2006, 2007):

$$f_i = 1 - w + w \cdot \Pi_i \quad (2)$$

where $w \in [0,1]$ is the strength of selection. This parameter specifies the importance of payoffs in the updating dynamic. When $w = 0$, strategies spread according to neutral drift (i.e. they spread stochastically and independently from payoffs); when $w = 1$, strategies spread according to the relative size of the payoffs reaped by the strategy-bearing nodes.

Each round, after all games have been played, one node is selected randomly from the population to update their strategy by emulating one of their social neighbors. This updating mechanism is called the death-birth rule (Ohtsuki et al., 2007). The updating node, i , adopts the strategy of any one of their social neighbors, j , with a probability proportionate to j 's relative fitness:

$$P(i \text{ emulates } j) = \frac{f_j}{\sum_{m \in N_i(S)} f_m} \quad (3)$$

where $N_i(S)$ is the set of social neighbors of i .

I analyze the evolutionary properties of cooperation in this model by employing two different approaches, one numerical and the other analytical. For the first, I run simulations to estimate fixation probabilities (the probability of a single invading strategies spreading to the entire population). For the second, I apply the technique of pair approximation to derive an analytical rule describing the game and network conditions under which cooperation can spread.

3. Results

3.1 Numerical results

Simulations begin with a population containing multiple strategies and run until one of the strategies has fixated (i.e. eliminated its competitor(s)). The fixation probability of a strategy is estimated based on the proportion of 8000 simulations which end with that strategy fixating. I focus primarily on the case of invasion, where one “mutant” is introduced into a homogeneous population (Figures 3a, 3b, 4a-d). I am interested not only in the conditions under which cooperators might invade a population of defectors (viability) but also the conditions under which a population of cooperators might fend off invading defectors (stability). Both cooperative and non-cooperative equilibria can be found in any society, so understanding how cooperation is maintained is just as important as understanding how it is initially fostered. And as the results show (Figures 3, 4), viability and stability are not symmetric since cooperators rely on assortment for their fitness advantage.

To run one of these simulations, I must specify network parameters, N , g , s , and o , game parameters, b and c , and the selection strength, w . I limit the N to 200 and g and s to 8 in my main

numerical analysis (Figure 4), and my analytical results suggest little generality is lost in this specification. I vary the overlap degree, o , from 0 to 8 by steps of 2 to analyze the evolutionary dynamics under various social contexts. (The step size is constrained by the network generation algorithm.) I vary the relative gains from cooperation, b/c , around a median value of 8 to capture the interactive effects of network structure and game payoffs on the evolutionary dynamics. Earlier findings by Ohtsuki et al. (2006, 2007) as well as my own numerical and analytical results suggest that the boundary of the evolutionary feasibility of cooperation lies in this region of the game-network parameter space (where b/c is close to g and s). I vary b/c by varying b and holding c constant at $c = 1$. Multiplying both b and c by a scalar alters the payoff of every outcome by the same factor. Scaling the payoffs up or down in this manner is equivalent to altering the strength of selection (w). I conduct my primary analyses under conditions of weak selection ($w = 0.1$) in accordance with much of the theoretical literature on the evolution of cooperation on networks (Allen et al., 2017; Allen & Nowak, 2014; Dong et al., 2023; Ohtsuki et al., 2006, 2007; Tarnita et al., 2009). In Appendix C, I discuss selection strength more extensively and analyze its impact on the evolution of cooperation (see Figures C1 and C2).

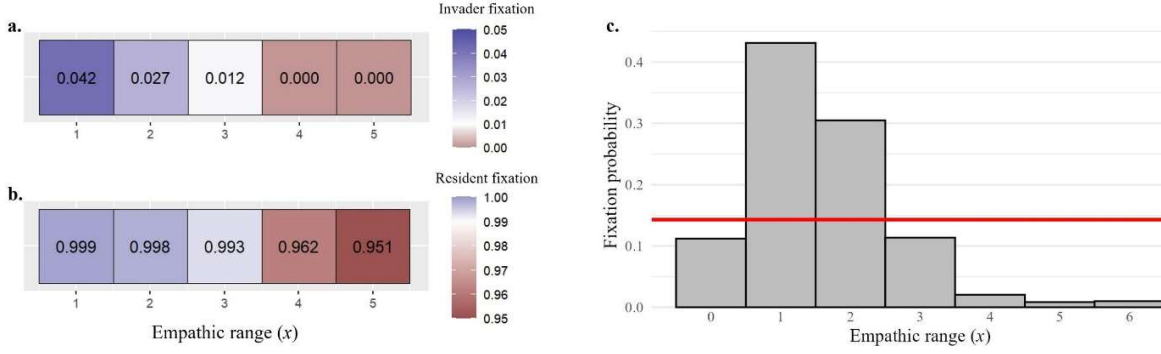
The fixation probability estimates of the evolutionary game simulations indicate that whereas unconditional cooperation relies on a highly social interaction context to evolve, empathy (cooperation conditional on social proximity) can persist and spread when this sociality is low as long as the relative gains from cooperation are sufficiently large (Figure 4). In other words, the numerical results suggest that conditioning cooperation on social proximity is adaptive when interactions occur among both familiars and strangers.

A strategy is selected for if its fixation probability is larger than that of a neutral mutant ($1/N$). In Figures 3 and 4, fixation probability estimates for invading cooperators larger than

(smaller than) $1/N$ are colored blue (red). Similarly, fixation probability estimates for resident cooperators larger than (smaller than) $1 - (1/N)$ are colored blue (red). Thus, blue (red) cells indicate game and network conditions under which cooperation is selected for (against). Note that in the absence of sociality ($o = 0$), empathizers are no different from defectors, so their fixation probability estimates hover around those of neutral mutants, and in the context of full sociality ($o = g$), empathizers are no different than unconditional cooperators, so their fixation probability estimates align.

Figures 3a and 3b report the fixation probability estimates for empathizers with different empathic ranges ($x = 1, 2, 3, 4, 5$) competing against defectors in the context of partial sociality ($o/g = 0.5$) when the gains from cooperation are slightly larger than the social and economic degrees ($b/c = 6 > g = s = 4$). These conditions select for all empathy variants with $x \leq 3$. More generally, fitness decreases with empathic range. Figure 3c reports the fixation probability estimates for simulations run under the same game and network conditions but starting from a uniform distribution of all seven strategies from $x = 0$ (defectors) to $x = 6$ (unconditional cooperators). In this environment of many competing strategies, as in the case of a single competing strategy, discriminatory empathizers ($x = 1, 2$) are selected for.

Figure 3: The evolutionary advantage of conditioning cooperation on social proximity

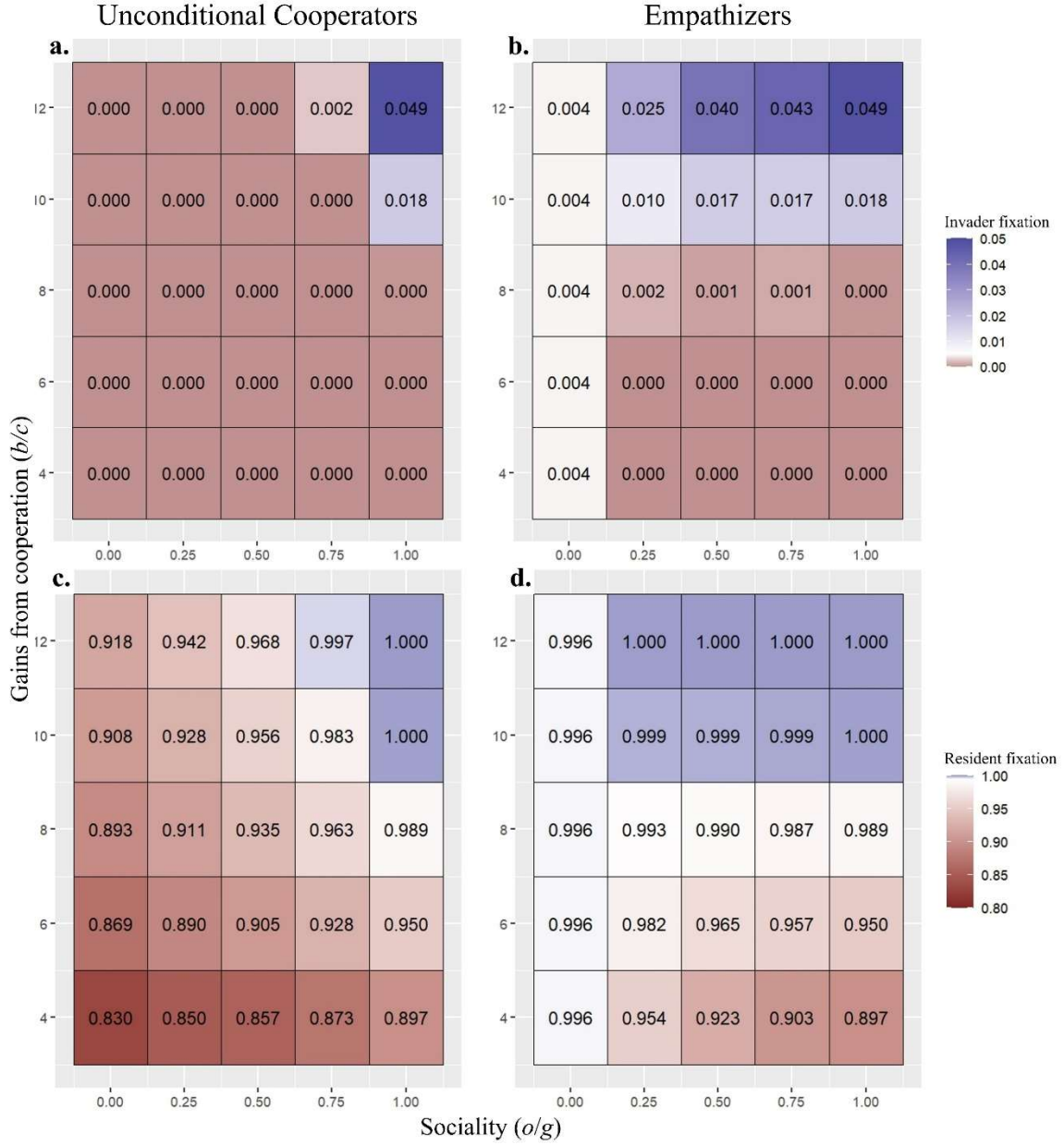


$N = 100$, $g = s = 4$, $o = 2$, $w = 0.1$, $b = 6$, $c = 1$, 8000 simulations per estimate. In the case of partial sociality ($o/g = 0.5$), evolutionary game simulations suggest that conditioning cooperation on social proximity is adaptive. Fitness appears to decrease with empathic range. **a**, The fixation probability estimates for empathizers with different ranges introduced into a population of defectors (viability). **b**, The fixation probability estimates for resident empathizers with different ranges fending off invading defectors (stability). Empathizers with a range of 1 cooperate only with social neighbors whereas empathizers with a range of 5 cooperate with almost everyone. If a cell is blue (red), the empathizers are selected for (against). **c**, The fixation probability estimates for empathizers with ranges 0 (defectors) through 6 (unconditional cooperators) starting from a uniform distribution of all seven strategies, $x_i \sim \mathcal{U}(0,6)$. Strategies with fixation probabilities above (below) the red line—marking the fixation probability of a neutral mutant—are selected for (against).

Figure 4 reports the fixation probability estimates for unconditional cooperators ($x \geq \text{diameter}(S)$) and empathizers ($x = 1$) competing against defectors under various conditions of sociality and gains from cooperation. The fitness of unconditional cooperators increases with gains from cooperation as well as sociality. Empathizer fitness increases with gains from cooperation, but its relation to social context is more complex. In the context of partial sociality ($o/g > 0$) and when the gains from cooperation exceed the degrees of the social and economic layers ($b/c > 8 = s = g$), empathizers are selected for (viability fixation probability estimates exceed $1/N$, and stability fixation probability estimates exceed $1 - (1/N)$). Below this b/c threshold, empathizers are selected against. Viability fixation probability estimates increase with sociality when $b/c > 8$, but stability fixation probability estimates decrease with sociality when $b/c < 8$. The explanation is this: as sociality increases, empathizers cooperate more, and when the gains from cooperation are sufficiently high, this increases their average fitness relative to

competing defectors, but when the gains from cooperation are low, this decreases their average fitness relative to competing defectors.

Figure 4: The impact of social context on the evolution of cooperation



$N = 200$, $g = s = 8$, $w = 0.1$, $c = 1$, 8000 simulations per estimate. Unconditional cooperation relies on high sociality and gains from cooperation to evolve, but discriminatory empathy can persist and spread even when sociality is low as long as the gains from cooperation are sufficiently large. **a, b**, The fixation probability estimates for cooperators invading a population of defectors (viability). **c, d**, The fixation probability estimates for resident cooperators fending off invading defectors (stability). **a, c**, The estimates for unconditional cooperators. **b, d**, The estimates for empathizers who cooperate only with social neighbors. If a cell is blue (red), the cooperators are selected for (against).

3.2. Analytical results

In their 2007 paper, Ohtsuki, Nowak, and Pacheco apply the technique of pair approximation to an evolutionary game model on a multilayer network and find that unconditional cooperation is favored by selection when $\frac{b}{c} > \frac{g \cdot s}{o}$. I apply this technique to replicate this rule for the evolution of unconditional cooperation and to derive a similar rule for the evolution of empathy: $b/c > s$. This analytical result aligns with the numerical results. Both suggest that discriminating on the basis of social distance mitigates the damage low sociality inflicts on the evolutionary feasibility of cooperation.

Pair approximation comprises a method for approximating evolutionary dynamics and equilibrium conditions on networks by focusing on the dynamics as they occur among node pairs (Baalen, 2000). This abstraction away from the complex geometry of the full network makes possible the derivation of differential equations that describe the essential dynamics of the model. In the context of the model in this paper, pair approximation shows that when selection strength is weak ($w \ll 1$), the local density of strategies on the network equilibrates faster than the global density of strategies. The strategy with the higher fitness in this local strategy density equilibrium is likely to prevail in the simulation.

Let p_A be the prevalence of strategy A in the entire population, and let $q_{A|B}^{(*)}$ be the probability that any neighbor on layer $*$ of a B-strategy node is an A-strategy node (i.e. $q_{A|B}^{(*)}$ represents the local density of A around B in the $*$ layer). Then, in a population of competing A and B strategies, the following identities always hold:

$$q_{A|A}^{(G-O)} = q_{A|B}^{(G-O)} = p_A \quad (4)$$

$$q_{*|*}^{(O)} = q_{*|*}^{(S)} \quad (5)$$

On the network of edges belonging only to the economic layer ($G - O$), the probability of a neighbor of either strategy being an A player is equal to the global prevalence of that strategy. This is because these non-social ties are unrelated to strategy transmission, so no assortment arises on $G - O$. The local strategy densities on the social (S) and overlap (O) layers are identical since the overlap layer is a subset of the social layer.

In the case of weak selection, $q_{A|A}^{(S)}$ equilibrates before p_A does. This local strategy density equilibrium approximates the state of the population in the simulations while $p_A \in \left(\frac{1}{N}, 1 - \frac{1}{N}\right)$. In this equilibrium, the following relationship holds (Ohtsuki et al., 2006, Supp. Eq. 17):

$$q_{A|A}^{(S)} - q_{A|B}^{(S)} = \frac{1}{s - 1} \quad (6)$$

In words, A nodes are more likely than B nodes to be social neighbors with other A nodes. This strategy homophily (i.e. clustering of strategies) arises on the social layer because social neighbors may, at some point, have acquired their current strategies from one another. The mathematical derivation can be found in Appendix D.

At this point, rather than estimating and comparing fixation probabilities as Ohtsuki and his coauthors do (2006, 2007), I employ a shortcut I developed: I compare the fitness of the strategies competing for emulation in the local strategy density equilibrium. In Appendix D, I present a proof of the validity of this approach.

To compare the fitness of two strategies competing for emulation in this equilibrium, I must compare their payoffs, and to compare their payoffs, I must compare their expected economic neighborhoods. But since $q_{A|A}^{(G-O)} = q_{A|B}^{(G-O)} = p_A$, the difference in economic neighborhoods is the same as the difference in overlap neighborhoods. Let A_A be the number of A nodes in the overlap

neighborhood of an A node and A_B be the number of A nodes in the overlap neighborhood of a B node. From the local strategy density equilibrium relationship (Appendix D), I find that

$$E(A_A - A_B) = \frac{o}{s} \quad (7)$$

Thus, the expected difference in total round payoffs between an unconditional cooperator (C) and a defector (D) competing for emulation is given by

$$E(\Pi_C - \Pi_D) = (b \cdot C_C - c \cdot g) - (b \cdot C_D) = \frac{b \cdot o}{s} - c \cdot g \quad (8)$$

which is positive when

$$\frac{b}{c} > \frac{g \cdot s}{o} \quad (9)$$

This inequality—originally derived by Ohtsuki et al. (2007)—specifies the conditions of sociality and gains from cooperation under which unconditional cooperation is selected for.

In the case of empathizers who cooperate only with social neighbors ($x = 1$), the expected difference in total round payoffs between an empathizer (M) and a defector (D) competing for emulation is given by

$$E(\Pi_M - \Pi_D) = (b \cdot M_M - c \cdot o) - (b \cdot M_D) = \frac{b \cdot o}{s} - c \cdot o \quad (10)$$

which is positive when

$$\frac{b}{c} > s \quad (11)$$

This inequality specifies that empathy is selected for as long as the gains from cooperation exceed the degree of the social layer.

The numerical estimates from the simulations corroborate the analytical rules for both unconditional cooperators and empathizers. As shown in Figure 4, in the simulations where $g = s =$

8, unconditional cooperators are only selected for in the upper right corner where $b/c > 64/o$ whereas empathizers are selected for whenever $b/c > 8$.

The evolutionary success of any strategy in the simulations depends firstly on its capacity to duplicate before being eliminated (Figure C2) and secondly on its relative fitness in the local strategy density equilibrium. Under weak selection, cooperators invading a population of defectors may survive to the local density equilibrium; then, if the network and game conditions satisfy the relevant analytical rule, the invading cooperators reap a higher average payoff and are therefore likely to spread. Similarly, under weak selection, defectors invading a population of cooperators may survive to the local density equilibrium; then, if the network and game conditions satisfy the relevant analytical rule, the resident cooperators reap a higher average payoff and are therefore likely to fend off the defectors.

4. Discussion

In this paper, I developed an evolutionary game model on a multilayer network to explore the impact of social context on the evolution of cooperation. The main results are intuitive: when we interact with both familiars and strangers, it is adaptive to cooperate with the former but not the latter. Low sociality impedes the evolution of unconditional cooperation but not the evolution of socially-contingent cooperation—i.e. empathy. However, if empathy spreads to the whole population (i.e. fixates), the prevalence of cooperative behavior depends directly on the degree of sociality.

Empathy, as I have defined it, combines the evolutionary tactics of discrimination and assortment to concentrate the benefits of cooperation among cooperators: empathizers cooperate with those who, due to the strategy transmission process, are more likely than chance to also be

empathizers. The limiting factor then becomes the degree of the social layer which dictates the “relatedness” of overlap neighbors—i.e. the likelihood they share the same strategy. This interpretation is embodied in the analytical rule for the evolution of empathy, which can be rewritten as $(1/s)b > c$, such that $1/s$ corresponds with the relatedness coefficient of Hamilton’s rule (Bowles & Gintis, 2011; Hamilton, 1964; Smaldino, 2023).

These results illustrate a basic logic underlying the evolution of empathy—a logic that does not depend on the model’s assumptions of static, homogeneous networks, weak selection, or death-birth updating. If behaviors spread among familiars (via biological reproduction or social learning), then familiarity functions as a proxy for behavioral relatedness. Thus, conditioning cooperation on familiarity concentrates the benefits of cooperation among fellow cooperators, allowing this behavior to persist and spread.

Studies of empathy and socially-contingent cooperation have most often explained the evolution of this form of conditional cooperation with reference to Hamilton’s theory of kin selection (Hamilton, 1964) and Trivers’ theory of reciprocal altruism (Trivers, 1971), since social proximity may coincide with genetic relatedness and interaction duration (Batson, 2010; Binmore, 2005; de Waal, 2009; de Waal, 2008; de Waal & Preston, 2017; Osiński, 2009; Rachlin & Jones, 2008). If we interpret the dynamics and results of the model in the context of genetic evolution, then the social layer, where the strategies spread, is a kin network, and social distance corresponds to genetic relatedness. The strategy of empathy in this case is identical to discriminatory kin-based altruism: cooperate with close kin; defect with others. And this strategy is an evolutionary improvement over unconditional cooperation when individuals interact with both kin and non-kin. If, instead, we interpret the dynamics and results of the model in terms of cultural evolution, then social distance corresponds to cultural rather than genetic relatedness, and the evolutionary mechanism

illustrated is more closely related to parochial altruism (Bowles & Gintis, 2011) than kin selection. Both genetic and cultural interpretations of the model align with the evidence that relational closeness correlates with cooperation between kith and between kin (Rachlin & Jones, 2008). These dual interpretations also align with the evidence that individuals' cooperative proclivities are products of both heredity and socialization (Eisenberg et al., 2013; Kosse et al., 2020).

The model suggests that modern human ecologies may impact cooperative behavior through two distinct channels: first, through the context-dependent expression of our evolutionary inheritance, and second, through cultural evolution itself. Since genetic evolution occurs at a much slower rate than cultural evolution (due to the different means of transmission), our genetic inheritance may reflect ancient human ecologies while our cultural inheritance may reflect modern human ecologies (Boyd & Richerson, 2005). Consequently, our innate behaviors may be maladaptive to large-scale, anonymous market societies. Whereas empathy may effectively foster cooperation in big game hunts and childcare, it is poorly suited to address climate change and international conflict. The effects of social context on cultural evolution may also hinder the resolution of modern cooperation problems. The results of the model suggest that asocial human ecologies could erode the evolutionary feasibility of unconditional cooperation and select for non-cooperative behavior (either in the form of unconditional defection or vestigial empathy).

The insights the model provides into the behavioral ecology of cooperation suggest cooperation problems might be solved either by altering individual incentives to align self-interest with collective welfare or by changing the social context to better select for and provoke cooperative behavior. The most effective solution depends on the nature of the specific cooperation problem. If the context is unavoidably asocial, the incentive approach might be justified by the reality of self-interested actors. This case is exemplified by a carbon tax implemented to mitigate climate

change. Here, the tax brings the cost individuals impose on the global population back into their own self-interested calculation, thus relieving the need for any internally motivated cooperation. In other contexts, it may be possible to increase the sociality of interactions, thus provoking more cooperation. This case is exemplified by the management of local resource commons (Dietz et al., 2003; Ostrom, 2009; Pretty, 2003). Here, the delegation of commons governance to local communities that depend on the resource may function well on the basis of empathy without any top-down policy solution tailored to self-interested actors (Bowles & Gintis, 2007; Ostrom, 1990).

More broadly, the model developed here exemplifies how the mathematical tools of evolutionary game theory and multilayer networks lend themselves to modelling the evolution of context-dependent behaviors. Such theoretical models provide important insights into the nuance and dynamism of human behavioral ecology (Gonzalez & Rice, 2024), which could prove key to navigating the complex social and environmental problems we face today (Schill et al., 2019).

Appendix A. Multilayer network generation

The Watts-Strogatz model (Watts & Strogatz, 1998) specifies an algorithm capable of generating networks with small-world properties (i.e. small distances and high transitivity). By modifying the rewiring method to preserve degree distribution, this same algorithm can produce random regular networks as follows:

1. Construct a circulant network with the desired even degree.
2. Arrange the edges in a list and for each edge, designate one adjacent node as the “tail” and the other as the “head.”
3. Rewire each edge in the list by selecting an edge at random and swapping their “tail” nodes (adding as a constraint the condition that no self-loops or duplicate edges are

created). If a random subset of the edges are rewired such that some of the initial circulant structure remains, then the resulting network will have the small-world properties of short distances and high transitivity. The more edges rewired, the lower the transitivity of the resulting network.

To extend this algorithm to generate a multilayer network with the given parameters of N , s , g , and o , (where s , g , and o are even and $o \leq \min(g, s)$), I begin with a circulant network of degree $s + g - o$. After rewiring, this network $(S' \cup G')$ will become the union of the social and economic layers $(S \cup G)$. I partition the edges of this union circulant network into three disjoint subsets: the social sans overlap layer $(S' - O')$, the economic sans overlap layer $(G' - O')$, and the overlap layer (O') . I then rewire the networks to obtain $S - O = R(S' - O')$, $G - O = R(G' - O')$, and $O = R(O')$, swapping only edges within the same subset while also avoiding the creation duplicate edges in the superset union network. The original edge is included in the set of potential rewiring pairs, so with the same probability as rewiring with any other given edge, the edge is not rewired. Also, if no pair rewiring is possible that does not create duplicate edges, then the original edge is kept. This process is illustrated in Figure 1 for $N = 20$, $s = g = 4$, and $o = 2$. When all edges have been rewired, the social layer is obtained by adding the rewired social sans overlap edge set to the rewired overlap edge set ($S = (S - O) + O$), and the economic layer is obtained by adding the rewired economic sans overlap edge set to the rewired overlap edge set ($G = (G - O) + O$). This algorithm can be modified to generate a three-layer multilayer network with regular, controlled overlap between each layer. In this case, the edge set of the union circulant network must be partitioned into seven disjoint subsets, one for layer 1 alone, one for layer 2 alone, one for layer 3 alone, one for layer 1 and 2 without layer 3, one for layer 1 and 3 without layer 2, one for layer 2 and 3 without layer 1, and one for the overlap of all three layers, each of which must be rewired

separately and without creating duplicate edges in the edge superset. Accordingly, with more than three layers, the process becomes even more unwieldy.

Appendix B. Utility function specification

Let i and j be nodes interacting in the game described in Figure 2. If i is selfish, she will defect since $b > b - c$ and $0 > -c$. If i cares sufficiently about j , she will cooperate since $b > c$. These motivations can be expressed in terms of a utility function incorporating the payoffs of i and j : $u_i(\pi_{i,j}, \pi_{j,i})$. To operationalize empathy, I specify the other-regarding component of i 's utility function as a hyperbolic function of the social distance between i and j in accordance with the empirical findings of the social discounting literature (Jones, 2022; Jones & Rachlin, 2006):

$$u_i = \pi_{i,j} + \frac{a_i \pi_{j,i}}{1 + \delta_i (d_{i,j} - 1)} \quad (\text{B.1})$$

where $\pi_{i,j}$ represents the game payoff of player i interacting with player j , $d_{i,j}$ is the social distance between i and j , a_i represents how much i values the payoffs of a social neighbor relative to her own, and δ_i is the social discount factor which specifies how quickly empathy decays with social distance.

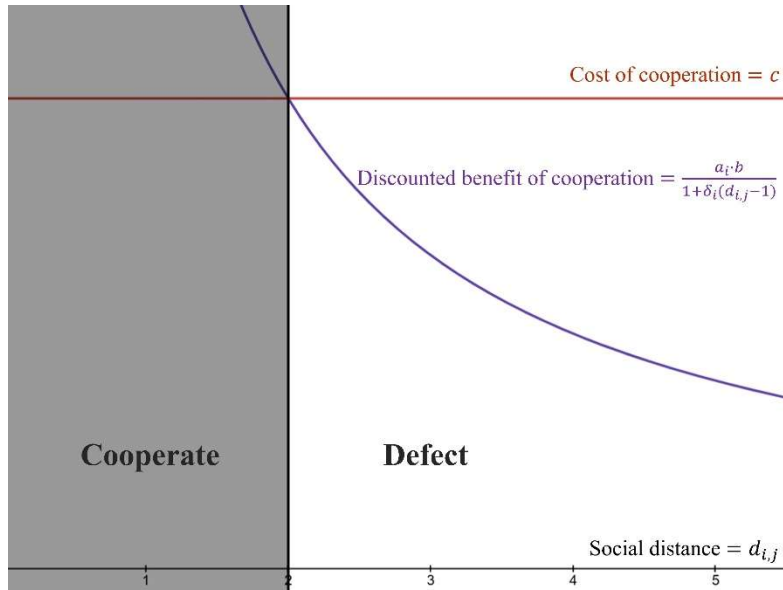
Individual i will thus cooperate with j as long as

$$\frac{a_i b}{1 + \delta_i (d_{i,j} - 1)} > c \quad (\text{B.2})$$

Individuals for whom $a_i < c/b$ will defect unconditionally. Individuals for whom $a_i > c/b$ and $\delta_i = 0$ will cooperate unconditionally. And individuals for whom $a_i > \frac{c}{b}$ and $\delta_i > 0$ will cooperate conditional on sufficient social proximity. Specifically, these empathizers cooperate with all j for whom $d_{i,j} < \frac{a_i b - c}{c \delta_i} + 1$. Thus, this utility function produces a behavioral strategy that can be alter-

natively defined by the single discrete empathic range variable, $x_i \in \mathbb{N}$, indicating that i will cooperate with all j for whom $d_{i,j} \leq x_i$. (I define x_i based on the weak inequality for intuitiveness of interpretation.) Figure B1 illustrates graphically this derivation of x_i from b , c , a_i , and δ_i . The strategy defined by x_i could also be obtained from alternative utility function specifications. For example, the specification $u_i = \pi_i + \frac{a_i \pi_j}{d_{i,j} - 1}$ (which reflects Goeree et al.'s “1/d Law of Giving” (2010)) yields the same discrete empathic range trait x_i . The evolutionary dynamics in this paper, however, depend only on the empathic range trait, so my results are agnostic with regard to the choice of utility function specification.

Figure B1: Social discounting utility function specification



If the socially discounted benefit of cooperation (which declines with social distance) exceeds the cost of cooperation, the empathizer will cooperate. This means that given a_i and δ_i , i will cooperate with every economic neighbor within a certain distance in the social layer and defect with all others. In the example shown in this figure, i will cooperate only with economic neighbors who are 1 or 2 edges away in the social layer. This behavioral strategy can be represented as a discrete empathic range: $x_i = 2$.

Appendix C. Selection strength

C.1 Conceptual discussion

In evolutionary models, weak selection allows a single cooperator to invade a population of defectors. Isolated cooperators necessarily have a lower payoff than the defectors they are competing against, so they must initially spread stochastically against the gradient of selection to form a cluster of cooperators, which can then compete with defectors in terms of fitness. How realistic, then, is this assumption?

Selection strength likely differs across the realms of cultural and genetic evolution. In the case of genetic evolution, fitness refers to an organism's propensity to survive and reproduce and thus pass on their genetic traits. Here, fitness is a product of a multitude of interactions of which the trait-relevant game is only one, so weak selection is justified.

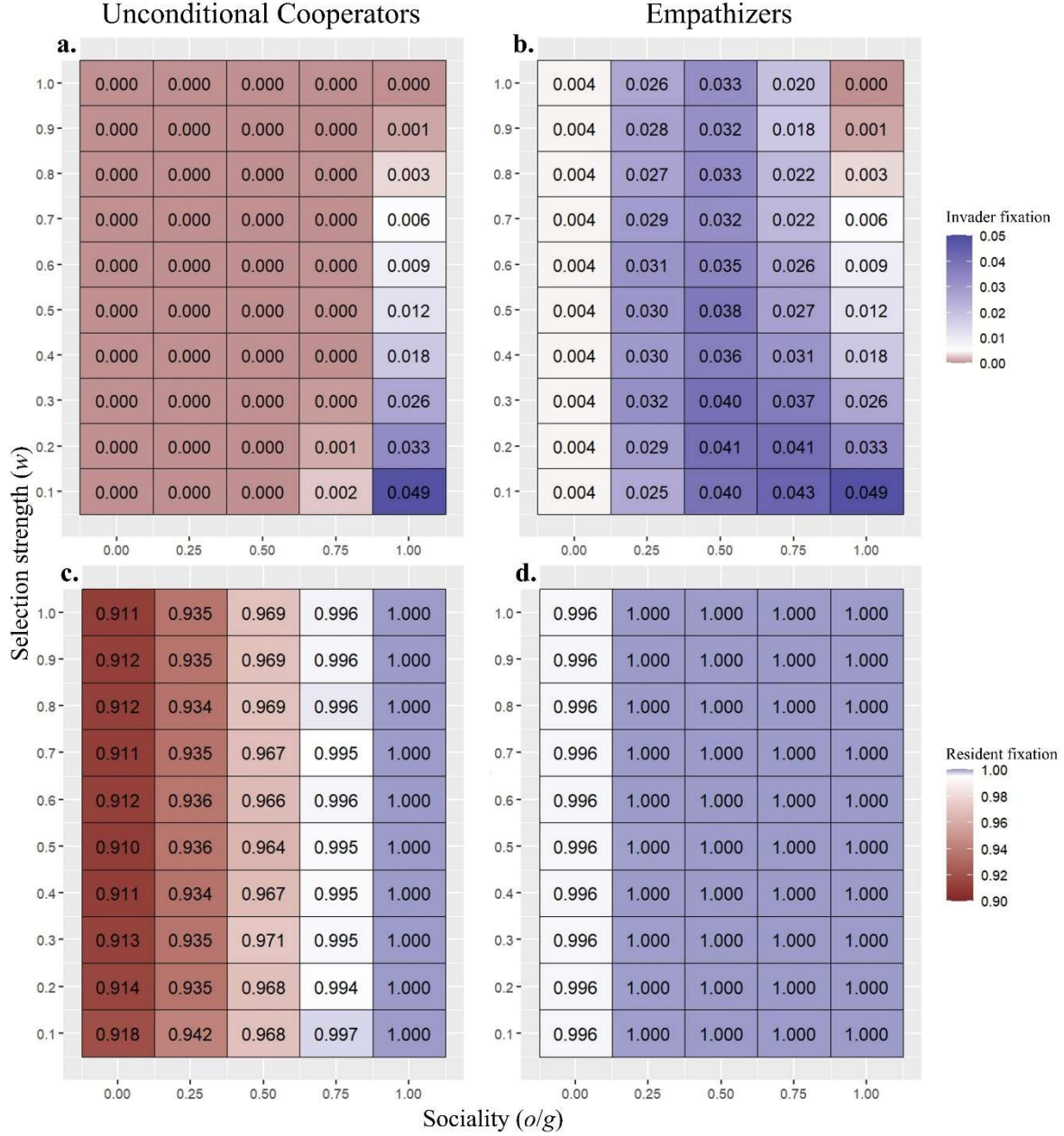
In the case of cultural evolution, since enculturation is not limited to vertical transmission following biological reproduction, fitness applies to the traits carried by the organism rather than the organism itself. The propensity of a socially learned behavior to persist and spread need not be directly correlated to the overall material success of the trait-bearer. The latter could be the case if the spread of the cultural trait is achieved by means of power and wealth (e.g. control of the media, intentional indoctrination, conquest and replacement). But cultural traits could also be selected for by voluntary preferential adoption, in which case, the fitness of the trait in the individual is likely a function of their payoffs from trait-relevant interactions.

C.2 Numerical results

Figure C1 reports the fixation probability estimates for unconditional cooperators and empathizers ($x = 1$) competing against defectors under various conditions of sociality (o/g) and selection strength (w). I hold the gains from cooperation at a constant level sufficient to promote some evolutionary success of cooperation ($b/c = 12$). The viability fixation probability estimates decrease with selection strength for unconditional cooperators and for empathizers when sociality is high (in which case they act like unconditional cooperators). On the other hand, no clear relationship exists between selection strength and the stability fixation probabilities estimates for resident co-operators (either unconditional cooperators or empathizers).

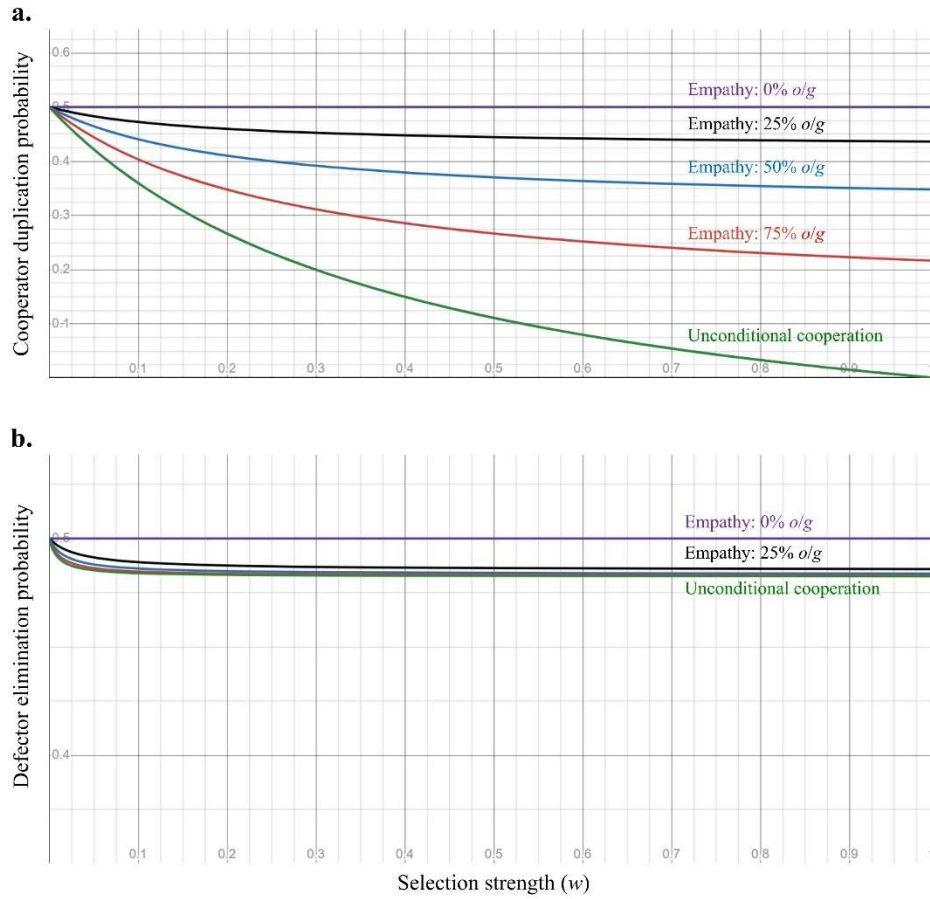
The detrimental effect of selection strength on the evolutionary viability of invading cooperators can be explained with reference to the probability of those invaders forming a cluster. As selection strength increases, invading cooperators are less likely to duplicate before they are eliminated, and for empathizers, this effect intensifies with increasing sociality (Figure C2a). The effect of selection strength on the duplication probability of unconditional cooperators is not mediated by sociality since their behavior is not conditioned on it. In the case of the evolutionary stability of resident cooperators, however, cluster formation is not a challenge since the initial conditions are characterized by one massive cooperator cluster. Higher selection strength still increases the chance of the invading defector duplicating, but the effect is miniscule compared to the case of cooperator invasion (Figure C2b). In both cases, when payoffs cease to matter (due to a selection strength of zero or when empathizers are indistinguishable from defectors), the probability that an invading strategy duplicates before it can be eliminated becomes 0.5.

Figure C1: The impact of selection strength on the evolution of cooperation



$N = 200$, $g = s = 8$, $b = 12$, $c = 1$, 8000 simulations per estimate. In the case of cooperator invasion (**a.** and **b.**), the evolutionary viability of unconditional cooperation appears to decrease with increasing selection strength. This effect also holds for empathizers when sociality is high. In the case of defector invasion (**c.** and **d.**), the evolutionary stability of cooperation appears to be unrelated to selection strength. If a cell is blue (red), the cooperators are selected for (against).

Figure C2: The impact of selection strength on initial trait proliferation



$N = \infty$, $h = g = 8$, $b = 12$, $c = 1$. **a.** As selection strength increases, invading cooperators are less likely to duplicate before they are eliminated, and for empathizers, this effect intensifies with increasing sociality. **b.** In the case of resident cooperators, the probability that the invading defector is eliminated before it can duplicate also decreases with selection strength, but the effect is miniscule. In both cases, when payoffs cease to matter (due to a selection strength of zero or when empathizers are indistinguishable from defectors), the probability that an invading strategy duplicates before it can be eliminated becomes 0.5.

C.3 Calculating the probability of invader duplication

The probability that event X occurs before event Y, given that X occurs each period with probability x and Y with the probability y , is $\frac{x}{x+y}$. Using the fitness equation and adding c to all payoffs in

Figure 2 to avoid negative probabilities (as is done in the simulations), we can calculate these duplication probabilities. For simplicity, I assume N to be arbitrarily large (if I keep a finite N in

the calculations, the results do not change much, but the functions become even more cumbersome). For unconditional cooperators, the probability in each period that the invader duplicates is

$$\left(\frac{s}{N}\right) \frac{f_C}{f_C + (s-1)f_D} = \left(\frac{s}{N}\right) \frac{1-w}{s(1-w) + (s-1)wgc} \quad (C.1)$$

And the probability in each period that the invader is eliminated is $\frac{1}{N}$. The probability then that the unconditional cooperator duplicates before it can be eliminated is

$$\frac{sf_C}{(s+1)f_C + (s-1)f_D} = \frac{s(1-w)}{2s(1-w) + (s-1)wgc} \quad (C.2)$$

For empathizers, the probability in each period that the invader duplicates is

$$\left(\frac{s}{N}\right) \frac{f_E}{f_E + (s-1)f_D} = \left(\frac{s}{N}\right) \frac{1-w + w(g-o)c}{s(1-w + wgc) - woc} \quad (C.3)$$

And the probability in each period that the invader is eliminated is $\frac{1}{N}$. The probability then that the empathizer duplicates before it can be eliminated is

$$\frac{sf_E}{(s+1)f_E + (s-1)f_D} = \frac{s(1-w + w(g-o)c)}{2s(1-w + wgc) - woc(s+1)} \quad (C.4)$$

These duplication probabilities are plotted in Figure C.2a. Note that if there is no difference in fitness (if the payoffs are equal or if $w = 0$), the duplication probabilities simplify to

$$\frac{sf}{(s+1)f + (s-1)f} = \frac{1}{2} \quad (C.5)$$

Note also that

$$\frac{d}{do} \left(\frac{sf_E}{(s+1)f_E + (s-1)f_D} \right) = \frac{-swc(s-1)f_D}{[(s+1)f_E + (s-1)f_D]^2} < 0 \quad (C.6)$$

i.e. duplication probability declines with overlap.

Using the same tools and assumptions, we can calculate probability that invading defectors are eliminated before they can duplicate. In the case of unconditional cooperators, the probability

in each period that the defector is eliminated is $1/N$, and the probability in each period that the defector duplicates is

$$\left(\frac{s}{N}\right) \frac{1 - w + wg(b + c)}{s(1 - w) + wg(b + c) + (s - 1)wbg} \quad (\text{C.7})$$

The probability then that the defector is eliminated before it can duplicate is

$$1 - \frac{s(1 - w + wg(b + c))}{2s(1 - w) + (s + 1)wg(b + c) + (s - 1)wbg} \quad (\text{C.8})$$

In the case of empathizers, the probability in each period that the defector is eliminated is $\frac{1}{N}$, and the probability in each period that the invader duplicates is

$$\left(\frac{s}{N}\right) \frac{1 - w + w(ob + gc)}{s(1 - w + wob) + wc(sg - so + o)} \quad (\text{C.9})$$

The probability then that the defector is eliminated before it can duplicate is

$$1 - \frac{s(1 - w + w(ob + gc))}{2s(1 - w + wob) + wc(2sg - so + o)} \quad (\text{C.10})$$

These duplication probabilities are plotted in Figure C.2b.

Appendix D. Derivation of the analytical rule

In this section, I derive the local density equilibrium conditions and formulate a proof demonstrating the logic of the shortcut I employ to obtain the analytical rule for the evolution of empathy.

As before, let p_A be the prevalence of strategy A in the entire population, and let $q_{A|B}^{(*)}$ be the probability that any * neighbor of a B-strategy node is an A-strategy node. Also, let $p_{AA}^{(*)}$ be the prevalence of AA strategy pairs among all $Nk/2$ edges in any layer * of k degree. Then, in a population of competing A and B strategies, the following identities always hold:

$$p_A + p_B = 1 \quad (\text{D.1})$$

$$p_{AA}^{(*)} + p_{AB}^{(*)} + p_{BB}^{(*)} = 1 \quad (\text{D.2})$$

$$p_{AB}^{(*)} = p_{BA}^{(*)} \quad (\text{D.3})$$

$$q_{A|B}^{(*)} = \frac{p_{AB}^{(*)}}{p_B} \quad (\text{D.4})$$

$$q_{A|A}^{(*)} = 1 - q_{B|A}^{(*)} \quad (\text{D.5})$$

$$q_{A|A}^{(G-O)} = q_{A|B}^{(G-O)} = p_A \quad (\text{D.6})$$

$$q_{*|*}^{(O)} = q_{*|*}^{(S)} \quad (\text{D.7})$$

The intuition behind equation (D.4) is that the prevalence of AB pairs in the vicinity of a B multiplied by the global prevalence of B is equal to the global prevalence of AB pairs—multiplying $q_{A|B}^{(*)}$ by p_B undoes the conditionality of the prevalence. As discussed in the main text, the last two identities are the consequence of the separation of the interaction (economic) and updating (social) layers.

The probability that the number of A nodes increases in any given round is equal to the probability that a B node is chosen to update and becomes an A:

$$P\left(\Delta p_A = \frac{1}{N}\right) = p_B \sum_{s_A=0}^s \frac{s!}{s_A! s_B!} q_{A|B}^{(S) s_A} q_{B|B}^{(S) s_B} \frac{s_A f_A}{s_A f_A + s_B f_B} \quad (\text{D.8})$$

where s_A denotes the number of social neighbors of the updater with strategy A (so $s_A + s_B = s$), and f_A denotes the expected fitness of an A. The intuition behind this expression is this: p_B is the probability a B node is chosen to update; $\frac{s!}{s_A! s_B!} q_{A|B}^{(S) s_A} q_{B|B}^{(S) s_B}$ is the probability of any given B node having s_A social neighbors with strategy A; and $\frac{s_A f_A}{s_A f_A + s_B f_B}$ is the probability that one of the s_A social neighbors is chosen to be emulated. The sum is taken across these probabilities for all pos-

sible neighborhood configurations and their prevalence. Consequently, the probability that the number of social AA pairs increases by s_A is given by

$$P\left(\Delta p_{AA}^{(s)} = \frac{2s_A}{sN}\right) = p_B \frac{s!}{s_A! s_B!} q_{A|B}^{(s) s_A} q_{B|B}^{(s) s_B} \frac{s_A f_A}{s_A f_A + s_B f_B} \quad (\text{D.9})$$

since updating a B node with s_A social neighbors with strategy A results in s_A new AA pairs out of $sN/2$ total social edges.

Now, let each round of each simulation be considered as one unit of time. Then,

$$\frac{d}{dt}(p_A) = \frac{1}{N} \cdot P\left(\Delta p_A = \frac{1}{N}\right) - \frac{1}{N} \cdot P\left(\Delta p_A = -\frac{1}{N}\right) \quad (\text{D.10})$$

and

$$\frac{d}{dt}(p_{AA}^{(s)}) = \sum_{s_A=0}^s \frac{2s_A}{sN} \left[P\left(\Delta p_{AA}^{(s)} = \frac{2s_A}{sN}\right) - P\left(\Delta p_{AA}^{(s)} = -\frac{2s_A}{sN}\right) \right] \quad (\text{D.11})$$

In the case of weak selection ($w \ll 1$), $p_{AA}^{(s)}$ changes more quickly than p_A since

$$\lim_{w \rightarrow 0} \left(\frac{d}{dt}(p_A) \right) = 0 \quad (\text{D.12})$$

but

$$\lim_{w \rightarrow 0} \left(\frac{d}{dt}(p_{AA}^{(s)}) \right) = \frac{2}{sN} p_{AB}^{(s)} \left[1 + (s-1)(q_{A|B}^{(s)} - q_{A|A}^{(s)}) \right] > 0 \quad (\text{D.13})$$

This is to say that when there is no selection occurring and therefore no differences in fitness, A nodes are just as likely to become B nodes as B nodes are to become A nodes, so the expected rate of change of the global prevalence of strategies is 0. But strategy updating even without selection still leads to a clustering of strategies in the social layer of the network since in any pair of social neighbors, one may have adopted its current strategy by emulating the other. A more detailed derivation of these equations can be found in the supplementary section of Ohtsuki et al. (2006).

The intuition for equation (D.11) is this: The change in the prevalence of AA social pairs depends on the prevalence of AB social pairs, since both the creation and destruction of AA pairs relies on the existence of a B near an A (to create an AA, an AB pair must become an AA pair, and to destroy an AA pair, a B node must occur in the AA pair's extended neighborhood to be emulated). Thus, the number of AA pairs changes only along the strategy boundaries marked by AB pairs. Now, consider a given AB pair. The neighborhood of the A includes on average $(s-1)q_{A|A}^{(s)}$ A nodes, and the neighborhood of the B includes on average $1 + (s-1)q_{A|B}^{(s)}$ A nodes. If the B updates and emulates an A, then, on average, $1 + (s-1)q_{A|B}^{(s)}$ new AA pairs will be created, and if the A updates and emulates a B, then, on average, $(s-1)q_{A|A}^{(s)}$ AA pairs will be lost. Thus, the rate of change of the number of AA pairs is proportionate to $1 + (s-1)(q_{A|B}^{(s)} - q_{A|A}^{(s)})$.

Since $q_{A|A}^{(s)} = p_{AA}^{(s)}/p_A$, we can also derive the time derivative for $q_{A|A}^{(s)}$ as strength of selection approaches zero:

$$\lim_{w \rightarrow 0} \left(\frac{d}{dt} (q_{A|A}^{(s)}) \right) = \frac{2}{sN} \frac{p_{AB}^{(s)}}{p_A} \left[1 + (s-1)(q_{A|B}^{(s)} - q_{A|A}^{(s)}) \right] \quad (\text{D.14})$$

It is due to this difference in the rate of change of p_A and $q_{A|A}^{(s)}$ that, in the case of weak selection, $q_{A|A}^{(s)}$ equilibrates before p_A does. The $q_{A|A}^{(s)}$ equilibrium, defined by $\frac{d}{dt} (q_{A|A}^{(s)}) = 0$, yields the following relationships (Ohtsuki et al., 2006):

$$q_{A|A}^{(s)} = p_A + \frac{1}{s-1} (1 - p_A) \quad (\text{D.15})$$

$$q_{B|A}^{(s)} = 1 - q_{A|A}^{(s)} = 1 - p_A - \frac{1}{s-1} (1 - p_A) = p_B - \frac{1}{s-1} p_B \quad (\text{D.16})$$

$$q_{A|A}^{(s)} - q_{A|B}^{(s)} = p_A + \frac{1}{s-1} (1 - p_A) - p_A + \frac{1}{s-1} p_A = \frac{1}{s-1} \quad (\text{D.17})$$

Thus far, I have followed the method of Ohtsuki et al. (2006, 2007). At this point, Ohtsuki and his coauthors estimate fixation probabilities and derive their analytical rules by comparing these formulas. In contrast, I derive the rules for the evolution of unconditional cooperation and empathy using a shortcut whereby I compare the expected payoff of the competing strategies at the local strategy density equilibrium.

But why does this work? Consider the probability that an updater emulates an A or a B node:

$$E[\Pr(U \rightarrow A)] = p_A \left[\frac{s \cdot q_{A|A}^{(S)} \cdot E[f_A]}{\sum_{N_s(U)} f} \right] + p_B \left[\frac{s \cdot q_{A|B}^{(S)} \cdot E[f_A]}{\sum_{N_s(U)} f} \right] \quad (D.18)$$

$$E[\Pr(U \rightarrow B)] = p_A \left[\frac{s \cdot q_{B|A}^{(S)} \cdot E[f_B]}{\sum_{N_s(U)} f} \right] + p_B \left[\frac{s \cdot q_{B|B}^{(S)} \cdot E[f_B]}{\sum_{N_s(U)} f} \right] \quad (D.19)$$

so

$$\begin{aligned} E[\Pr(U \rightarrow A)] &> E[\Pr(U \rightarrow B)] \\ &\Leftrightarrow p_A \left[\frac{s \cdot q_{A|A}^{(S)} \cdot E[f_A]}{\sum_{N_s(U)} f} \right] + p_B \left[\frac{s \cdot q_{A|B}^{(S)} \cdot E[f_A]}{\sum_{N_s(U)} f} \right] \\ &> p_A \left[\frac{s \cdot q_{B|A}^{(S)} \cdot E[f_B]}{\sum_{N_s(U)} f} \right] + p_B \left[\frac{s \cdot q_{B|B}^{(S)} \cdot E[f_B]}{\sum_{N_s(U)} f} \right] \\ &\Leftrightarrow p_A (q_{A|A}^{(S)} \cdot E[f_A]) + p_B (q_{A|B}^{(S)} \cdot E[f_A]) \\ &> p_A (q_{B|A}^{(S)} \cdot E[f_B]) + p_B (q_{B|B}^{(S)} \cdot E[f_B]) \end{aligned} \quad (D.20)$$

Using Equations D.15 and D.16, this inequality simplifies to

$$p_A \cdot E[f_A] > p_B \cdot E[f_B] \quad (D.21)$$

Now, recall that a trait is said to be selected for if it fares better than a neutral mutant. If A is a neutral mutant of B, then $E[f_A] = E[f_B]$, in which case Inequality (D.21) simplifies to

$$p_A > p_B \quad (\text{D.22})$$

Thus, strategy A fares better than a neutral mutant if

$$p_A \cdot E[f_A] - p_B \cdot E[f_B] > p_A - p_B \quad (\text{D.23})$$

which is true when

$$\begin{aligned} E[f_A] &> E[f_B] \\ \Leftrightarrow E[\Pi_A] &> E[\Pi_B] \end{aligned} \quad (\text{D.24})$$

Interestingly, this rule is also arrived at by comparing $E[\Pr(U \rightarrow A)]$ with $E[\Pr(U \rightarrow B)]$ when the population is equally split between A and B ($p_A = p_B$)—or by switching to a deterministic updating rule based on the maximum payoff once the local strategy density equilibrium is reached.

Now, to compare the expected payoffs of the two competing strategies, I compare their expected economic neighborhoods in the local strategy density equilibrium. In the non-social economic network ($G - O$), there is no difference in the expected neighborhoods (since assortment only arises on the social network). Therefore, the expected difference in economic neighborhood is equal to the expected difference in the overlap neighborhood. Let A_A be the number of A nodes in the overlap neighborhood of an A node and A_B be the number of A nodes in the overlap neighborhood of a B node. To find $E(A_A - A_B)$ in the local strategy density equilibrium, we must consider eight scenarios arising from the strategy of the updater, U , and its position relative to the A and B nodes competing for emulation:

1. U is an A player

a. U is in the overlap neighborhood of both A and B (occurs with probability $\left(\frac{o}{s}\right)^2$)

$$E(A_A - A_B) = (o - 1) \left(q_{A|A}^{(o)} - q_{A|B}^{(o)} \right) \quad (\text{D.25})$$

- b. U is in the overlap neighborhood of A but not B ($Pr = \frac{o}{s} \left(1 - \frac{o}{s}\right)$)

$$E(A_A - A_B) = 1 + (o - 1)q_{A|A}^{(o)} - oq_{A|B}^{(o)} \quad (D.26)$$

- c. U is in the overlap neighborhood of B but not A ($Pr = \frac{o}{s} \left(1 - \frac{o}{s}\right)$)

$$E(A_A - A_B) = oq_{A|A}^{(o)} - (o - 1)q_{A|B}^{(o)} - 1 \quad (D.27)$$

- d. U is in the overlap neighborhood of both A and B ($Pr = \left(1 - \frac{o}{s}\right)^2$)

$$E(A_A - A_B) = o \left(q_{A|A}^{(o)} - q_{A|B}^{(o)} \right) \quad (D.28)$$

2. U is a B player

- a. U is in the overlap neighborhood of both A and B ($Pr = \left(\frac{o}{s}\right)^2$)

$$E(A_A - A_B) = (o - 1) \left(q_{A|A}^{(o)} - q_{A|B}^{(o)} \right) \quad (D.29)$$

- b. U is in the overlap neighborhood of A but not B ($Pr = \frac{o}{s} \left(1 - \frac{o}{s}\right)$)

$$E(A_A - A_B) = (o - 1)q_{A|A}^{(o)} - oq_{A|B}^{(o)} \quad (D.30)$$

- c. U is in the overlap neighborhood of B but not A ($Pr = \frac{o}{s} \left(1 - \frac{o}{s}\right)$)

$$E(A_A - A_B) = oq_{A|A}^{(o)} - (o - 1)q_{A|B}^{(o)} \quad (D.31)$$

- d. U is in the overlap neighborhood of both A and B ($Pr = \left(1 - \frac{o}{s}\right)^2$)

$$E(A_A - A_B) = o \left(q_{A|A}^{(o)} - q_{A|B}^{(o)} \right) \quad (D.32)$$

Whether U is an A or a B player, the expected difference in the number of A nodes in the overlap neighborhoods is then

$$\begin{aligned}
E(A_A - A_B) &= \left(\frac{o}{s}\right)^2 (o-1) (q_{A|A}^{(o)} - q_{A|B}^{(o)}) \\
&\quad + \frac{o}{s} \left(1 - \frac{o}{s}\right) \left((o-1)q_{A|A}^{(o)} - oq_{A|B}^{(o)} + oq_{A|A}^{(o)} - (o-1)q_{A|B}^{(o)}\right) \\
&\quad + \left(1 - \frac{o}{s}\right)^2 o (q_{A|A}^{(o)} - q_{A|B}^{(o)})
\end{aligned} \tag{D.33}$$

Substituting in $q_{A|A}^{(o)} - q_{A|B}^{(o)} = \frac{1}{s-1}$, this becomes

$$\begin{aligned}
E(A_A - A_B) &= \left(\frac{o}{s}\right)^2 \frac{o-1}{s-1} \\
&\quad + \frac{o}{s} \left(1 - \frac{o}{s}\right) \left(\frac{2o}{s-1} - \left(p_A - \frac{1}{s-1}(1-p_A)\right) + p_A - \frac{1}{s-1}p_A\right) \\
&\quad + \left(1 - \frac{o}{s}\right)^2 \frac{o}{s-1} \\
&= \frac{o}{s}
\end{aligned} \tag{D.34}$$

Lastly, note that if we separate the social layer (S) from a “cultural” trait transmission layer (L), the rule for the evolution of empathy becomes $\frac{b}{c} > \frac{o_{gs} \cdot l}{o_{gl}}$, where o_{gs} is the social-economic overlap degree, l is the cultural degree, and o_{gl} is the cultural-economic overlap degree. As mentioned above, the multilayer network generation algorithm could be modified to generate a three-layer multilayer network on which such evolutionary game simulations could be run.

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2. THE SOCIAL AND CULTURAL EFFECTS OF MARKETS AND CAPITALISM

Evidence from Folklore and Ethnography

1. Introduction

How do economic systems shape the ways we behave, interact, and understand the world? Do the relations and tasks of a capitalist society produce a set of preferences and beliefs about the world distinct from those of a hunter-gatherer society? Do the social and cultural effects of capitalism differ from those of markets? In this paper, I analyze the effects of markets and capitalism on prosociality, morality, ecocentrism, and stratification using folklore and ethnographic text as data. Building off the work of Michalopoulos and Xue (2021), I sharpen the technique of constructing indices of societal characteristics from folklore text, assemble an analogous dataset of indices based on ethnographic text from the electronic Human Relations Area Files (eHRAF) World Cultures database, and extend the analysis of the economic determinants of culture and social structure to ecocentrism and stratification. The social and cultural effects of markets and capitalism evidenced by the results imply that non-economic consequences should be taken into account when designing economic policy. This aligns with the literature on moral crowding out, which shows that the market setting can alter the behavioral expression of social and moral preferences (Bowles, 2016; Gneezy & Rustichini, 2000).

The nature of the dynamic relationships between economic systems and social, cultural, and political systems constitutes a perennial question for social theorists. Although it has, in the past century, fallen somewhat out of vogue to theorize across disciplinary boundaries, the heirs of classical traditions of grand social theory persist in various forms today. Modern scholars of cultural evolution and endogenous preferences (Bowles, 1998; Boyd & Richerson, 2005; Gintis, 2016; Henrich, 2021), political economy (Acemoglu et al., 2001; Darity et al., 2006; Harvey, 2020;

Wood, 1991), cultural economics (Michalopoulos et al., 2018; Michalopoulos & Xue, 2021; Nunn & Wantchekon, 2011), economic sociology (Beckert, 2003), economic anthropology (Graeber, 2014; Graeber & Wengrow, 2021), complex social systems (Bettencourt et al., 2007; Romanowska et al., 2021), and cliodynamics (Currie et al., 2020; Turchin, 2011; Turchin et al., 2022) carry on the discourse of Montesquieu, Smith, Tocqueville, Marx, Durkheim, Weber, Polanyi, Parsons, and the like, integrating social, cultural, political, and economic dimensions into their analysis of the structure and dynamics of society.

Of the many frameworks conjectured to approximate the laws of motion of society, the theories of historical and cultural materialism are particularly relevant to this paper's inquiry into the social and cultural effects of economic systems. Proponents of historical and cultural materialism hold that while the economic, social, cultural, and political spheres of a society co-evolve, the effect of the economic system (the "base") on the sociocultural system (the "superstructure") dominates its converse (Engels, 1972; M. Harris, 2001). Applications of evolutionary frameworks to explaining human behavior, culture, and history also implicitly reflect this perspective through the assumption that the fitness of cultural and behavioral traits derives from the material payoffs they yield (Bowles & Gintis, 2011; Boyd & Richerson, 2005; Henrich, 2021; Nunn, 2021). The mechanism underlying the social and cultural effects of economic systems might be both evolutionary and contextual—i.e. economic systems might shape preferences, beliefs, and behaviors by influencing which learned traits spread and persist as well as through context and constraints on the expression of our genetic and cultural inheritance. And economic systems may influence cultural evolution both by shaping who interacts with whom (i.e. the transmission network) and by selecting for certain traits (i.e. as part of the adaptive landscape). For example, in "Trade and Geography in the Spread of Islam," Michalopoulos, Naghavi, and Prarolo show how trade routes

promoted the spread of Islam by exposing more people to the religion and by increasing the incentives of conversion (2018).

The debate over the social and cultural effects of markets and capitalism has a long history from Montesquieu and Marx to Henrich and Graeber. Some argue that markets and capitalism encourage prosociality, peace, harmony, and moral universalism (from Montesquieu (1748) to Henrich et al. (2004; 2010), Schilpzand & de Jong (2023), Harris et al. (2023), and Enke (2023)) while others argue that markets and capitalism erode community and moral responsibility and encourage greed, selfishness, individualism, and materialism (from, e.g., Marx & Engels (1906), to Polanyi (1944), Weber (1978), Lane (2000), Marglin, (2008), Falk & Szech (2013), and Graeber (2014)). Many also claim that markets and capitalism shape the way we think and feel about nature and our relationship to it, pushing us away from ecocentrism (a nature-centered worldview) and toward anthropocentrism (a human-centered worldview) (Abram, 2012; Kimmerer, 2013; Worster, 1987). Whereas many traditional Indigenous knowledge systems assign sacredness and personhood to the more-than-human world, the dominant framework in modern market societies conceptualizes nature solely as an object for human use (Abram, 2012; Kimmerer, 2013). The inequality produced by markets and capitalism is also often tied to the creation and maintenance of social hierarchies. A number of scholars of social and economic stratification argue that racist, sexist, classist, and xenophobic myths arise alongside group-based economic disparities as a means of justifying and thus stabilizing this inequality (Bright et al., 2025; Folbre, 2023; Mason et al., 2022; Zinn, 2015). In this paper, I contribute to this literature by employing folklore and ethnographic text as data to explore the effects of markets and capitalism on prosociality, morality, ecocentrism, and stratification.

It is important to note that although markets and capitalism are often conflated, they are not synonymous. The historical and cross-cultural prevalence of markets is not evidence of universal capitalism. Capitalism is a historically specific economic system characterized by private ownership of the means of production and the wage-labor relation (Wood, 2002). Markets occupy a specific niche in capitalism (Polanyi, 1944), where they become essential for social reproduction—i.e. most people in a capitalist society must sell their labor for a wage to provide for their own subsistence (Wood, 2002). The roles, relations, tasks, contexts endemic to capitalism may produce different social and cultural forms than markets, money, and trade more broadly. I therefore distinguish between markets and capitalism in my analysis.

Cross-cultural collections of folklore and ethnography lend themselves to the analysis of the social and cultural effects of economic systems through their depictions of societies with wide-ranging social, cultural, and economic characteristics. And the perspectives provided by these dual sources complement each other. In fact, folklore is often considered an essential part of ethnography (Bascom, 1953) or a kind of autobiographical ethnography (Dundes, 1969). Since folklore consists of the stories a people tell about themselves and the world and ethnographies—i.e. observations of a people—are usually written by out-group anthropologists, folklore and ethnography present, respectively, emic (insider) and etic (outsider) perspectives of a culture (Dundes, 1969). And whereas folklore allows a glimpse into the worldview of a people—their ontology, their epistemology, their values (Toelken, 1996)—ethnography recounts the observable social structure, cultural norms, and behavior in a society.

But what is folklore exactly? And what does it reveal about its carriers? In this paper, I use the term folklore as Yuri Berezkin does to refer simply to the traditional stories of a people (2015). As the definition suggests, folklore is primarily transmitted vertically from generation to genera-

tion within a group. Consequently, folktales spread when a group migrates or proliferates (Berezkin, 2015; Michalopoulos & Xue, 2021). They may also spread via horizontal transmission, passing from one group to another (Berezkin, 2015; Boas, 1916; Michalopoulos & Xue, 2021, Online Appendix). Different stories persist and spread with differential success. Thus, their dispersal might be modelled in an evolutionary manner (Tehrani, 2023; Toelken, 1996; Wilson, 1976). And through the selective transmission of stories, folklore comes to reflect social, cultural, political, economic, and natural conditions. If a story ceases to be relevant, useful, insightful, relatable, or entertaining, it may not be passed on, or it may be altered (Bascom, 1953; Dundes, 1969). The fitness (propensity to persist and spread) of specific stories is thus a function of their relevance, usefulness, insightfulness, relatability, and entertainment value as well as their carriers' own capacities to persist and spread themselves and their cultural influence. And folklore can affect the group's fitness by conveying preferences, beliefs, and behavior adapted to their specific human ecology. Stories serve as vessels for education and enculturation by describing the patterns of the natural world, instilling a sense of meaning and sacredness, inculcating and maintaining social and moral norms, and developing a sense of group identity (Akerlof & Snower, 2016; Bascom, 1954; Michalopoulos & Xue, 2021, Online Appendix; Witzel, 2012). Stories may also aim to legitimize the status quo (Akerlof & Snower, 2016; Bascom, 1953; Wrenn, 2021), or they may provide spaces for challenging the status quo (Marshall, 2012). In short, folklore is both a reflection of society and a societal force.

The method of using folklore text as data to analyze the relationship between culture and economic systems was pioneered by Michalopoulos and Xue in their paper, "Folklore" (2021), where they transform Berezkin's catalogue of folklore motifs (2015) into a dataset of the textual prevalence of different concepts in each folklore tradition. By applying regression analysis to these

data, Michalopoulos and Xue show that geographical, political, cultural, and economic conditions are reflected in folklore. A number of subsequent papers have employed their data to explore the economic determinants of culture (Becker, 2024; Enke, 2023; Eruchimovitch et al., 2024; Fan et al., 2024). I derive indices to measure market exposure, capitalist relations, prosociality, morality, ecocentrism, and stratification from Michalopoulos and Xue’s data based on the presence of relevant words in each culture’s folklore motifs. I also extend this method to ethnographic text from the eHRAF World Cultures database, developing an analogous dataset of social, cultural, and economic indices based on the prevalence of relevant words and subjects in the collected ethnographies of each culture. I test the economic indices for validity using historic trade route data (from Michalopoulos et al., 2018) and the eHRAF subsistence type categories (Table 4). I then employ the text-based indices in regressions to analyze the social and cultural effects of markets and capitalism (Tables 5-7). I also conduct an instrumental variable analysis of the effects of markets, using proximity to historic trade routes as an instrument for my text-based markets indices (Tables 5 and 6).

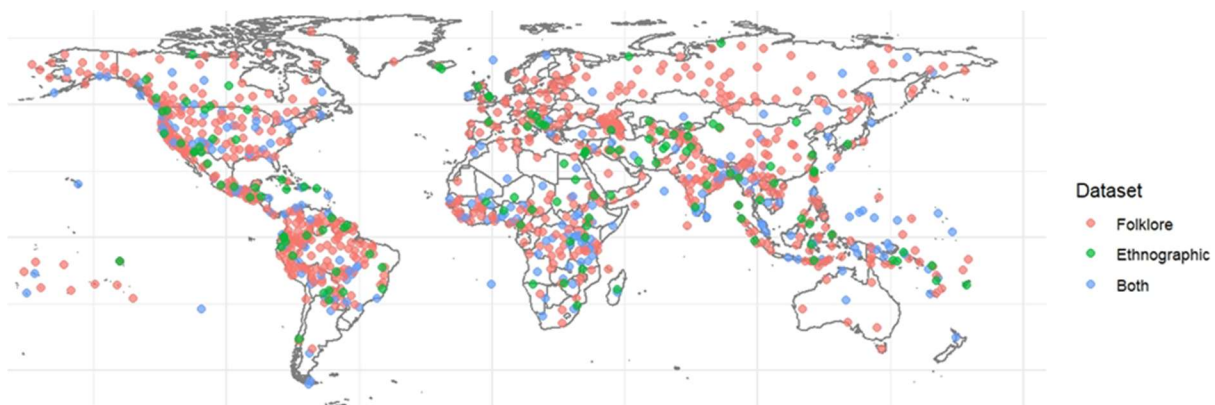
In the rest of this paper, I describe the assembly of data from folklore and ethnographic text, the construction of social, cultural, and economic indices from these data, and the empirical strategy (Data and Method); I then report the regression results (Results); finally, I discuss the implications of the results, the limitations of the method, and further avenues of research (Discussion).

2. Data and Method

To explore the effects of markets and capitalism on prosociality, morality, ecocentrism, and stratification, I develop social, cultural, and economic indices based on the textual prevalence of rele-

vant themes and words in folklore and ethnography and employ these indices in OLS and IV regression analyses. I construct folklore indices using the dataset (2021) Michalopoulos and Xue assembled from Berezkin’s catalogue of folklore motifs (2015). I construct ethnographic indices using the electronic Human Relations Area Files (eHRAF) World Cultures database. The sample of societies represented in these two datasets span the globe (Figure 1). In this section, I describe the process of assembling the folklore and ethnographic data, the method of index construction and validation, and the empirical strategy.

Figure 1: Map of cultures in folklore and ethnographic datasets



The societies in the folklore and ethnographic datasets span the globe. Pink points represent cultures present only in the folklore data; green points represent cultures present only in the ethnographic data; and blue points represent cultures present in both folklore and ethnographic data.

2.1 Folklore data

2.1.1 Berezkin’s catalogue of folklore motifs (2015)

The folklore text used in this paper comes from the catalogue of 2,564 folklore motifs from 958 folklore traditions that Yuri Berezkin compiled from over 6,000 sources (2015).³ A folklore motif, according to Berezkin, is an episode or an image that appears in multiple folklore traditions (2015,

³ This catalogue first became available in 2015 and has been updated several times, the latest time being in 2022. Currently, it contains 2,945 motifs associated 999 folklore traditions. I use the Michalopoulos and Xue’s dataset which they derive from the 2019 version of the catalogue.

p. 37). Anthropologists and folklorists have long noted the redundancy of images and episodes across different folklore traditions, and several efforts have been made to catalogue these motifs and their spatial and cultural distribution, but Berezkin’s catalogue is by far the most extensive and globally representative. The source texts include books and articles published mostly in the 20th century (though the age of the stories they record cannot be determined). In the catalogue, each motif has a reference ID, a title, and a one or two sentence description. The contents range from mythological representations of the sun and moon to etiologies of natural phenomena to tales of tricksters. Table 1 presents some descriptive statistics on the folklore motifs and sources. In accordance with Michalopoulos and Xue’s precedent, I drop the 15 cultures that are associated with fewer than 5 motifs. Table 2 presents two example motifs from the catalogue and a sample of the folklore traditions the motifs appear in.

Table 1: Summary of folklore data

This table summarizes the global distribution of folklore motifs in Berezkin’s catalogue, including the number of cultures, the average number of motifs and sources per culture, and the average publication year of the sources. Standard deviations are in parentheses.

<i>Continent</i>	<i>Cultures</i>	<i>Motifs per culture</i>		<i>Sources per culture</i>		<i>Publication year</i>	
Africa	137	55.1	(51.3)	12.9	(9.7)	1961.5	(16.4)
Asia	286	111.6	(99.6)	18.2	(15.2)	1960.9	(18.7)
Europe	54	257.8	(144.4)	33.9	(18.4)	1964.0	(13.5)
North America	246	74.2	(47.5)	12.0	(9.8)	1951.9	(20.3)
Oceania	55	41.3	(21.5)	9.9	(5.8)	1944.6	(16.9)
South America	165	58.4	(41.2)	9.7	(8.6)	1965.8	(19.4)
World	943	88.6	(88.1)	14.8	(13.2)	1958.7	(19.5)

2.1.2 Michalopoulos and Xue’s data (2021)

In the 2021 paper, “Folklore,” Michalopoulos and Xue transform Berezkin’s catalogue of folklore motifs into a dataset of the prevalence of various concepts in the folklore traditions. This dataset

consists of 958 culture observations and 9,005 concept variables. To create the concept variables, they use a semantic network project called ConceptNet to amass a list of 9,005 common words (the 10,000 most common words minus NLTK stop words like “a” and “the”); for each of these “concepts,” they obtain a list of the 50 most closely related words according to ConceptNet, and they count the number of motifs in each culture that contain any of these related words in the motif title or description. In short, each society is associated with a number of folklore motifs, and each motif is associated with a number of concepts. Michalopoulos and Xue’s concept variables count the number of motifs in each folklore tradition associated with each concept. For example, 16 out of the 152 folklore motifs of the Arapaho people are tagged with words relating to “earth,” so the “earth” concept variable has a value of 16 for the Arapaho observation. Table 2 shows a sample of the concepts associated with motifs I11 and M91b.

Table 2: Folklore motifs and concepts.

These two folklore motifs from Berezkin’s catalogue (2015) exemplify how each of the 2,564 folklore motifs is tied to multiple cultural traditions and multiple concepts (Michalopoulos and Xue, 2021). The concept variables created by Michalopoulos and Xue (2021) are then derived by counting the number of motifs in each culture tagged with the concept.

<i>ID</i>	<i>Motif title</i>	<i>Motif description</i>	<i>Cultures</i>	<i>Concepts tagged</i>
I11	Cosmic turtle or toad	A turtle, toad, or frog supports the earth or is its embodiment	• Arapaho • Aztec • Bengali • Bulgarians • Buryat • Cheyenne • Chinese <i>and 55 other cultures</i>	• aid • aspect • assist • assistance • backer • backing • behalf <i>and 50 other concepts</i>
M91b	Sold ashes	A person manages to fraudulently sell or exchange ash for gold and money. Others are unsuccessfully offering ash for sale.	• Amhara • Assamese • Bashkir • Bengali • Buryat • Georgians • Kazakh <i>and 45 other cultures</i>	• accept • accomplish • accomplishment • achievement • acquisition • administer • allegedly <i>and 159 other concepts</i>

2.2 Ethnographic data

The ethnographic text used in this paper comes from the Human Relations Area Files World Cultures database, which is an online collection of over 770,000 pages of ethnographies describing over 360 cultures. This ethnographic collection originated as a project in the 1930s and 40s meant to aggregate ethnographic sources from many cultures and classify the topics of those texts, thereby expediting the process of cross-cultural research (Fischer & Ember, 2018). The collection has been indexed by subjects at the paragraph level based on the Outline of Cultural Materials (Murdock et al., 2008). There are more than 700 different subjects in this classification scheme which cover a vast range of topics from kinship patterns to religious beliefs and from modes of production to technology. Using the search engine on eHRAF, I can specify any combination of

OCM subjects and/or keywords, and it will return the number of paragraphs containing the specified subjects/keywords in the collected ethnographies of each culture. For example, by searching “subject: ritual,” I find that there are 13 paragraphs in the collected Maasai ethnographies that are tagged with the OCM subject, “ritual,” and by searching “text: wage OR profit,” I find that there are 29 paragraphs in the collected Kazakh ethnographies that contain one of these words. This search feature allows me to extract the textual prevalence of different themes and assemble an ethnographic dataset analogous to Michalopoulos and Xue’s folklore dataset (2021).

The eHRAF World Cultures database also classifies the cultures by subsistence type. These categories do not necessarily characterize the state of each society today or throughout all the coverage time of the ethnographies; rather, the categories are meant to capture the mode of subsistence that predominates in the ethnographies (eHRAF User Guide). This classification includes a “commercial economy” category for societies that rely primarily on the medium of markets for subsistence (rather than directly on agriculture, pastoralism, or hunting and gathering).

Table 3 presents some descriptive statistics on the eHRAF World Cultures database from which I derive the ethnographic data. Note that I drop the 16 societies that are associated with fewer than 50 pages.

Table 3: Summary of ethnographic data

The first table reports the average number of ethnography pages and documents and the average birth year of the ethnography authors. Standard deviations are in parentheses. The second table reports the number of cultures in each subsistence type category.

<i>Region</i>	<i>Cul- tures</i>	<i>Pages per culture</i>		<i>Documents per cul- ture</i>		<i>Author birth year</i>	
Africa	70	1920.0	(1752.1)	17.9	(14.2)	1920.5	(12.5)
Asia	71	2290.9	(2255.9)	18.1	(15.5)	1915.0	(19.4)
Europe	17	2965.9	(2302.5)	22.8	(22.1)	1897.7	(102.3)
Middle America and the Caribbean	18	2387.7	(1761.5)	15.6	(7.9)	1912.4	(23.8)
Middle East	11	2435.6	(1922.2)	20.4	(19.0)	1925.5	(14.8)
Native North America	60	2722.8	(3978.8)	26.6	(34.4)	1902.8	(14.2)
non-Native North America	20	3287.1	(2313.1)	25.1	(16.9)	1935.0	(8.7)
Oceania	32	2180.4	(1838.6)	21.2	(20.9)	1910.3	(16.9)
South America	44	1201.1	(925.6)	11.0	(8.0)	1907.5	(42.2)
World	343	2241.9	(2430.6)	19.5	(20.4)	1913.1	(31.6)

<i>eHRAF subsistence type</i>	<i>Cul- tures</i>
Commercial economy	28
Intensive agriculturalists	75
Horticulturalists	59
Agro-pastoralists	25
Pastoralists	18
Primarily hunter-gatherers	29
Hunter-gatherers	59
Other subsistence combi- nations	50

2.3 Index construction

From the concept variables in Michalopoulos and Xue's folklore data (2021) and from the subject and keyword search results in the eHRAF World Cultures database, I construct indices to measure the social, cultural, and economic characteristics of each society. This method rests on the assumption that the stories a people tell and the accounts of their ethnographers reflect their social, cultural, and economic realities and that these societal characteristics imprinted in text can be quanti-

fied based on the distribution of words and subjects. In other words, people more exposed to markets tell more stories about markets, and their ethnographies contain more market-related content as well. I test the validity of the markets and capitalism indices using data on historic trade route (Michalopoulos et al., 2018) and the eHRAF commercial economy subsistence type category (Table 4). In Appendix A, I report the constituent terms in every index (Table A1), discuss the methodological choices of index construction further, map out the global variance of each index, and present examples of the folklore motifs and ethnography paragraphs from which the indices are derived.

2.3.1 Constructing the folklore indices

To construct indices for markets, prosociality, morality, ecocentrism, and stratification, I selected sets of concepts from Michalopoulos and Xue's data based on the related words tagged and the context in which they appear in the motifs (Table A1). In this selection process, I attempted to maximize coverage of relevant words, minimize inclusion of irrelevant words, and minimize redundancy of words (to reduce the number of times the same motif is counted). The market concepts tag words related to markets, trade, and money; the prosociality concepts I selected tag words related to caring, giving, helping, and sharing; the morality concepts tag words related to what a person should or should not do; the ecocentrism concepts tag words related to the more-than-human world; the stratification concepts tag words related to hierarchy, rank, domination, and servitude. I do not construct a capitalism index from folklore because none of the folklore motifs in Berezkin's catalogue relate specifically to the economic system of capitalism (characterized by the wage-labor relation and concentrated, private ownership of the means of production).

To create the indices from these concept lists, I create indicator variables for every constituent concept (either present or not present in each folklore tradition). I then apply principal component analysis to the set of relevant indicator concept variables and use the standardized first principal component as the index. I tested several different versions of the market index (and subsistence type indices) for validity using historic trade route data (Michalopoulos et al., 2018) and eHRAF subsistence type categories before choosing this particular PCA-indicator-concept method. Michalopoulos and Xue also apply principal component analysis to the folklore concepts in constructing their index for the presence of “high gods” (2021, pp. 2013-2014); and in “Market Exposure and Human Morality” (2023), Enke similarly constructs social, cultural, and economic indices based on the proportion of relevant concepts present each folklore tradition. For an extended methodological discussion of concept selection and index construction, see Appendix A.

2.3.2 *Constructing the ethnographic indices*

As with the folklore index construction, to create the ethnographic indices, I first select a list of relevant terms (Table A1). This can be done using OCM subjects and/or keywords. I construct the economic indices from keywords and the social and cultural indices from OCM subjects. The advantage of using keywords is that there are no constraints on my choice of terms, allowing me to derive indices based on the highly relevant terms.⁴ The advantage of using subjects is that they capture more of the context of the terms since the paragraphs are tagged by ethnographers who read the texts. My objective in keyword/subject selection is to choose terms that correspond one-to-one with the societal characteristic of interest. I then obtain the indices from the standardized textual prevalence of relevant terms. The markets index derives from keywords related to markets,

⁴ One issue with the keyword approach is that a small portion of the ethnographic documents are not written in English. To account for this, I include the prevalence of the word “the” in all regressions.

trade, and money; the capitalism index from keywords related to capitalism, employment, wages, and profit; the prosociality index from subjects related to giving, helping, and selfishness; the morality index from the “ethics” subject; the ecocentrism index from the co-occurrence of subjects related to sacredness and subjects related to cultural ideas about the more-than-human world; and the stratification index from the “social stratification” subject.

I contend that the term precision advantage of keywords outweighs the contextualization advantage of subjects for the economic indices (e.g. the presence of the word “market” clearly indicates markets and “capitalism” indicates capitalism, regardless of context), but the contextualization advantage of subjects outweighs the term precision advantage of keywords for the social and cultural indices (e.g. paragraphs describing ecocentrism are better identified via contextualized subject tags than any specific keywords). The reason I use textual prevalence of terms in ethnography and presence/absence of terms in folklore is simply the difference in quantity of text. The amount of text in the eHRAF World Cultures database (more than 700,000 pages of ethnography) far exceeds the amount of text in Berezkin’s catalogue (2,564 folklore motifs).

2.3.3 *The challenge of validating the indices*

Many of the societies in the data have experienced significant social, cultural, and economic change since the historical period reflected in folklore and ethnography.⁵ This makes index validation difficult. Michalopoulos and Xue (2021) and Enke (2023) compare their cultural indices to modern survey data on values, but a null result using this technique might indicate either an invalid index or cultural change. And while the degree of modern persistence of social, cultural, and eco-

⁵ The median coverage range in the ethnographic data is 1820 – 1987. The mean publication year of the folklore sources is 1959, but the folktales themselves may be hundreds, thousands, or even tens of thousands of years older (some folklore motifs in the Berezkin catalogue (such as the Cosmic Hunt) may be of paleolithic origin (d’Huy, 2013)).

conomic traits apparent in folklore presents a promising avenue for future research, that is not the focus of this paper. Due to the lack of cross-cultural data that are contemporaneous with folklore and ethnography, I do not test the validity of the indices for prosociality, morality, ecocentrism, and stratification as measures of prosocial behavior, moral norms, ecocentric worldview, and social stratification and hierarchy, respectively. Thus, a conservative interpretation of my findings should focus on the social and cultural traits within the context of folklore and ethnography. I do, however, test the markets and capitalism indices for validity using cross-cultural, contemporaneous data.

To test the validity of the market indices, I regress them on the log distance of the societies from historic trade routes. This trade route data—from Michalopoulos et al. (2018)—only covers Africa, Asia, and Europe (Figure 2), so I exclude observations in the Americas and Oceania from these regressions. To test the validity of the capitalism index, I regress it on the eHRAF subsistence type category for commercial economies. I control for the quantity of text and the demographic characteristics of the ethnographer.⁶ Table 4 reports the results of these regressions. The log distance from historic trade routes is negatively and statistically significantly correlated with the markets indices from folklore and ethnography, and the capitalism index of societies categorized in eHRAF as commercial economies is, on average, 1.760 standard deviations higher than societies of other subsistence types, holding constant baseline controls.

⁶ I use the same baseline controls here as in the main analysis: for folklore regressions, the number of motifs and its square, the number of sources, and the mean publication year of the source; for ethnography regressions, the number of ethnographic pages and documents, the mean birth year of the author, the modal gender of the author, an indicator for whether the author is American or British, the mean beginning and end dates of coverage, and the prevalence of the word “the.”

Table 4: Testing markets and capitalism indices for validity

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. For trade route regressions (1-4), observations in the Americas and Oceania are dropped since trade route data only covers Africa, Asia, and Europe. For folklore regressions (1 and 2), standard errors are clustered by language family, and baseline controls include the number of motifs and its square, the number of sources, and the mean publication year of the source. For ethnography regressions (3-5), baseline controls include the number of ethnographic pages and documents, the mean birth year of the author, the modal gender of the author, an indicator for whether the author is American or British, the mean beginning and end dates of coverage, and the prevalence of the word “the.”

	Markets (folklore)		Markets (ethnography)		Capitalism (ethnography)
	(1)	(2)	(3)	(4)	(5)
Log distance from trade (pre-600 CE)	−0.157*** (0.033)		−0.083* (0.043)		
Log distance from trade (pre-1800 CE)		−0.157*** (0.048)		−0.217*** (0.047)	
eHRAF commercial economy category					1.760*** (0.338)
Baseline controls	Yes	Yes	Yes	Yes	Yes
Observations	477	477	167	167	342
R2 Adj.	0.583	0.570	0.088	0.157	0.301

2.4 Empirical strategy

To analyze the social and cultural effects of markets and capitalism, I apply regression analysis to the indices derived from folklore and ethnography. The general model specification for both folklore and ethnography regressions is as follows:

$$y_i = \mu + \alpha E_i + \mathbf{B}'_i \beta + \varepsilon_i \quad (1)$$

where i denotes the cultural group, y is the social/cultural index of interest (prosociality, morality, ecocentrism, or stratification), μ is the intercept, E is the economic index of interest (markets and/or capitalism), and $\mathbf{B}$ is the vector of baseline controls. α , the coefficient of interest, denotes the average change in the social/cultural index associated with a standard deviation increase in the economic index, holding constant baseline controls.

Following the precedent of Michalopoulos and Xue (2021) and Enke (2023), I cluster the standard errors of the folklore regressions by language family. Since folklore is a linguistic phe-

nomenon, folklore index values are likely correlated with language family. The baseline controls of the folklore regressions include the number of motifs and its square, the number of sources, and the mean publication year of the source. Controlling for the number of motifs is important because folklore traditions with more motifs are more likely to contain any given concept. For the ethnography regressions, the baseline controls include the number of ethnographic pages and documents, the mean birth year of the author, the modal gender of the author, an indicator for whether the author is American or British (as a majority are), the mean beginning and end dates of the coverage range of the documents, and the prevalence of the word “the.” By controlling for the demographic characteristics of the “average” ethnographer of each cultural group, I try to account for ethnographer bias.

As my main analysis, I estimate the model using ordinary least squares for the global samples of societies. For folklore, I regress each social/cultural index on the markets index (Table 5, Panel A). For ethnography, I regress each social/cultural index on the markets index alone (Table 6, Panel A) then on the markets and capitalism indices together (Table 7, Panel A).

I also conduct a series of robustness checks (Figure 3) to explore whether subsistence types (agriculture, pastoralism, and hunting and gathering), urbanization, political states, or education system might be confounding the relationship between markets/capitalism and prosociality, morality, ecocentrism, and stratification. For example, if agriculture is related to both markets and stratification, the markets index coefficient would capture some of the effects of agriculture on stratification, or if hunting and gathering is related to both capitalism and ecocentrism, the capitalism index coefficient would capture some of the effects of hunting and gathering on ecocentrism. I also run the regressions with regional fixed effects to test whether the observed effects persist when comparing societies within the same region. The terms that comprise the indices for subsist-

ence types, urbanization, political states, and education systems are reported in Table A1 in Appendix A.

In addition to calculating the OLS results, I employ the method of instrumental variables to try to parse the causal effects of markets on prosociality, morality, ecocentrism, and stratification. I use societal distance from historic trade routes as the instrument for the text-based markets indices, again following the precedent of Enke (2023).⁷ The map of trade routes, which was assembled by Michalopoulos, Naghavi, and Prarolo (2018), consists of historic trade routes and ancient ports in the Old World in two periods: pre-600 CE and pre-1800 CE (Figure 2). As the index validation tests show (Table 4), the markets index from ethnography is more closely related to pre-1800 CE trade routes whereas the markets index from folklore is closely related to both. Therefore, I use the log distance from pre-1800 CE trade routes as the instrument for the ethnographic markets index and the log mean distance from trade routes in both periods as the instrument for the folklore markets index. For the exclusion restriction to be satisfied, distance from the historic trade route must be related to the social and cultural characteristics of a society only through the effects of markets. So, the social and cultural traits of a people apparent in folklore or ethnography must not have prompted them to move closer to or farther from ancient ports and trade routes or influenced the geographical development of these ports and trade routes.

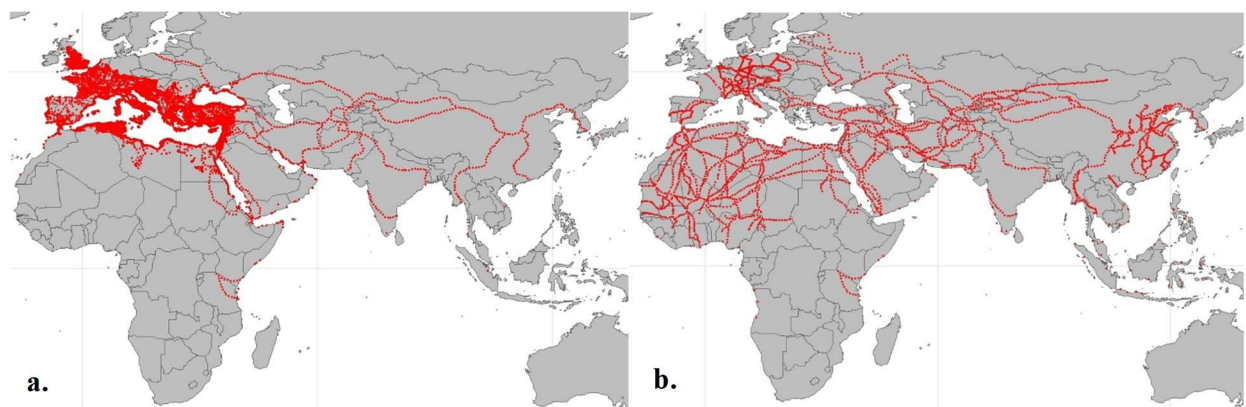
Additionally, sampling bias could produce erroneous results if some groups are overrepresented in the map of historic trade routes. Of the sources that Michalopoulos, Naghavi, and Prarolo (2018) draw from to compile the historic trade route data (Brice & Kennedy, 2002; de Graauw et

⁷ Enke also employs a variable for ecological polarization as an instrument for his text-based markets index based on the idea that societies that live in different ecological zones are more likely to trade with each other. However, I find it unlikely that ecology only influences social and cultural characteristics through markets. Social structure and culture likely adapts to ecological constraints (e.g. in harsh environments, strict norms of cooperation may be essential to survival). So, I do not implement ecological polarization as an instrument for markets.

al., 2014; McCormick et al., 2013; O’Brien, 1999), Brice and Kennedy’s *An Historical Atlas of Islam* (2002) and McCormick et al.’s network of Roman roads are explicitly focused on Islamic and Roman trade, respectively; even the sources that are not explicitly focused on specific cultures (de Graauw et al., 2014; O’Brien, 1999) may undersample trade routes that the cartographers’ own (mostly Western) societies have been less exposed to. The correlations observed in the regression analysis, then, might reflect the characteristics of the Roman, European, and Islamic cultures rather than the social and cultural effects of markets.

Despite these limitations, I estimate and report the IV results alongside OLS results for the Old World (Tables 5 and 6, Panels B and C).⁸

Figure 2: Historic trade routes and ports in the Old World



a. Old World trade routes and ports from pre-600 CE. **b.** Old World trade routes and ports from pre-1800 CE. These data come from Michalopoulos, Naghavi, and Prarolo’s 2018 paper, “Trade and Geography in the Spread of Islam.”

⁸ Another difference between my method and Enke’s (2023) is that I drop observations in the Americas and Oceania when I conduct the IV regression analysis. I believe that Enke’s use of the distance from Old World trade routes as an instrument for the market exposure of New World societies is inappropriate. Trade networks did exist in the pre-Columbian Americas (Mann, 2005), so the degree of market exposure of Indigenous American societies is unlikely to be related to their distance around the earth to Old World trade routes.

3. Results

In this section, I present the results of the main regression analyses estimating the social and cultural effects of markets and capitalism. Table 5 reports the coefficient estimates from regressing prosociality, morality, ecocentrism, and stratification on markets, where independent and dependent variables are indices constructed from folklore text. Table 6 reports the corresponding estimates from ethnographic text. In both tables, Panel A reports the OLS regression coefficient estimates, using the global sample. Panel B reports the OLS regression coefficient estimates when the sample is restricted to Africa, Asia, and Europe (the “Old World”). Panel C reports the IV regression coefficient estimates for the Old World, where the log distance to historic trade routes in the Old World is employed as the instrument for the text-based market index.⁹ Table 7 reports the coefficient estimates from regressing prosociality, morality, ecocentrism, and stratification indices on markets and capitalism indices in ethnography (Panel A) and on the eHRAF commercial economy subsistence category (Panel B). Figure 3 summarizes the regression results for a series of alternative regression specifications.

The regression results from applying OLS to the global folklore sample (Table 5, Panel A) indicate that a standard deviation increase in the markets index is associated with, on average, a 0.351 s.d. increase in the morality index ($p < 0.01$), a 0.136 s.d. decrease in the ecocentrism index ($p < 0.01$), and a 0.254 s.d. increase in the stratification index ($p < 0.01$), holding constant the number of motifs and sources and the mean publication year of the sources. There is no statistically significant relationship between markets and prosociality. Restricting the sample to the Old World (Panel B) weakens the results for morality, ecocentrism, and stratification but reveals a positive, statistically significant relationship between markets and prosociality for this subsample. The IV

⁹ For the IV estimates, all first stage regressions yield an F statistic far greater than 10, suggesting a strong instrument.

results (Panel C) suggest that market exposure decreases ecocentrism in folklore and increases prosociality, morality, and stratification in Old World folklore (if the exclusion restriction is satisfied).

The regression results from applying OLS to the global ethnography sample (Table 6, Panel A) indicate that a standard deviation increase in the markets index is associated with, on average, a 0.128 s.d. increase in the prosociality index ($p < 0.1$), a 0.279 s.d. decrease in the ecocentrism index ($p < 0.01$), and a 0.274 s.d. increase in the stratification index ($p < 0.01$), holding constant the amount of text, the demographic characteristics of the ethnographer, and the range of historical coverage. There is no statistically significant relationship between markets and morality. Restricting the sample to the Old World (Panel B) eliminates the relationship between markets and prosociality but strengthens the relationship between markets and ecocentrism and stratification. The IV results (Panel C) suggest that market exposure increases stratification in ethnography (if the exclusion restriction is satisfied).

Across both folklore and ethnography, markets are negatively correlated with ecocentrism and positively correlated with stratification. Both sources exhibit some evidence of a positive relationship between markets and prosociality. The strong positive relationship between markets and moral content in folklore is not clearly present in ethnography.

Table 5: The social and cultural effects of markets in folklore

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Baseline controls include the number of motifs and its square, the number of sources, and the mean publication year of the source. Standard errors are clustered by language family. For the IV regressions in Panel C, log distance to Old World historic trade route is used as an instrument for the text-based market index, and all observations from the Americas and Oceania are dropped.

	<i>N</i>	Prosociality	Morality	Ecocentrism	Stratification
Panel A: OLS (World)					
Markets	943	0.032 (0.042)	0.351*** (0.028)	-0.136*** (0.038)	0.254*** (0.049)
Panel B: OLS (Old World)					
Markets	477	0.209*** (0.046)	0.281*** (0.034)	-0.047 (0.034)	0.246*** (0.053)
Panel C: IV (Old World)					
Markets	477	0.206** (0.100)	0.356*** (0.118)	-0.154* (0.089)	0.805*** (0.138)
Baseline controls		Yes	Yes	Yes	Yes

Table 6: The social and cultural effects of markets in ethnography

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Baseline controls include the number of ethnographic pages and documents, the mean birth year of the author, the modal gender of the author, an indicator for whether the author is American or British, the mean beginning and end dates of coverage, and the prevalence of the word “the.” For the IV regressions in Panel C, log distance to Old World historic trade route is used as an instrument for the text-based market index, and all observations from the Americas and Oceania are dropped.

	<i>N</i>	Prosociality	Morality	Ecocentrism	Stratification
Panel A: OLS (World)					
Markets	342	0.128* (0.072)	0.058 (0.052)	−0.279*** (0.047)	0.274*** (0.059)
Panel B: OLS (Old World)					
Markets	167	0.024 (0.090)	0.100 (0.087)	−0.355*** (0.090)	0.345*** (0.085)
Panel C: IV (Old World)					
Markets	167	0.059 (0.261)	0.558* (0.315)	−0.260 (0.203)	0.782*** (0.269)
Baseline controls		Yes	Yes	Yes	Yes

Table 7 reports the coefficient estimates from regressing prosociality, morality, ecocentrism, and stratification on capitalism and markets in ethnography (Panel A) and on the eHRAF commercial economy subsistence category (Panel B). A standard deviation increase in the capitalism index is associated with, on average, a 0.205 s.d. decrease in the prosociality index ($p < 0.01$), a 0.185 s.d. decrease in the ecocentrism index, and a 0.260 s.d. increase in the stratification index, holding constant the market index, the amount of text, the ethnographer’s demographic characteristics, and the range of historical coverage (Panel A). In these same regressions, markets are positively correlated with prosociality and stratification and negatively correlated with ecocentrism, holding constant the capitalism index and the baseline controls. Thus, the social and cultural correlates of markets are distinct and separable from those of capitalism in ethnography. Replacing

the text-based indices for markets and capitalism with the eHRAF commercial economy category from the subsistence type classification in the World Cultures database yields results similar in sign and statistical significance to the text-based capitalism index (Panel B). Holding constant the baseline controls, societies categorized as commercial economies score, on average, 0.719 s.d. lower on prosociality ($p < 0.01$), 0.691 s.d. lower on ecocentrism ($p < 0.01$), and 0.607 s.d. higher on stratification ($p < 0.01$) than societies that depend primarily directly on agriculture, pastoralism, and hunting and gathering for subsistence. In line with the text-based index results, there is no statistically significant relationship between the commercial economy category and the moral content of ethnographies.

Table 7: The effects of markets versus capitalism in ethnography

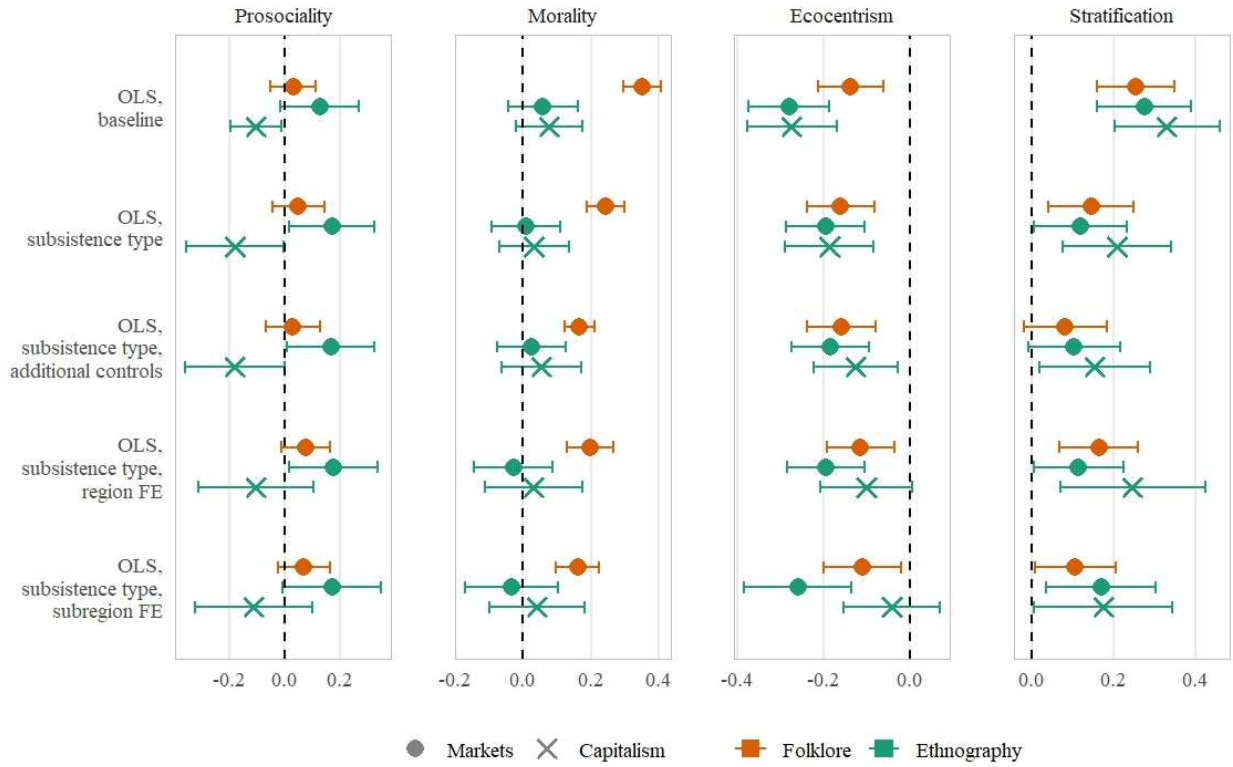
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Panel A reports the results from regressing the text-based social and cultural indices on the text-based indices for capitalism and markets. Panel B reports the results from regressing the text-based social and cultural indices on the commercial economy subsistence type category as classified by eHRAF ethnographers. Baseline controls include the number of ethnographic pages and documents, the mean birth year of the author, the modal gender of the author, an indicator for whether the author is American or British, the mean beginning and end dates of coverage, and the prevalence of the word “the.”

	<i>N</i>	Prosociality	Morality	Ecocentrism	Stratification
Panel A: Text-based indices					
Capitalism	342	−0.205*** (0.077)	0.064 (0.051)	−0.185*** (0.048)	0.260*** (0.069)
Markets		0.223** (0.097)	0.028 (0.054)	−0.194*** (0.047)	0.153** (0.060)
Panel B: eHRAF category					
Commercial economy	342	−0.719*** (0.204)	−0.159 (0.112)	−0.691*** (0.088)	0.607*** (0.177)
Baseline controls		Yes	Yes	Yes	Yes

Figure 3 reports the OLS coefficient estimates from regressing prosociality, morality, ecocentrism, and stratification on capitalism and markets for five different specifications using the global samples of folklore ($N = 943$) and ethnography ($N = 342$). The error bars represent 95% confidence intervals. All regressions include baseline controls (the same as in the main analysis presented in Tables 5-7). In the baseline specification, the sole independent variable is markets or capitalism. The specifications labeled “subsistence type” include as covariates text-based indices for agriculture, pastoralism, and hunting and gathering. The specification labeled “additional controls” includes as covariates text-based indices for urbanization and political states in the folklore regressions and text-based indices for urbanization, political states, and education system in the ethnography regressions. The specification labeled “region FE” includes fixed effects for continent in the folklore regressions and fixed effects for region (see Table 3) in the ethnography regressions. The specification labeled “subregion FE” includes fixed effects for country in the folklore regressions and fixed effects for subregion (e.g. northern Africa, eastern Africa, ...) in the ethnography regressions. These regional categories come from the data sources (Michalopoulos and Xue, 2021, and eHRAF World Cultures).

In general, the inclusion of additional controls dampens but does not eliminate the social and cultural effects of markets and capitalism observed in the main analysis. The effects observed in the main analysis cannot be entirely explained by the relationships between markets, capitalism, prosociality, morality, ecocentrism, and stratification on the one hand and agriculture, pastoralism, hunting and gathering, urbanization, political states, and education systems on the other. Nor can the effects be entirely explained by interregional variation.

Figure 3: Results for alternative regression specifications



This figure reports the OLS coefficient estimates from regressing prosociality, morality, ecocentrism, and stratification on markets and capitalism for five different specifications using the global samples of folklore ($N = 943$) and ethnography ($N = 342$). Coefficient estimate error bars represent 95% confidence intervals. All regressions include the baseline controls. Baseline specification: markets/capitalism is the only independent variable (aside from the baseline controls). Subsistence type: agriculture, pastoralism, and hunting/gathering indices. Additional controls: in folklore regressions, urbanization and political state indices; in ethnography regressions, urbanization, political state, and education system indices. Region FE: in folklore regressions, continent fixed effects; in ethnography regressions, region (see Table 3) fixed effects. Subregion FE: in folklore regressions, country fixed effects; in ethnography regressions, subregion (e.g. northern Africa, eastern Africa, ...) fixed effects.

4. Discussion

A great deal has been written about the effects of markets and capitalism on prosociality, morality, ecocentrism, and stratification. My contribution in this paper is not to form any novel theory but rather to apply folklore and ethnographic text as evidence to weigh the contradicting hypotheses of these long debates and to separate markets and capitalism in this analysis. In this section, I interpret the results of the regression analyses, recount the limitations of the method, discuss the

implications of the findings, and suggest several avenues for future research. Overall, the results suggest that markets and capitalism are associated with decreased ecocentrism and increased stratification; that, in folklore, markets are associated with increased moral content; and that while markets are weakly associated with increased prosociality, capitalism is associated with decreased prosociality. The instrumental variable estimates of the social and cultural effects of markets provide some evidence to support a causal interpretation consistent with historical and cultural materialism—insofar as the exclusion restriction is satisfied. These findings imply that social and cultural consequences should be considered when evaluating economic policy.

4.1 Prosociality and morality

My results add to the mixed evidence on the effects of markets and capitalism on prosociality and morality. In the global sample of folklore, I find no relationship between markets and prosociality. This result contrasts with the strong evidence Enke finds in his folklore-based analysis (2023).¹⁰ In the global sample of ethnography, I find a positive relationship between markets and prosociality but a negative relationship between capitalism and prosociality. This supports my hypothesis that the social and cultural consequences of capitalism differ from those of markets.

The morality results differ across the text sources. I find no effects of markets and capitalism on the moral content of ethnography, but I find a strong effect of markets on the moral content of folklore. This incongruence does not, in and of itself, invalidate the indices or regression results because, as discussed in the introduction, folklore and ethnography offer complementary (not parallel) perspectives on societies. The moral content of folklore may differ from the prominence of

¹⁰ This incongruity is attributable to the different sets of concepts included in the indices (see Appendix A). Enke also argues that market exposure is related to moral universalism, but once again, I disagree with his selection of concepts to include in this cultural index. I do not think the nuance of moral universalism can be captured by the prevalence of decontextualized words.

moral behavior, and the morality of behavior from the emic perspective may differ from the morality of that same behavior from the etic perspective—ethnographers cannot entirely escape the framing of their own moral enculturation.

In the cases of both prosociality and morality, the relationship between folklore content and behavior is somewhat unclear. Stories about desirable behavior might be told in response to undesirable behavior. So are societies that tell more tales of prosociality and morality successfully maintaining higher levels of prosocial and moral behavior? Or does the prominence of these sorts of tales reflect a perpetual deficiency of desirable behavior? Are societies that tell fewer tales of prosociality and morality simply neglecting the maintenance of such behavioral norms? Or does the lack of stories reflect a lack of need to enforce these norms—or an alternative mechanism of enforcement?

Folklore may simply occupy different functional roles in different societies. It may be more important to tell stories with moral lessons in large-scale anonymous market societies than in small, socially proximate societies, where our innate behavioral capacities—which evolved primarily in this human ecology (Boyd & Richerson, 2005)—may be sufficient to maintain societal coordination and cooperation. This relates to the argument that moralizing gods evolved to support the functioning of complex societies (e.g. Henrich et al., 2010).¹¹ But again, it does not necessarily follow that individuals behave more morally and prosocially in societies that worship moralizing gods. The moral norms inculcated through religion and folklore may serve only to compensate for the detrimental behavioral effects of social disembeddedness.

¹¹ This argument has recently met with some pushback (Lightner et al., 2023).

4.2 Ecocentrism

The results from both folklore and ethnographic regressions suggest that markets and capitalism diminish ecocentrism. This makes some intuitive sense. As we depend more on trade with other humans for our subsistence and less on direct interactions with the more-than-human world, we tend to tell fewer stories about the more-than-human world and assign less sacredness to nature. The relative prominence of humans/nature in our economic environments corresponds to the relative prominence of humans/nature in our conceptual framework of the world and what is considered sacred.

This relationship is demonstrated by folklore traditions even without atomizing them into regression-compatible concept variables. The stories we tell reflect our ecologies and define our ontologies, dividing the perceived world into named entities, describing relationships among these entities, and assigning sacredness to this system. Creation myths in particular exemplify how a people conceptualize themselves in relation to the more-than-human world (Kimmerer, 2013). Consider, for example, a creation story from the site of the earliest complex societies: In Genesis, God creates humans in his own image and grants them dominion over the earth and all non-human animals. This cosmogony formulates a hierarchy of nature in which humans hold a privileged and separate status (White, 1967). In comparison, the mythologies of many Indigenous peoples grant personhood to the more-than-human world and conceptualize the relationship between humans and nature in terms of kinship, embedding humans not in a hierarchy of nature but in a web of coinciding material, social, and sacred relations, where humans are tasked not with dominion but with a responsibility of reciprocity (Kimmerer, 2013). And these different ontologies of nature apparent in mythology may manifest behaviorally in human-environment interactions (Campbell & Moyers, 2011; Kimmerer, 2013). Insofar as Indigenous mythologies are more ecocentric on

average, the behavioral consequences of ecocentrism are evidenced by modern global spatial data which show that much of the remaining undegraded land on earth is managed by Indigenous peoples (Kennedy et al., 2023). Thus, markets and capitalism might have both direct and indirect effects on the natural environment: they might incentivize the (over)exploitation of natural resources for profit, and they might select for anthropocentric preferences that prioritize human material gain over the well-being of the more-than-human world.

4.3 Stratification

The folklore and ethnography regression results show a strong positive effect of markets on stratification, and in ethnography, capitalism is also strongly associated with stratification. The magnitude of the effects is somewhat lessened when subsistence type controls are added and again when urbanization and state controls are added, suggesting that some of the relationship between markets and stratification is explained by their association with agriculture, cities, and states, but some positive correlation persists even when these are controlled for (Figure 3).

The text-based indices for stratification may be capturing social, cultural, and/or economic forms of stratification in society. By social and cultural stratification, I mean the hierarchical partitioning of society in the external realm of social and political organization and in the internal realm of cultural concepts of otherness. By economic stratification, I refer to disparities in economic outcomes across different groups within a society. These dimensions of stratifications often move together. Social and political hierarchies may arise from and intensify economic inequality, and ideologies of hierarchical essentialism may be employed by an elite as a means to justify their position atop the pyramid of power and wealth and legitimize exploitative economic relations. The idea that markets and capitalism generate inequality and that this economic stratification is often

accompanied by social and cultural stratification is hardly novel, but the salience of the relationship observable in folklore and ethnography across a global sample is striking and so is the separability of the effects of markets, capitalism, agriculture, cities, and states.

A popular historical theory attributes stratification in complex society to the invention of agriculture (e.g. Diamond, 1999; Harari, 2015; Kaplan et al., 2009). The surplus generated through agriculture allows individuals to specialize in non-food production, and this specialization necessitates markets (so the individuals not producing food can obtain food) and promotes stratification when surplus is employed to expropriate the surplus produced by others. In other words, property confers power, and thus wealth begets wealth, and markets facilitate this inequality-augmenting feedback loop. And this economic stratification may occur both at the societal level through proletarianization and/or enslavement and at the household level through the gendered division of labor. And although wealth accumulation may not inevitably lead to a sociocultural dominance hierarchy, it seems to be a precondition (Gintis, 2016). Through this lens, markets and agriculture are jointly responsible for stratification in complex society, which aligns with the regression results shown in Figure 3.¹²

The relationship between capitalism and stratification might be explained by the accumulation, concentration, and centralization of capital and the impoverishment of the proletariat described by the Marxist school of thought (Marx, 1889, 1932; Sweezy, 1972). The profit imperative at the core of the logic of capitalism expands the wealth of the few through the exploitation of the wage-earning worker. While the Marxist tradition focuses on economic class, the traditions of feminist and stratification economics emphasize the role of gender and race in understanding strat-

¹² David Graeber also suggests that the rise of coinage in the Axial Age is intimately tied to slavery through war: coins were needed to pay soldiers on far-ranging military expeditions, and to meet this demand for coins, war captives were forced to mine for gold and silver as slaves (2014).

ification under capitalism. Patriarchal and racial ideologies and systems of oppression have been instrumental to the rise and development of capitalism (Folbre, 2023; Robinson, 2000; Williams, 1994), and they have been shaped and harnessed by capitalism to support its functioning and stability (via, e.g., unpaid care work maintaining the labor force, racial divide-and-conquer strategies inhibiting class-based collective action, and essentialist myths of race and gender rationalizing the racialized and gendered allocation of roles) (Bright et al., 2025; Folbre, 2023; Mason et al., 2022; Zinn, 2015).

4.4 Limitations

There are several limitations of the method employed in this paper that are worth pointing out. First, the method I employ to transform text into data extracts terms from their context. Decontextualization limits the accuracy and precision of the indices (e.g. a passage describing a lack of X would be tagged as related to X). This limitation might be addressed by conducting validation tests, but this leads us to the second limitation: the challenge of validating the social and cultural indices. As discussed in Data and Methods, given the paucity of relevant contemporaneous, cross-cultural data on prosociality, morality, ecocentrism, and stratification, I do not test the text-based social and cultural indices for validity. This limits my confidence in generalizing the results of the text-based index regressions to the real-world social and cultural effects of markets. Third, the lack of timestamp on the cultural observations limits the sharpness of the indices and muddies the historical interpretation of the results. This is something of an innate issue with folklore since the stories and the motifs they contain are shaped continually as they are told and retold. And the collections of ethnography for each culture often span a wide coverage range, over which the economic and social structure of the societies may have changed drastically. Fourth, the content of

the text may be skewed by the biases of the folklore transcribers and ethnographers. I have tried to address this concern by controlling for the mean publication date of the sources of each folklore tradition and the mean birth year and modal gender of each culture's ethnographers. Fifth, as discussed in Data and Methods, the historic trade route data used as an instrument for market exposure only covers the Old World, and may even in that range be unrepresentative. The sources of the trade route data appear to oversample the routes of Roman, Islamic, and European traders, and thus, proximity to these trade routes may also serve as a proxy for exposure to Roman, Islamic, and European culture. If this is the case, the exclusion restriction of the IV analysis is not satisfied.

4.5 Implications

In the 1998 paper, "Endogenous Preferences," Bowles suggests that markets and other economic institutions may influence preferences and their behavioral expression through context and through cultural transmission and evolution. The results of the text-as-data analysis here—like the findings of the literature on crowding out (Bowles, 2016; Gneezy & Rustichini, 2000)—provide evidence for these effects. Whereas crowding out may be explained predominantly in terms of the contextual effects of markets on the behavioral expression of preferences, the cross-cultural analysis results presented here may reflect more the cultural transmission and evolution effects that Bowles describes.

Regardless of the underlying mechanism, the results imply that economic policies should be evaluated based not just on the economic outcomes they produce but also on their social and cultural consequences. If markets and capitalism shape prosociality, morality, ecocentrism, and stratification, then a society's collective decision regarding how to allocate resources and organize

production must reckon with the first-order social and psychological effects and the second-order behavioral effects produced by these social and psychological characteristics.

In fact, if preferences are endogenous to economic system (as the results suggest), this presents a problem for the traditional method of generating actionable knowledge from economic models by maximizing a social welfare function with respect to a policy parameter. Endogenous preferences preclude the derivation of the social welfare function from the utility function of a representative agent since the very criterion for evaluating the outcome has become endogenous. In this context, the model may reveal multiple stable social-cultural-economic configurations which cannot be definitively ranked but rather must be evaluated by the actual constituents of the society in question. Thus, the normative ambiguity introduced by endogenous preferences necessitates the engagement of diverse stakeholders in deciding among the potential societal trajectories and equilibria illuminated by social science research.

4.5 Future research

The data and results of this paper open the door to many avenues for further research. First, the data and method of employing folklore and ethnographic text as data to explore the relationships among social, cultural, political, and economic traits and structures could be extended to other variables of interest. For example, the same approach could be applied to analyzing the effects of markets on states, cities, community structure, and gender norms or to exploring the social, cultural, and political effects of subsistence types (used in this paper as additional controls). Michalopoulos and Xue employ data on the caloric potential of the land to validate their index for agriculture (2021). This same variable could be used as an instrument to explore the causal effects of agriculture on, for instance, gender norms and stratification. Second, the IV analysis in this paper

could be strengthened by assembling and employing a global map of cross-culturally representative historic trade routes. Third, machine learning techniques might be employed as an alternative method for transforming folklore and ethnographic text into data (Michalopoulos, 2025). One advantage of using machine learning is that it might capture more of the contextual meaning of folklore and ethnography that is missed by prevalence measures; disadvantages of this technique include the opacity and stochasticity of the transformation process. Fourth, the causal and correlational evidence exhibited by the analysis offers an opportunity to explore potential causal mechanisms by developing theoretical models. Evolutionary game theory lends itself especially well to modeling endogenous preferences. Fifth, further empirical work might explore the relationship between the text-based social and cultural indices and modern-day attitudes and behaviors. The first challenge is to match the cultural groups in Berezkin's catalogue and eHRAF World Cultures to those in modern data on attitudes, values, preferences, and behavior. Then, there's the challenge of interpreting null results (did the preferences/behaviors change? Or are the indices invalid?). Nonetheless, where matching is possible, it could be insightful to compare the prosociality index to cross-cultural variance in experimental game behavior or to explore whether ecocentrism in folklore or ethnography can be tied to ecologically sustainable practices.

Appendix A. Construction and attributes of indices

In this appendix, I report the terms used to construct each folklore and ethnographic index (Table A1); I present heat maps and example passages of folklore and ethnography to illustrate, respectively, the global variation and textual foundations of the indices I use in my main analysis (Table

A2); and I discuss in more depth my methodological decisions in folklore concept selection and index construction.

A.1 Understanding the indices: Maps and text samples

To better understand the nature of the social, cultural, and economic indices I employ in my main analysis, I plot out the geographical variation of each index as a global heat map, and I supply one example passage of folklore or ethnographic text that epitomizes each index (Table A2). Rather than mapping the indices themselves, I first regress each index on the relevant (folklore/ethnographic) baseline controls, and I plot the residuals of these regressions. This way, the heat map reflects the variation that drives the regression results—the variation that is not attributable to factors such as the quantity of text or the demographic characteristics of the ethnographer. To exemplify the text that the indices are derived from, I select folklore motifs (from Berezkin’s catalogue (2015)) and ethnography paragraphs (from documents in eHRAF World Cultures) that score highly in each index. Specifically, for the folklore indices, I chose the motif that tags the highest number of relevant concepts; in the case of a tie, I chose the high-scoring motif that appears in the most folklore traditions. And for the ethnographic indices, I chose a paragraph from a document with a large number of paragraphs tagged with the relevant keywords/subjects. This procedure for selecting an ethnography passage is more arbitrary than the folklore motif selection procedure due to the extremely large quantity of text in eHRAF World Cultures that satisfies the search criteria for most of the indices.

A.2 Methodological decisions for constructing indices from folklore

There are a number of ways to transform the folklore motifs from Berezkin’s catalogue and the eHRAF search results into data. For both folklore and ethnography, indices are constructed by selecting relevant terms then applying some procedure to capture the textual prevalence of these terms. I chose the method of index construction after testing the validity of each text-based economic indices against the historic trade route data (Michalopoulos et al., 2018) and eHRAF subsistence type categories (the validation test results for the chosen indices are reported in Table 4).

A.2.1 Folklore concept selection

One way to choose relevant concepts would be to let the data speak for themselves via the LASSO shrinkage method. I explored this approach with the folklore concept data, but the concepts selected by the algorithm to predict, for example, distance from historic trade route appeared unrelated to markets or trade. Michalopoulos and Xue also come up with mixed results when they experiment with this method (2021, Online Appendix). I therefore handpicked the set of relevant concepts to construct each index based on their related words and the context in which they appear in the folklore motifs. As mentioned in section 2.3, my criteria for concept selection were inclusion of relevant words, exclusion of irrelevant words, and minimal redundancy. Michalopoulos and Xue’s “Concepts Tagged Per Motif” dataset allows the recovery of the related words tagged for each concept and the motifs they appear in. The related words from ConceptNet are not always synonymous with the concept itself. For example, the concept variable “give” tags not only motifs with the word “give” but also those with the word “take.” The concept variable “equitable” tags motifs which contain the words “fair” or “unfair,” “just” or “unjust,” “equal” or “unequal,” etc. Additionally, linguistic proximity may muddy the interpretation of correlations. For example, the

concept “reciprocal” tags motifs with the words “exchange” and “barter.” Also, some words are homonyms—they have multiple different meanings. For example, the word “bear” refers to the animal but also is synonymous with “carry,” and “bank” may refer to the financial institution or to the shore of a river (in the folklore motifs, it is only used in the latter sense). These ambiguities can cause problems if the concept variables are employed (alone or within indices) in regression analyses without first examining the list of related words and the contexts in which they appear in the folklore motifs. In Enke’s 2023 paper, for example, the concepts included (such as “bank,” “cooperate,” “education,” “equitable,” “give,” “reciprocal,” and “tolerance”) often tag irrelevant words and thus dilute the accuracy of his measures.

A.2.2 Methods for constructing the folklore indices

Given the sets of relevant concepts, the indices may be constructed a number of different ways. First, I construct prevalence indices by taking the mean of the prevalence of all relevant concepts in the collected motifs of each culture (thus measuring what proportion of motifs contain related words). Second, I construct standardized prevalence indices by taking the mean of all relevant standardized prevalence concept variables. These two versions differ because the latter weights every concept equally whereas the former weights concepts relative to their prevalence. Third, I construct proportion indices by taking the mean of indicator variables for all relevant concepts (thus measuring what proportion of relevant concepts appear in any of the motifs of a culture). Fourth, I apply principal component analysis to each of these three versions, yielding three more types of indices from the first principal components. These indices should only be used if all constituent concepts load onto the first principal component with the same sign (which is not always the case for the PCA prevalence and the PCA standardized prevalence indices). Fifth, I log-trans-

form the prevalence and the proportion indices to create two more versions. I then standardize all six level indices. Thus, I have constructed eight different versions of sociocultural and economic indices from the sets of relevant concepts in folklore. The PCA proportion versions of economic indices fare best when tested for validity against the historic trade route data in the Old World and the eHRAF subsistence type categories (using the 221 Ethnographic Atlas cultures that appear in both folklore and ethnographic datasets), so I employ these PCA proportion versions in the main analysis.

Table A1: Constituent terms of indices from folklore and ethnography

All folklore indices are derived from Michalopoulos and Xue's concept variables (2021), which tag motifs that contain words related to the concepts. Both concepts and related words are reported in the table. Ethnographic indices are constructed either from the paragraph-level tagging of OCM subjects (underlined) or from the keywords that appear in the text itself (*in italics*).

<i>Index</i>	<i>Folklore</i>				<i>Ethnography</i>	
	Concepts	Related words			<u>OCM Subjects/Keywords</u>	
Agriculture	• farmer • harvest • plow • rice • sow	• agricul- tural • agricul- ture • cereal • corn • crop • cultivate • farm • farmhand • fertilize	• furrow • grain • harvest • haymak- ing • maize • peasant • pig • plough • plow	• plough- man • plow- man • scatter • seed • sow • sprout • wheat	• <i>agricultural</i> • <i>agriculture</i> • <i>crops</i> • <i>cultivate</i> • <i>cultivating</i> • <i>cultivation</i> • <i>farm</i> • <i>farmer</i> • <i>farming</i> • <i>garden</i>	• <i>gardening</i> • <i>harvest</i> • <i>harvesting</i> • <i>horticul- tural</i> • <i>horticulture</i> • <i>planting</i> • <i>sow</i> • <i>sowing</i> • <i>sown</i>
Capitalism	N/A	N/A			• <i>capitalism</i> • <i>capitalist</i> • <i>corporation</i> • <i>employee</i>	• <i>employer</i> • <i>employment</i> • <i>profit</i> • <i>wage</i>

Ecocen- trism	• animal • buffalo • crow • fish • flower • forest • fox • grass • hill • insect • moon • ocean • plant • rabbit • rain • rat • reptile • river • season • sky • snow • soil • spider • star • sun • tree • turtle • wind • wolf	• arachne • animal • amphib- ian • beast • beetle • bird • bison • bloom • blossom • blizzard • brook • buffalo • bunny • buzzard • celestial • cliff • conifer- ous • crocodile • crow • cub • dam • deer • dirt • down- river • downhill • earth • elk • episode • era • finale • firma- ment • fish • flower • fox • grass • ground • hare • hawk • heaven • heavenly	• heliacal • heron • hill • horizon • hum- mock • insect • land • lion • lizard • lunar • magpie • mammal • mizar • moon • mos- quito • moun- tain • mouse • moth • ocean • oceanic • orbit • owl • pet • plant • precipi- tation • rabbit • rain • rainwa- ter • rainy • rat • raven • reptile • reptilian • ridge • river • rooster • season • sea • seawater • serpent	• shell • sky • snail • snake • snow • snowfall • soil • solar • sparrow • spider • spider- man • slope • spring • star • starman • stellar • stream • summer • sun • sunlight • sunny • sunrise • sunset • terrapin • thunder- storm • tortoise • tree • treelike • turtle • wasp • water- course • weather • web • were- wolf • wind • winter • wolf • year	Any of the following: • <u>animism</u> • <u>mythology</u> • <u>sacred objects and places</u> • <u>spirits and gods</u> together with any of the fol- lowing: • <u>ethnobotany</u> • <u>ethnogeography</u> • <u>ethnometeorology</u> • <u>ethnozoology</u>
Education	NA	NA			• <u>education</u>

<i>Index</i>	<i>Folklore</i>				<i>Ethnography</i>	
	Concepts	Related words			OCM Subjects/Keywords	
					◦ <u>education system</u> ◦ <u>educational theory and methods</u> ◦ <u>elementary education</u> ◦ <u>liberal arts education</u> ◦ <u>students</u> ◦ <u>teachers</u> ◦ <u>vocational education</u>	
Hunting / gathering	• fisherman • hunter	• chase • chaser • deer • fish	• fisher • fisherman • hunt • hunter	• scavenger • stalker	• <i>fish</i> • <i>fisher</i> • <i>fishing</i> • <i>forage</i> • <i>forager</i> • <i>foraging</i>	• <i>gatherer</i> • <i>hunt</i> • <i>hunter</i> • <i>hunter-gatherer</i> • <i>hunting</i>
Markets	• cheap • income • market • money • seller • trade	• barter • bazaar • buy • bargain • buyer • cheap • cheaply	• cost • ex-change • expensive • fund • income • market • merchant	• money • price • sale • sell • seller • swap • trader	• <i>bazaar</i> • <i>bought</i> • <i>buy</i> • <i>buyer</i> • <i>buying</i> • <i>coins</i> • <i>currency</i> • <i>exchange</i> • <i>exchanging</i> • <i>market</i> • <i>market-place</i>	• <i>merchant</i> • <i>money</i> • <i>price</i> • <i>sale</i> • <i>sell</i> • <i>seller</i> • <i>selling</i> • <i>sold</i> • <i>trade</i> • <i>trader</i> • <i>trading</i>

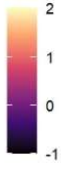
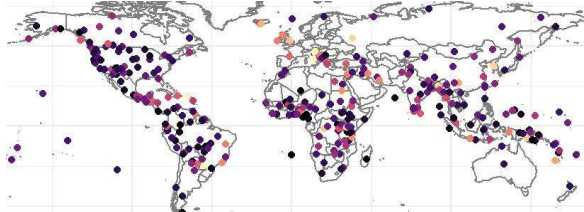
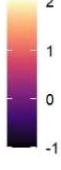
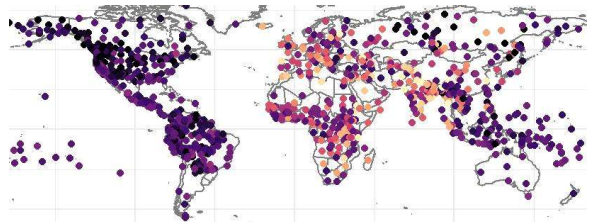
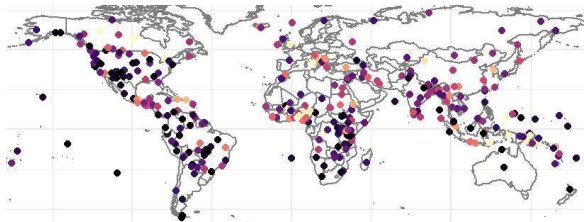
Moral content	• deceive • deserve • duty • evil • forbid • forgive • guilty • injustice • justify • offend • ought • proper • punish • respect • rule • shame • sin • virtue • wrong • wrongdoing	• accuse • admire • annoy • appropriate • appropriately • ashamed • astray • award • ban • burden • cajole • cannot • chastity • cheat • confuse • convict • convince • correct • corrected • correctly • corruption • culprit • deceit • deceitful • deceiver • deception • decent • dishonor • disgrace • disappoint • disturb • duty • dupe • earn • endanger • esteem • error • evil • excuse • explain • forbid	• forgive • fraud • get • gratitude • grief • guilty • guideline • harm • honesty • honor • hoodwink • humiliation • hurt • improper • impede • inappropriate • injustice • injure • insult • inequality • incorrectly • justification • justify • law • mercy • mistake • mistakenly • molest • must • necessary • need • negligence • obligation • offend • ought	• prohibit • prohibition • proper • properly • rationale • receive • regard • reign • repent • repentance • responsibility • respect • right • ruler • rule • scold • seduce • shame • shameful • sin • sinner • sinful • suitable • sympathy • task • threat • tormentor • torture • trick • unjust • unjustified • unworthy • violate • virtue • want • wife • worthy • wrong	• <u>ethics</u>
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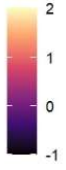
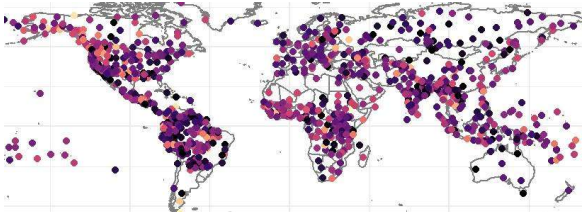
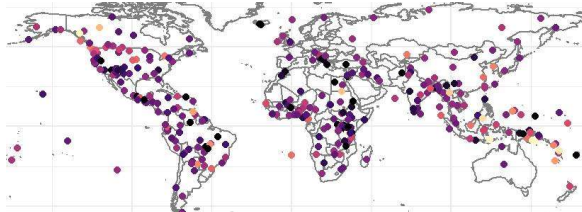
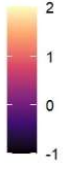
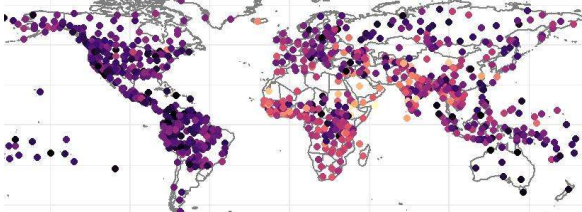
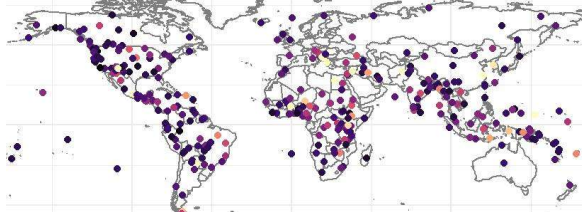
<i>Index</i>	<i>Folklore</i>				<i>Ethnography</i>	
	Concepts	Related words			OCM Subjects/Keywords	
			• patience • person • pity • precise • pretext • prevent	• wrongly		
Pastoralism	• graze • herd • mule • pastoral	• camel • cattle • cow • donkey • flock • foal • graze	• herd • herder • herds- man • hoof • horse • livestock • mule	• nibble • ox • pasture • saddle • sheep • shepherd • swine- herd	• <i>graze</i> • <i>grazing</i> • <i>herd</i> • <i>herder</i> • <i>herding</i> • <i>husbandry</i>	• <i>livestock</i> • <i>pastoral</i> • <i>pastoralism</i> • <i>pastoralist</i> • <i>pasture</i>

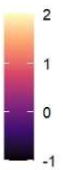
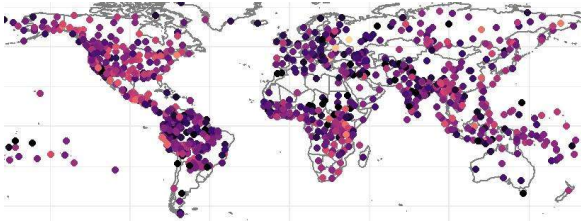
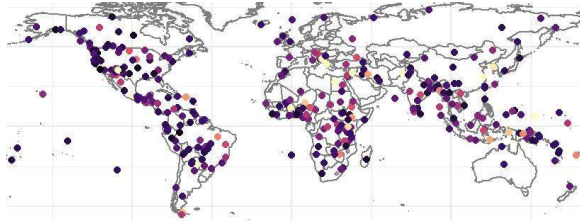
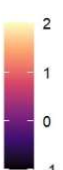
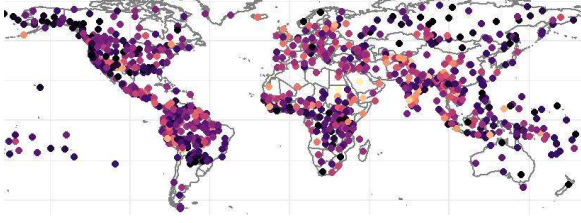
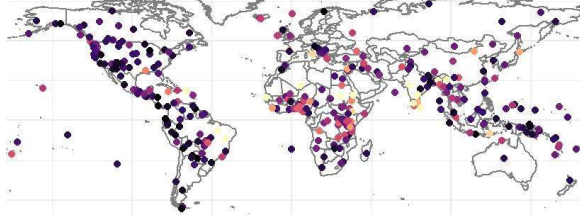
<i>Index</i>	<i>Folklore</i>				<i>Ethnography</i>
	Concepts	Related words			OCM Subjects/Keywords
Prosocial- ity	• caring • gener-osity • gift • given • help • sharing • sympa-thetic	• affection-ate • aid • assis-tance • benevo-lent • care • caregiver • compas-sionate • contrib-ute • donate • generos-ity	• generous • gener-ously • gift • give • giver • goodwill • grant • gratitude • help • helper	• helpful • lend • present • relief • rescue • share • support • sympa-thize • sympa-thy	The (standardized) preva- lence of • <u>gift giving</u> • <u>mutual aid</u> minus the (standardized) prevalence of • <u>in-group antagonisms</u>
Political state	• king-dom • politi-cal	• king • kingdom • kingship	• prince • princess • realm	• reign • ruler • political	• <u>government activities</u> ◦ <u>government enterprises</u> ◦ <u>government regulation</u> ◦ <u>miscellaneous government activities</u> ◦ <u>public education</u> ◦ <u>public finance</u> ◦ <u>public welfare</u> ◦ <u>public works</u> ◦ <u>research and development</u> ◦ <u>taxation and public in-come</u> • <u>citizenship</u> • <u>administrative agencies</u>
Stratifica- tion	• domi-nate • obedi-ence • rank • servant	• comply • conquer • control • disobedi-ence • dominate • domina-tion • hierarchy	• house-keeper • lord • maid • maidser-vant • obedient • over-taken • rank	• seniority • servant • slave • status • subser-vient • suprem-acy • tier	• <u>social stratification</u> ◦ <u>age stratification</u> ◦ <u>gender status</u> ◦ <u>ethnic stratification</u> ◦ <u>castes</u> ◦ <u>classes</u> ◦ <u>serfdom and peonage</u> ◦ <u>slavery</u>
Urbaniza- tion	• urban	• city			• <u>cities</u>

Table A2: Global variation and example text for main indices

For each text-based index used in my main analysis, I plot out the global variation of the residuals obtained by regressing the index on the baseline controls, and I present examples of folklore motifs and ethnography paragraphs from which the index was derived. I exclude non-Indigenous American groups from the ethnographic maps so that they are comparable with the folklore maps (Berezkin’s catalogue includes no non-Indigenous American groups). All folklore motifs come from Berezkin’s catalogue (2015), and all ethnography paragraphs were accessed through eHRAF World Cultures. These example passages were selected based on the number of index component terms tagged.

<i>Index</i>	<i>Folklore</i>	<i>Ethnography</i>
Capitalism 		 “Employment of wage labour is considered to be the main index of exploitative income: first, because it seems to be the most important and widespread source of expropriated labour among Nupe peasants; and second, because it is under the prevailing conditions the most direct and characteristic criterion of the rural capitalist development which is dawning at present in Nupeland.” (Kohnert, 1979)
Markets 	 m91b1: Leather sold “A man is going to sell a pet skin. On the way, he gets big money by deception or by chance. Usually, upon return, a person says that he received money for the skin, after which others slaughter their livestock and try unsuccessfully to sell the skins for money they are not worth.”	 “Almost every day some woman sets off with a basket or two of produce to sell in the markets of Bangkok. People buy a sewing machine to earn money by making clothing to order, or a portable gasoline motor that can be rented for cash up and down the canal.” (Hanks, 1972)

Index	Folklore	Ethnography
Prosociality 	 k128a: The best apples for the princess “The princess will marry the one who brings her the best apples (figs, fish, etc.) or who brings enough to prevent her from eating everything. Along the way, the two brothers don't share with the magic assistant, their gift to the princesses is rejected. The youngest is divided and (after additional tests) gets a princess.”	 “The son of another neighbor fixed this woman's lawn mower and helped her with yard work—again, jobs that the woman's daughter and son-in-law usually do. She tried to lure him close to slip a ten-dollar bill into his pocket, but he refused. Her initial plan for repayment was to send beer to the house, but she reasoned that only the young man's father would drink it. Instead, the woman had Hasegawa's General Store in Hana deliver a cake to the family as a Father's Day gift; this would be a present they could not refuse.” (Linnekin, 1985)
Morality 	 1106a: A cut belly “Antagonist makes formally justified, but essentially unfair demands on the hero. The hero performs them or is punished by an antagonist. The antagonist then takes an object or animal belonging to the hero, but cannot return it and is punished equally or more severely.”	 “In actuality, there is no rigid separation of esoteric and exoteric knowledge. Probably an intelligent layman among the Navahos picks up a good deal of esoteric knowledge during his lifetime. On the other hand, the fact that such knowledge is regarded as esoteric means that it is not cited in public moral discourses or in the teaching of children. The essential beliefs involved in ethical discourse are therefore entirely exoteric for the average Navaho. Ethics can be talked about freely.” (Ladd, 1957)

<i>Index</i>	<i>Folklore</i>	<i>Ethnography</i>
Ecocentrism 	 m65: The trickster was pinched and the meat was eaten “Trickster bakes meat obtained by trick, deception; immobilized by sticking to a tree, ground, or stone; at this time, another character (fox, wolf, coyote, birds) eats all the meat.”	 “Since for eons man has been advancing toward oneness with the universe, he identifies himself with all its parts. This world may be considered a functioning central world; others, left behind but remembered in myth, are underneath; there are others above. The number of worlds is hypothetical, there being little agreement about it; myth furnishes details of four underworlds, of the sky immediately above, and of one still higher, Land-beyond-the-sky.” (Reichard, 1950)
Stratification 	 k67b: A deal not to be angry “A character of low social status (who does not have supernatural abilities) undertakes to work for a character of high social status (with supernatural abilities) on the condition that the owner does not get angry with the employee. By repeatedly annoying the owner, the employee makes him angry and, as a result, be severely punished or pay a lot of money.”	 “In a sense the caste structure constituted the basis of traditional society. Tanjore District in particular has been known for the rigidity and complexity of its caste structure. In the village this structure not only divided the population into sections of unequal ritual status, but also dominated economic and political life. The fundamental importance of the caste structure to the social life of the village can be seen in its settlement pattern (chap. ii), which clearly segregates the three primary segments—Brahmins, Non-Brahmins, and Adi-Dravidas—from one another.” (Béteille, 1971)

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3. MARKETS AND PROSOCIALITY

A Theoretical Synthesis and Meta-Analysis

1. Introduction

The debate over the effects of markets on prosocial and moral behavior is long and contested (e.g., Bowles, 1998; Hirschman, 1982; Marx & Engels, 1906; Montesquieu, 1748). Do markets promote moral universalism, peace, and civility? Or do they foster self-interest, greed, social fragmentation? The evidence from experimental economics is mixed. Henrich and his coauthors, in their groundbreaking field experiments in 24 small-scale societies, find that prosocial and fairness-oriented behavior increase with market exposure (2010; 2004). In contrast, a number of studies show that market contexts diminish prosociality in the experimental setting (Bartling et al., 2015; Ellingsen et al., 2012; Falk & Szech, 2013; Hoffman et al., 1994; Kay et al., 2004; Liberman et al., 2004; Pillutla & Chen, 1999; Roth et al., 1991). I contend that a theory of dual cultural and contextual effects of markets can account for these apparently incongruous patterns.

In the 1998 paper, “Endogenous Preferences,” Bowles argues that markets shape preferences through cultural transmission and the evolution of norms, through intrinsic and extrinsic motivations, and through the learning and situation construal effects of economic tasks and environments. He characterizes “ideal” markets as anonymous and ephemeral and argues that these qualities undermine the evolution of “nice traits” (p. 94). I similarly argue that the typical attributes of market exchange exert evolutionary and contextual forces on prosociality. Specifically, anonymity, ephemerality, and competition select against prosociality, and mutualism selects against antagonism.

These effects are complicated by the evolution of large-scale societies, where prosociality in anonymous and ephemeral interactions may be key to collective survival and propagation (e.g.,

Boyd & Richerson, 2005; Harari, 2015; Henrich, Ensminger, et al., 2010). Group selection, then, is likely to stimulate the development of mechanisms that support anonymous prosociality. This does not imply though that large-scale societies are more prosocial. The prevalence of prosociality (or any behavior) in a society is the product of both preferences and environments, so societies with more anonymous environments and preferences that support prosociality in such environments may, from the bird's eye view, be more or less prosocial than less anonymous societies devoid of mechanisms supporting anonymous prosociality.

In this paper, I synthesize across the theoretical insights of evolutionary theory, game theory, and political economy. I then conduct a meta-analysis of the evidence from experimental economics.

A number of previous meta-studies and surveys of economic experiments have explored the effects of context and culture on prosociality (e.g., Balliet, 2010; Bradley et al., 2018; Cochard et al., 2021; Dal Bó & Fréchette, 2018; Engel, 2011; Jin et al., 2025; Oosterbeek et al., 2004; Sally, 1995; Spadaro, Graf, et al., 2022). These existing meta-studies provide several relevant observations: behavioral observability and subject identification have a weak positive affect on prosociality (Bradley et al., 2018; Engel, 2011); communication increases prosociality (Balliet, 2010; Jin et al., 2025; Sally, 1995); ephemerality tends to reduce prosociality (Dal Bó & Fréchette, 2018; Jin et al., 2025, study 2); national economic development is weakly negatively related to dictator giving (Cochard et al., 2021; Engel, 2011). The meta-analyses of Jin et al. (2025) and Spadaro et al (2022) are closest to the one I present here. They examine the effects of situational context and societal institutions, respectively, on prosociality in prisoner's dilemmas and public goods games among strangers. My method, however, is differentiated by the inclusion of dictator and ultimatum

games, the focus on within-study effects, and the measures of market-related contexts and market exposure.

I compile studies of prisoner's dilemmas, public goods games, dictator games, and ultimatum games that vary market-related contexts (anonymity, ephemerality, and explicit market or money framing) and cross-country studies that allow me to test for cultural effects of market exposure. I measure market exposure using the prevalence of wage labor and log GDP per capita. In my main analysis, I focus on within-study variance by including study fixed effects in the meta-regressions. I find large, significant negative effects of anonymity and ephemerality on prosociality and smaller, less consistent negative effects of explicit market frames on prosociality. I find no relationship between country-level market exposure and prosociality.

The structure of the rest of the paper is as follows: in section 2, I develop my theoretical framework; in section 3, I present my methods; in section 4, I report results; and in section 5, I interpret the results and suggest directions for future research.

2. Theoretical framework

Before I delve into a meta-analysis of the experimental evidence, it is important to lay out the possible channels through which various types of markets may shape the evolution and behavioral expression of prosociality. In this section, I review the theoretical literature on the evolutionary origins of prosociality, explore the various contextual attributes of markets and their potential behavioral consequences, discuss theories of the effect of markets on cultural evolution, and present experimental games as a tool for testing the hypothesized relationship between markets and prosociality. The theoretical framework developed here structures the empirical analysis and interpretation of results.

2.1 The evolution of prosociality

In this paper, prosociality refers to behavior that benefits others. The costs and consequences of prosocial behavior range widely from holding a door for a stranger or giving a complement to saving someone from a burning building or raising a child. Prosociality may be driven by intrinsic social preferences such as altruism, farseeing and socially strategic self-interest, or externally enforced social norms. Our capacity for prosociality has been instrumental to our success. We are a social species, and collective action problems (where the pursuit of the common good is individually costly) are endemic to our societies. Whether in the context of mammoth hunts, wars, or climate change, our individual and collective survival and spread has, throughout history, depended on effective cooperation. But how can this behavior evolve if, at the individual level, the benefits are separated from the costs?

Before delving into the evolutionary origins of prosociality, let us consider one of the fundamental features of human behavioral ecology: our dual inheritance of genes and culture (Boyd & Richerson, 2005; Henrich & Muthukrishna, 2021). Unlike most animals, much of our behavior is socially learned. Preferences and beliefs diffuse and transmit within and across generations, cohering along group lines due to conformism, forming what we refer to as culture. Culture accumulates and mutates and evolves, each trait persisting and spreading with differential success on an adaptive landscape shaped by our social, economic, built, and natural environments. Genes and culture co-evolve. Our genetic inheritance shapes the evolution of culture, and our cultural inheritance shapes the evolution of genes.

There are three evolutionary mechanisms that can produce prosociality: group selection, assortment, and discrimination. Each of these mechanisms can operate along the genetic or the

cultural dimensions of human behavioral ecology. The fundamental logic of group selection is simple: if the collective benefits of prosocial behavior exceed the individual costs, groups with more prosociality will be more successful than groups with less (Boyd & Richerson, 2005; Kropotkin, 1902). This differential success might manifest in differential persistence and/or differential spread and may or may not be at the expense of other groups. Group selection alone can explain prosociality if the selection at the group level, where prosociality yields a higher average payoff, is stronger than the selection at the individual level group-level selection, where self-interest yields a higher average payoff.

But prosociality can also evolve if the benefits of prosocial actions fall disproportionately on other prosocial actors—i.e. if the benefits of prosociality are sufficiently concentrated among prosocial individuals. This can occur via assortment if prosocial individuals are more likely to interact with other prosocial individuals (the second mechanism) or via discrimination if prosocial individuals can identify one another and limit their prosocial behavior to interactions with other prosocial individuals. These mechanisms can manifest in many forms, including empathy, where prosociality is contingent on social proximity (Garrison, 2026), direct reciprocity, where prosocial behavior is contingent on past interactions (Axelrod, 1984; Trivers, 1971), indirect reciprocity, where prosociality is contingent on reputation (Nowak & Sigmund, 2005), kin-based altruism, where prosociality is contingent on kinship (Hamilton, 1964), parochial altruism, where prosociality is reserved for the in-group (J.-K. Choi & Bowles, 2007), and social networks, which can produce assortment through social learning and endogenous group formation (McPherson et al., 2001; Rand et al., 2011, 2014).

These mechanisms help us postulate how markets might shape prosociality. Variation in prosociality may arise from both cultural differences (different learned preferences) and contextual

differences (different behavioral expressions of preferences). Individuals from different cultural backgrounds may behave differently in a given context, and any given individual may behave differently in different contexts. Markets—like any environment—may exert a selection force (on which preferences evolve) as well as a contextual force (on how those preferences are expressed as behavior). Thus, holding context constant, individuals from societies with different degrees of market exposure might exhibit different levels of prosociality; and holding culture constant, individuals from the same society might express different degrees of prosociality in different market-related contexts.

Crucially, the effects of markets on behavior and the difference between cultural and contextual effects depends on the degree of context-dependency of behavior. Consider the extreme cases. If behavior is perfectly context-dependent, then there would be no evolutionary spillover effects of, for example, supermarkets on behavior in farmer's markets or coffee shops. Each context-specific behavior would evolve based on the social, psychological, and economic characteristics of that context. In this case, cultural and contextual effects are identical. At the other extreme, if behavior is not context-dependent, then every situation exerts some small pressure on the evolution of a universal utility function, and behavior is thus a product of the “average” social, psychological, and economic attributes of society, weighted by the relative contribution of each societal situation to cultural and genetic fitness. In this case, there are only cultural effects. Actual human behavioral ecology lies somewhere in between these extremes, so markets must have distinguishable cultural and contextual effects.

2.2 Market contexts and market cultures

What exactly constitutes a market? The task of defining the term might seem trivial. Definitions of markets typically describe a place for or process of monetary transaction, commercial exchange, or buying and selling (Lane, 1991, pp. 10–11; “Market (Economics),” 2026; Merriam-Webster, n.d.; Polanyi, 1944, p. 56; The CORE Econ Team, 2024; Weber, 1921/1978, p. 634). Market interactions are often characterized in their “ideal” form as mutualistic (The CORE Econ Team, 2024), competitive (Hirschman, 1982; Lane, 1991; Weber, 1921/1978), impersonal (Bowles, 1998; Graeber, 2014; Hirschman, 1982; The CORE Econ Team, 2024; Weber, 1921/1978), and ephemeral (Bowles, 1998; Hirschman, 1982; Weber, 1921/1978). In reality, the ethnographic and historical record reveals considerable diversity in the form and societal niche of markets (Graeber, 2014). The historical specificity of capitalism, for example, rests on the novel role of markets, which, with proletarianization, transformed from an opportunity for exchanging surplus to an imperative of survival (Wood, 2002). Even within modern, capitalist settings, market interactions may be personal (e.g., farmer’s markets) or impersonal (e.g., grocery stores), ephemeral (e.g., online shopping) or durable (e.g., employment).

Different forms of markets distinguished by different economic incentives and reservation options, social-economic relationships, and social-psychological situations may shape the evolution and expression of prosociality in different ways. I consider here the potential effects of anonymity, ephemerality, competition, and mutualism as well as the broader effects on cultural evolution in complex society.

2.2.1 *Anonymity*

Market interactions are often characterized as impersonal or anonymous (Bowles, 1998; Graeber, 2014; Hirschman, 1982; The CORE Econ Team, 2024; Weber, 1921/1978). The precise meaning

of these attributes varies across sources; impersonality and anonymity between market interactors may refer to a lack of identification, a large social/cultural distance, or simply the irrelevance of social relationships. I will use these terms to refer to a lack of social relationships—i.e. an anonymous interaction takes place between strangers. While there are, of course, numerous examples of personal market interactions, market interactions might tend to be anonymous for several reasons. Large social, cultural, and geographical distances may correspond to large differences in ecological, physical, and human capital, such that the gains from trade between strangers are especially large. Additionally, if market exchanges are characterized by the use of money, the association might arise based on the especial advantages of money in socially disembedded contexts. Social obligation may be sufficient to facilitate exchange between familiars, but money may be necessary when the exchange takes place between strangers (Graeber, 2014).¹³

Several important forms of prosociality tend to diminish with anonymity. Kin-based altruism, empathy, and parochial altruism promote prosocial behavior contingent on genetic, social, psychological, and cultural proximity (J.-K. Choi & Bowles, 2007; Cialdini et al., 1997; Davis, 2015; Garrison, 2026; Hamilton, 1964; Preston & Waal, 2002). These strategies of conditional prosociality concentrate the benefits among family, friends, and the in-group, who, due to genetic and cultural transmission of traits, are likely also prosocial individuals. But, consequently, in interactions among strangers, they produce little to no prosociality.

2.2.2 *Ephemerality*

The ephemeral quality of market interactions derives from the nature of monetary transactions. In a market exchange, money is used to immediately settle debts. Compare this to gift exchange,

¹³ Graeber argues that taxation ensures a universal demand for coins, enabling them to function as a medium of exchange between strangers.

which, like market exchange, facilitates the transfer of material goods, but, unlike market exchange, is drawn out by social debt obligations. Durable economic interactions like gift exchange shape and are shaped by the social relationships they are embedded within; ephemeral economic interactions like market transactions preclude the development of such parallel relationships (Graeber, 2014; Kimmerer, 2024). Of course, not all market interactions are ephemeral, and in durable market interactions such as employment, social relationships often do form.

Repeated interactions allow for reciprocity to function. Reciprocity is prosociality conditioned on past behavior. Direct reciprocity occurs when the same partners interact repeatedly and condition their behavior on the history of the interaction (Bowles & Gintis, 2011; Trivers, 1971). Indirect reciprocity occurs when the interactors change but reputational information on their behavioral tendencies is available (Nowak & Sigmund, 2005). These forms of conditional prosociality succeed by concentrating the benefits of prosociality among prosocial actors. Ephemerality undermines reciprocity by limiting both the information on past behavior and the potential to reap future benefits from present prosocial action.

Although I analyze anonymity and ephemerality separately, they often covary in the real world. Accordingly, empathy and reciprocity often co-occur and influence each other. Both mechanisms of prosociality operate on the basis of social relationships, which exemplify the personal and the durable, and both are therefore undermined when the interaction is socially disembedded.

2.2.3 Competition

Competition arises among actors on the same side of the market. Buyers compete with buyers and sellers with sellers. Competition and reservation options drive bargaining power in markets. Those with better reservation options and fewer competitors claim a larger share of the surplus. Increasing

the number of competitors or heightening the stakes intensifies competition. Under capitalism, firms compete for customers and investors, and workers compete for jobs. The stakes here are high. Firms rely on customers and investors to survive. Workers rely on wages to survive.¹⁴

Since competition shapes bargaining power, market actors are incentivized to manipulate the competitive environment. Workers and capitalists may clash over unionization and collective bargaining and over free trade agreements that expand the reserve army of labor. Firms may engage in anti-competitive behavior in pursuit of monopoly rents while consumers support antitrust laws to maintain firm competition. In this way, each side of the market seeks to undermine its own competition while promoting competition on the opposite side. This makes for a sort of meta-competition—a competition over competitive environments. Since the difficulty of collective action rises with the size of the collective, the winner of the meta-competition may be the side with fewer actors. But let us return to the simpler case where the competitive environment is held constant.

In terms of evolutionary selection, increasing individual-level competition selects against prosociality. Even if there are potential gains from prosociality, the separation of such benefits from the cost-bearing actor means that (in the absence of the evolutionary mechanisms of assortment or discrimination) self-interested behaviors yield higher average payoffs. Competition may also describe an environment where there are no potential gains from prosociality. This can be represented as a zero-sum game where one player's gain is the other's loss. Similarly, in ecology, competition refers to a negative interspecific interaction where if one species is removed, the other species is better off. In these contexts, prosociality is maladaptive.

¹⁴ This is the market imperative that Wood describes as specific to capitalism (2002).

The tendency of competitive environments to erode morality, fairness, and prosociality in a “race to the bottom” is well-documented across disciplines. In economics, Shleifer shows how market competition can incentivize child labor, corruption, disproportionate executive salaries, corporate earnings manipulation, and university involvement in commercial activities (2004), and Fehr and Schmidt show how a competitive environment can interact with a heterogeneous pool of self-interested and fairness-oriented preferences to yield an equilibrium dominated by self-interested behavior (1999). In social psychology, the classic Robber’s Cave experiment observed that a competitive environment provoked antagonism among competing children while a cooperative environment promoted prosociality (Sherif et al., 1954/1961). In the literary classic, *The Grapes of Wrath*, Steinbeck illustrates how a competitive niche with stark reservation options can provoke self-interested behavior in his description of a tractor driver taking three dollars per day to knock down his neighbor’s house so he can feed his own kids (1939, Chapter 5). In sum, competition is, in many ways, antithetical to prosociality.

2.2.4 Mutualism¹⁵

Market interactions are voluntary (though engagement in the market as a whole may not be). The payoff of an interaction then must be at least as good as the interactors’ reservation options. Thus, market exchange implies the existence of surplus. In this sense, market interactions are inherently mutualistic. Using the ecological definition, mutualism means that if one actor is removed, the other is worse off. But mutualism, then, is the opposite of competition. So how can markets be both mutualistic and competitive? Mutualism in markets arises from the existence of a surplus, in the mutual gains of interacting parties; competition arises on each side of the market among actors

¹⁵ The framework presented here in terms of evolutionary game theory overlaps significantly with the insights and observations of social interdependence theory (e.g., D. W. Johnson & Johnson, 2005).

competing for the opportunity to exchange, and competition arises across opposite sides of the market over how the surplus, once created, is divided.

I distinguish here between mutualism—which might be modelled as an invisible hand game—and costly cooperation or collective action—which might be modelled as a prisoner’s dilemma. In the former, the dominant strategy for self-interested players is to cooperate, which also maximizes the surplus; in the latter, their dominant strategy is to defect though mutual cooperation maximizes the surplus. Individual and collective payoffs are aligned in the former but not the latter. Thus, in the case of mutualism, prosociality is unnecessary to maximize the surplus, so evolution is likely to select for self-interest. Smith points this out when he describes how the mutualistic environment of markets, self-interest promotes collective well-being as if “led by an invisible hand” (1776/1976, pp. 477–478). Similarly, Montesquieu argues that “the spirit of trade” is contrary to both “robbery” (antagonism) and moral norms of prosociality (1748, Chapter 2). The political philosophers agree with the evolutionary theory. Mutualism might select against antagonism, but there is not clear reason why it would select for prosociality.

2.2.5 Large-scale society, market exposure, and cultural evolution

For much of our evolutionary history, we lived in relatively small groups of fewer than a hundred members (Hill et al., 2011). These environments likely selected for prosocial behaviors such as empathy and reciprocity that could facilitate collective action among familiars. With the rise of large-scale societies, the role and importance of markets grew in tandem with specialization and division of labor (e.g., McNeill & McNeill, 2003; Smith, 1776/1976). Economic interaction spheres expanded beyond the bounds of personal social networks, increasing the frequency and consequence of anonymous, ephemeral interactions. In these new environments, the sorts of col-

lective action problems that all societies face—maintaining civil order, providing for public goods, coordinating production, managing common resources, cooperating in defense or conquest of territory—would have been difficult to resolve with the prosocial behaviors adapted to small-scale society. While some of these collective action problems could be restructured into mutualistic interactions through enforceable laws and contracts (“mutual coercion mutually agreed upon” (Hardin, 1968)), others would be less amenable to this solution.

Societies that managed to foster prosociality among strangers and solve these large-scale collective action problems were more likely to persist and spread. Examples of successful large-scale cooperation and anonymous prosociality can be found in the laboratory (e.g., cooperation in anonymous, one-shot prisoner’s dilemmas), in modern society (e.g., tax compliance), and throughout history (e.g., wartime military service). Scholars debate the relative theoretical and historical importance of various potential mechanisms such as shared myths and expansive group identities (Harari, 2015), all-seeing, moralizing gods (Henrich, Ensminger, et al., 2010), and the evolution of norms of altruistic punishment (Boyd & Richerson, 2005).

We might then expect to find that individuals enculturated in large-scale societies are more prosocial in anonymous settings than individuals enculturated in small-scale societies (Henrich, Ensminger, et al., 2010). Even if this is the case, though, it does not mean that prosociality in general is more prevalent in large-scale societies. Consider two hypothetical societies, one where all economic interactions and collective action problems are socially embedded and the other where all such interactions are impersonal and ephemeral. The social society does not need the anonymous prosociality traits that the asocial society does, so constituents of the former would likely act less prosocially in an anonymous setting than constituents of the latter. However, this does not imply that the general prevalence of prosociality in the asocial society exceeds that of the

social society. The function of the anonymous prosociality adaptation is to mitigate the damaging effects of impersonality and ephemerality on prosociality. So, even in the boundary case, where mitigation is complete, the prevalence of prosociality in the two societies would be equal. And if anonymous prosociality is less effective than personal prosociality, then the social society wins the prosociality prize.

Note that the relationship I hypothesize here between markets and anonymous prosociality is not causal. Rather, markets and anonymous prosociality are both important to the functioning of large-scale societies, so we might expect them to be associated—i.e. individuals from large-scale societies are exposed to more markets and have learned to act prosocially toward strangers. It is worth asking then whether there might be any direct causal effects of markets on the evolution of prosociality.

As discussed earlier, the mutualistic interactions of markets (the invisible hand) are likely to select against antagonism (*doux commerce*), but the competitive interactions of markets are likely to select against prosociality. The logical implication of these postulations is that markets as a whole select for self-interest. It is important to qualify that the argument here applies to self-interest in the context of the market. It does not necessarily imply a spillover into other domains of society. For example, members of a market-exposed society may behave strictly according to self-interest in the context of markets but highly prosocially in community interactions.

Additionally, this selection effect may be moderated by the predominant characteristics of the market. Market interactions in small-scale societies may be more personal, more durable, and less competitive on average than market interactions in large-scale societies. Consequently, markets in small-scale societies may even select for prosociality. In this way, the cultural and contextual effects of markets may depend on the scale of the society.

In conclusion, three important questions help us think about the cultural effects of markets on prosociality. 1. How context-dependent is prosociality? If it is highly context-dependent, we would expect less spillover of evolutionary effects across contexts—i.e. markets would influence only market behavior. If prosociality is not very context-dependent, we would expect prosocial behaviors in all settings to be impacted by cultural exposure to markets. 2. How important are markets in society? The importance of markets corresponds to the prevalence of market behavior in society (which matters more if prosociality is more context-dependent) and to the cultural strength of selection of markets relative to other societal situations (which matters more if prosociality is less context-dependent). 3. What are the predominant social, psychological, and economic characteristics of markets in society? In the high context-dependency scenario, the predominant market context directly shapes the evolution of market-specific behavior; in the low context-dependency scenario, the predominant market context determines the direction of the selection effect on prosociality.

2.3 Testing the theory: experimental games across contexts and cultures

Economic experiments provide a method for testing theories of human behavior. Experimenters can manipulate the interaction context and incentives and observe how real people respond to these changes. In particular, experimental games have been used to explore the nature of human prosociality and its prevalence and variance across individuals, cultures, and contexts. Economic experiments are well-suited to the question of contextual effects but not as well-suited for the question of cultural effects. Context can be easily manipulated in an experimental setting. Enculturation cannot. Still, variance in context-specific behavior across different subjects from different societal backgrounds provide clues.

In this paper, I apply the technique of meta-analysis to the experimental evidence from prisoner's dilemma games, public goods games, dictator games, and ultimatum games to test some of the hypotheses laid out in this section. Specifically, I analyze the effects of varying anonymity, ephemerality, and market framing on prosociality in the experimental setting. Explicit market frames may reveal context-specific cultural effects of markets since individuals enculturated in an environment with markets may behave differently in settings explicitly framed as market interactions. I also examine the relationship between societal market exposure and prosociality by analyzing the variance in behavior of individuals from different countries. I am unable to explore the effects of competition and mutualism or the interaction of cultural and contextual effects due to the dearth of relevant studies, but I review the sparse existing evidence and suggest future studies in the discussion section.

2.3.1 Game descriptions

The most common games employed in experiments to investigate prosocial behavior are the prisoner's dilemma, the public goods game, the dictator game, and the ultimatum game. I restrict my analysis to these four games. The prisoner's dilemma (PD) is a symmetric game with a binary action set (cooperate or defect) and a payoff structure that yields a singular inefficient Nash equilibrium (defect, defect). The public goods game (PGG) is similar to the prisoner's dilemma but with a continuous choice set.¹⁶ In the PGG, players receive an endowment which they must split between a public and a private fund. All contributions to the public fund expand in value but are divided among all PGG players such that the dominant strategy is to contribute nothing, but the

¹⁶ Others have distinguished between the PD and PGG based on the number of players (i.e. the PGG is an n-person PD), but I distinguish between them based on whether the action set is binary or continuous. This makes the measures of prosociality more commensurable within these games (percent cooperation for PD and percent of endowment contributed for the PGG).

efficient outcome is to contribute everything. Both the PD and the PGG are social dilemmas. The dictator game (DG) is an asymmetric game where one player (the dictator) is given an endowment which they may share with another (passive) player (the recipient). The ultimatum game (UG) is similar to the DG in that one player (the proposer) is given an endowment with the task of dividing it between them and a recipient (the responder) except in the UG, the responder chooses either to accept or reject the proposer's offer. If the responder accepts the offer, the players each receive their agreed-upon share of the endowment; if the responder rejects the offer, both players get nothing.

In all four of these games, the behavior of experimental subjects tends to deviate significantly from the predictions of traditional economic theory. The self-interested *homo economicus* always defects in the PD, contributes nothing in the PGG, gives nothing in the DG, and offers the smallest possible share in the UG (which the *homo economicus* responder accepts). Real human subjects, however, cooperate, contribute, give, offer, and reject in substantial numbers and to substantial degrees. This discrepancy between experimental behavior and theoretical predictions demonstrates that the behavior of *homo sapiens*—unlike that of *homo economicus*—is shaped by social preferences and fairness norms. The magnitude of the deviation from theoretical predictions based on self-interest corresponds to the magnitude of prosociality. While this deviation from *homo economicus* is near universal, economic experiments reveal considerable variation in prosocial behavior across contexts and cultures. The meta-analysis presented here interrogates this inter-contextual and inter-cultural variance for signs of a relationship between markets and prosociality.

3. Empirical method

To investigate the relationship between markets and prosociality, I compile a meta-dataset from the results of economic experiments that vary anonymity, ephemerality, or market framing in the experimental context or include subjects from multiple societies. I estimate the effects of market contexts and market exposure on prosociality using meta-regressions with study fixed effects. In this section, I describe the search process and inclusion criteria for identifying relevant studies, the measures of anonymity, ephemerality, market framing, and market exposure, and the meta-regression method.

3.1 Search process and inclusion criteria

I identify studies first by combing the meta-datasets of previous meta-analyses and literature surveys (Andreoni & Croson, 2008; Balliet, 2010; Bradley et al., 2018; Cochard et al., 2021; Dal Bó & Fréchette, 2018; Doñate-Buendía et al., 2022; Engel, 2011; Oosterbeek et al., 2004), the references of groundbreaking papers, and the Cooperation Databank (Spadaro, Tidli, et al., 2022), a repository of experimental studies. I then searched EconLit and Google Scholar for relevant keywords.¹⁷ I exclude studies of games played for hypothetical money¹⁸, games played against simulated opponents programmed by the experimenters, games with sanctioning or punishment, games where anonymity, ephemerality, or partners are chosen by the subjects, games where

¹⁷ For anonymity studies, I searched for (prisoner's dilemma OR public good OR dictator OR ultimatum) AND "game" AND ("social distance" OR identification OR communication OR non-anonymous); for ephemerality studies, (prisoner's dilemma OR public good OR dictator OR ultimatum) AND "game" AND (repetition OR ("one-shot" AND repeated) OR (stranger AND partner) OR "shadow of the future"); for market framing studies, (prisoner's dilemma OR public good OR dictator OR ultimatum) AND "game" AND (market frame OR money prime); and for cross-cultural studies, (prisoner's dilemma OR public good OR dictator OR ultimatum) AND "game" AND ("cross-cultural" OR "cross-country" OR "cross-societal").

¹⁸ In most of the studies I include, the game payoffs are converted directly into real currency. Sometimes, one round of the game is chosen randomly to determine the payment the subject receives. I also include several studies with children in which the material incentives are toys or candy rather than money.

dictator or public goods contributions are given to charities rather than to the subjects, and games where the dominant strategy of the stage game is not defection (for the PD) or contributing 0 (for the PGG and DG). Some of the PGG, DG, and UG studies I include constrain the players' choices to a discrete set, but I exclude all such studies which limit the choice set to three or fewer options. While the majority of papers included are published in peer-reviewed journals, I also include the results from a number of unpublished working papers. Table 1 summarizes the resulting meta-dataset. Table A3 in the Appendix lists all studies included. As usual, university students comprise a large portion of the subject pool although a number of the more recent studies have employed online polling platforms and panel providers to recruit a representative sample of the population (e.g., Dorrough & Glöckner, 2019; Fiedler et al., 2018). In general, the representativeness of the subject pool varies widely across the collected studies, and so does the experimental setting (online, lab, or field), but this between-study variance does not pose an issue since my analysis is within-study.

Table 1: Descriptive statistics of meta-data

Throughout this paper, an observation refers to one subject in one treatment condition in which the subject may make one or more game choices.

	Anonymity	Ephemerality	Market frame	Cross-country	Total
Studies	111	41	21	79	242
Treatments	412	148	81	356	993
Obs.	31642	12529	6899	42771	93561
Year					
min	1966	1966	1994	1988	1966
median	2010	2012	2013	2010	2010
max	2025	2025	2024	2026	2026

3.2 Measures of market contexts and market exposure

3.2.1 Anonymity

To measure the effects of anonymity on prosociality, I compiled studies that varied players' identification, social distance, or opportunity to communicate. Identification studies vary whether or not players' names and actions are shared with each other (e.g., Charness & Gneezy, 2008; Rege & Telle, 2004) or whether they can see each other's faces (e.g., Rankin, 2006). Social distance studies examine differences in prosocial behavior toward friends, acquaintances, and strangers (e.g., Brañas-Garza et al., 2010; Chandrasekhar et al., 2018; Goeree et al., 2010). Communication studies vary whether the players can communicate face to face or by exchanging messages (e.g., Frey & Bohnet, 1997; Greiner et al., 2014; Orbell et al., 1988; Roth, 1995). I code these treatments as anonymous or non-anonymous. In anonymous treatments, thus, players are strangers who do not know each other's names, cannot see each other's faces, and cannot communicate, and in non-anonymous treatments, players are family, friends, or acquaintances (social distance ≤ 2), their identities are revealed to each other, or they can communicate (one- or two-way). I did not include studies examining the degree of anonymity from the experimenter (e.g., Hoffman et al., 1996) or studies which simulated surveillance with eye spots (e.g., Haley & Fessler, 2005).

3.2.2 Ephemerality

To analyze the effects of ephemerality, I compiled studies that varied the repetition of game interactions. Repeated games can be “finite” with a fixed number of rounds or “infinite” where the interaction continues from round to round with a fixed probability. Theoretical predictions diverge for these two cases, but both represent important forms of repetition, so I include both in my meta-data. In the context of prisoner's dilemmas, the effect of repetition on cooperation (often referred

to as “the shadow of the future” (Axelrod, 1984)) has most often been tested by varying the continuation probability of infinitely repeated games (e.g., Bó, 2005). In the literature on public goods games, repetition effects have been most often tested in finitely repeated games where subjects are either matched with the same partner(s) throughout the game (partners matching) or with different partners each round (strangers matching) (e.g., Andreoni, 1988; Keser & van Winden, 2000). I searched for studies of dictator and ultimatum games with varied repetition and alternating roles but found none.¹⁹ The ephemerality variable employed in the meta-regressions is the reciprocal of the expected number of rounds played by a fixed pair or group of subjects. For games that continue stochastically, this is equal to the termination probability in any given round (i.e. $1 - \text{the continuation probability}$). The outcome variable for prosociality in each game is obtained by averaging actions across all rounds.

3.2.3 *Market framing*

To investigate the situation construal effects of markets, I compiled studies that tested for market framing and money priming effects. Studies of market framing effects vary the name of the game (e.g., calling the PD the “The Stock Market Game” or “The Community Game” (Lieberman et al., 2004)), the name of the actions (e.g., telling the UG proposer to “divide” or to “exchange” (Hoffman et al., 1994)), or the name of the roles (e.g., calling PGG players “buyers” or “members” (Cherry et al., 2013)). Studies of money priming effects prime the treated subjects with a money-related task prior to the game (e.g., Gasiorowska et al., 2016). For the meta-regressions, I employ

¹⁹ Alternating roles allows for reciprocity. There are a few studies of repeated dictator games with alternating roles, such as Ben-Ner et al. (2004) and Diekmann (2004), but Ben-Ner et al. conceal the repetition of the game from the first-round dictators, and Diekmann programs the behavior of the initial (simulated) dictator. Some studies also compare dictator games to trust games, but the comparison is imperfect since trust game transfers expand in value while dictator game gifts typically do not. Nonetheless, this comparison is considered in the discussion section. As for the ultimatum game, the only experiment I found with varied repetition was Sauermann (2019), but although the game is repeated, the roles of the players do not alternate.

a simple indicator variable for explicit market framing. Several relevant studies are excluded due to severely limited choice (Gasiorowska et al., 2012), nonstandard game structure (Vohs et al., 2006), or varied game structure (as opposed to just varied framing) (Roth et al., 1991). This broader literature on market framing will be examined in the discussion section.

3.2.4 *Societal market exposure*

To analyze the cultural effects of societal market exposure, I compiled studies that compared behavior of subjects from different countries. I then retrieved data on GDP per capita and the percentage of individuals working wage labor jobs for each country in each study for the year closest to the study's publication date. These variables serve as proxies for national market exposure.²⁰ The meta-data cover 78 different countries and 31 distinct years, resulting in 226 unique country-year pairs within the 356 treatments.

The field experiments Henrich and his coauthors conducted in 24 small-scale societies (2004; 2010) provide valuable data on non-WEIRD cultures (Henrich, Heine, et al., 2010). I include these data in my cross-country analysis, and I also report their results on the effects of market exposure alongside my own results (Table 3). Although their subject pools are relatively small, their measures of market exposure are more granular than the country-level proxies I employ. In their first wave of experiments (2004), they rank the societies according to the frequency of market exchange, and in the second wave (2010), they measure the percentage of food purchased in a market. In my summary of their results, I standardize these two measures then pool the data from

²⁰ These data come from the World Bank's databank of World Development Indicators. GDP per capita is in constant 2015 USD (Code NY.GDP.PCAP.KD). The wage worker values are calculated as Wage and salaried workers (% of total employment) (Code SL.EMP.WORK.ZS) $\times$ Employment to population ratio, 15+, total (%) (Code SL.EMP.TOTL.SP.ZS) $\times$ 100. I also retrieved the urban population (% of total population) (Code SP.URB.TOTL.IN.ZS), so I could, as a robustness check, analyze the effects of market exposure, controlling for urbanization.

both waves. Henrich and a number of others have also explored whether intra-societal variance in prosociality is associated with differences in individual and village market exposure (Gurven et al., 2008, 2015; Henrich et al., 2004; Lamba & Mace, 2011; Rustagi et al., 2010; Rustagi, 2024). These intra-societal effects are not included in my main analysis, which focuses on inter-societal effects, but I survey the findings of this literature in the discussion section.

While the market context variables represent experimental manipulations, the market exposure variables do not. Consequently, the market context effects can be interpreted as causal, but the market exposure effects can be interpreted only as associations.

3.3 Regression specification

I apply the technique of meta-regression to the meta-dataset of experimental studies to estimate the effects of markets on prosociality. Since between-study effects may be biased by idiosyncrasies of the experimental setting that are difficult to control for (such as the phrasing of game instructions, the method of subject recruitment, and experimenter social cues), I employ study fixed effects to isolate within-study effects (Bland, 2026). Equation 1 conveys the regression model:

$$y_{t,s} = \alpha + \beta \cdot m_{t,s} + FE_s + \varepsilon_{t,s} \quad (1)$$

For each treatment t and study s , $y_{t,s}$ is the measure of prosociality in percentage terms (mean cooperation rate in the PD, mean contribution in the PGG, mean gift in the DG, and mean offer in the UG), $m_{t,s}$ is the variable for market-related context (anonymity $\{0,1\}$, ephemerality $(0,1]$, or market frame $\{0,1\}$) or market exposure (log GDP per capita or percentage wage workers), FE_s is the study fixed effects, and $\varepsilon_{t,s}$ is the error term. β , the effect of markets on prosociality, represents the coefficient of interest. I estimate this model through weighted least squares, using the number

of observations (subjects) per treatment as the weight.²¹ For each market variable (anonymity, ephemerality, market frame, log GDP per capita, and wage labor), I estimate this model for the PD, the PGG, the DG, and the UG as well as for a pooled meta-dataset of all games. In the pooled all-game regressions, I add game fixed effects to the model to account for the handful of studies which include more than one game.

I conduct three robustness tests as well. First, I estimate the model without weights, using OLS. Second, I add a control for urbanization to the cross-country regressions and re-estimate the model. Third, I pool my meta-data with PD and PGG experiments from the Cooperation Databank that fulfill my inclusion criteria but do not contain within-study variance of market exposure, and I re-estimate the regression model without study fixed effects for this combined meta-dataset, controlling for game and publication year. Without study fixed effects, the coefficients represent the pooled within- and between-study effects. While the idiosyncrasies of the experimental setting remains a concern, the sample size increases substantially when I include single country studies from the Cooperation Databank.

4. Results

In this section, I present the meta-regression results. Overall, I find strong, negative effects of anonymity and ephemerality on prosocial behavior in the experimental setting and weaker evidence for a negative effect of market framing. The effects of market-related contexts are largest for the prisoner's dilemma. I find little evidence of a relationship between market exposure and prosociality at the country level. For comparison, I also present the results of Henrich and his coauthors (2004; 2010) on the positive relationship between markets and prosociality across small-

²¹ As a robustness check, I also estimate the model with ordinary least squares. The estimates of these unweighted regressions are reported in Table A1 of the appendix.

scale societies. All coefficient estimates (besides those from Henrich et al.'s results) are within-study effects.

Table 2 reports the estimates of the effects of market-related contexts. Anonymity between players (no identification, familiarity, or communication) decreases prosociality by 17 percentage points on average compared to non-anonymity (identification, familiarity, or communication) ($p < 0.01$). This effect is aggregated from a 27 percentage point difference in the PD cooperation rate, a 21 percentage point difference in PGG contributions, a 12 percentage point difference in dictator game gifts, and a 3 percentage point difference in UG offers. Each of these game-specific effects is significant at 1% level. The ephemerality regression results show that prosociality decreases by 21 percentage points on average when the game is one-shot compared to when the game is infinitely repeated ($p < 0.01$).²² This effect is 28 percentage points for the PD ($p < 0.01$) and 14 for the PGG ($p < 0.01$). As discussed in the empirical method section, there are no DG or UG observations on the effects of ephemerality. As for the situation construal effects of markets, cooperation rates in the PD decline by 11 percentage points on average when the game is framed in market-related terms ($p < 0.01$), but this effect does not appear in PGG or DG experiments, and although the effect does seem to be present in the two UG studies I found, the small sample size undermines the statistical significance of the meta-regression coefficient estimate. Across all games, explicit market frames are associated with a 3 percentage point decrease in prosociality ($p = 0.03$).

Table 3 reports the estimates of the effects of societal market exposure. As noted in the method section, while the market context effects can be interpreted as causal, the market exposure effects cannot since market exposure is not an experimental manipulation, and “all else” is not

²² Obviously, there are no observations of infinitely repeated games, but this interpretation of the ephemerality coefficient is based on the limit as the termination probability approaches 0 (i.e. as the continuation probability approaches 1).

held constant. The GDP per capita and wage labor regressions show no association between market exposure and prosociality at the country level. For each game and across all games, the coefficient estimates for log GDP per capita are highly insignificant. Wage labor is slightly positively correlated with PGG contributions ($p = 0.04$) but slightly negatively correlated with DG gifts ($p = 0.04$). Pooling across all four games, wage labor has no effect on prosociality. In contrast with these cross-country null results, the results from Henrich et al.'s cross-cultural experiments show a significant positive relationship between market exposure and prosociality among the small-scale societies studied. A standard deviation increase in market exposure is associated, on average, with a 4 percentage point increase in prosociality in these data ($p < 0.01$).

The results from the OLS estimations are reported in Table A1 of the Appendix. The coefficients from these unweighted estimations do not change much in terms of magnitude or (in)significance except in the case of market framing effects, which are larger in magnitude and more significant. Controlling for urbanization does not alter the results on the effects of market exposure much for the within-study analyses (Table A2). However, the pooled within- and between-study effects for the combined meta-data provide some evidence of a positive relationship between market exposure and prosociality when urbanization is controlled for (Table A2).

Table 2: The effects of market-related contexts on prosociality

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. β represents the within-study effects of market-related contexts on prosocial behavior in the experiment (standard errors in parentheses). The regression model with study fixed effects is estimated via weighted least squares (weighting by the number of observations per treatment). Each observation corresponds to one subject in one treatment condition (which may include one or more game choices). The all-game regressions include game fixed effects. The anonymity variable $\{0,1\}$ indicates whether or not the interaction occurs anonymously, among strangers, and without communication. The ephemerality variable $(0,1]$ is calculated as the reciprocal of the expected number of game rounds. For treatments where continuation is random, this is equivalent to $1 - \text{the continuation probability}$. The market frame variable $\{0,1\}$ indicates whether or not the game has an explicit market framing.

		Prosociality				
		PD	PGG	DG	UG	All
Anonymity	β	-27.14*** (3.57)	-21.09*** (2.10)	-11.97*** (1.92)	-3.13*** (0.90)	-17.28*** (1.32)
	Studies	28	47	30	8	111
	Treatments	92	183	105	32	412
	Obs.	6439	8574	14517	2112	31642
Ephemerality	β	-28.01*** (5.35)	-13.86*** (2.80)	NA	NA	-20.93*** (3.28)
	Studies	17	24	0	0	41
	Treatments	84	64			148
	Obs.	8379	4150			12529
Market frame	β	-10.60*** (2.66)	0.05 (2.23)	-0.89 (3.05)	-10.60 (5.30)	-3.37** (1.56)
	Studies	6	9	5	2	21
	Treatments	26	31	20	4	81
	Obs.	1820	3295	1712	72	6899

Table 3: The effects of societal market exposure on prosociality

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. β represents the within-study effects of market-related contexts on prosocial behavior in the experiment (standard errors in parentheses). The regression model with study fixed effects is estimated via weighted least squares (weighting by the number of observations per treatment). Each observation corresponds to one subject in one treatment condition (which may include one or more game choices). The all-game regressions include game fixed effects. GDP per capita values (2015 USD) and wage labor values (wage and salaried workers, % of population 15+) are obtained from the World Bank for each country in each study for the year closest to the study's publication. The small-scale society market exposure data comes from Henrich et al. (2004 and 2010). For these regressions, I use standardized versions of Henrich et al.'s market exposure variables, and I do not include study fixed effects.

		Prosociality				
		PD	PGG	DG	UG	All
log GDP per capita	β	-0.31 (3.82)	0.21 (0.62)	-0.64 (0.69)	-0.19 (0.75)	-0.14 (0.44)
	Studies	12	42	19	13	79
	Treatments	30	190	80	57	356
	Obs.	6406	18518	15643	2235	42771
Wage labor	β	0.54 (0.33)	0.11** (0.06)	-0.13** (0.06)	0.01 (0.07)	0.04 (0.04)
	Studies	12	42	19	13	79
	Treatments	30	190	80	57	356
	Obs.	6406	18518	15643	2235	42771
Market exposure in small-scale societies (Henrich et al., 2004; 2010)	β	NA	2.71 (6.56)	4.58*** (1.32)	3.68** (1.43)	3.66*** (1.17)
	Studies	0	1	2	2	2
	Treatments		7	17	30	53
	Obs.		331	513	988	1801

5. Discussion

The results of the meta-regressions reveal strong negative effects of anonymity and ephemerality, weak negative effects of market framing, and no effects of GDP per capita or wage labor on prosociality in the experimental setting. With the inclusion of study fixed effects, the effects of market-related context can be interpreted as causal, since all else is held constant. In this section, I interpret these results, discuss relevant studies that I excluded from the meta-dataset, propose areas for future research, and consider the implications of the findings.

5.1 Market contexts

The strong negative effect of anonymity suggests that empathy (prosociality contingent on social proximity) is an important driver of prosociality. These results come from the most common manipulations of anonymity—identification, communication, and social network distance—using the most common games—the PD, PGG, DG, and UG—and real incentives. Findings from studies of group identification (Baldassarri & Grossman, 2013; Habyarimana et al., 2007), studies of other types of games (Andreoni et al., 2017; Charness et al., 2007; G. S. Choi & Storr, 2020; de Oliveira et al., 2014; Glaeser et al., 2000; Ostrom et al., 1992), and studies of hypothetical games (B. A. Jones, 2022; B. A. Jones & Rachlin, 2009; B. Jones & Rachlin, 2006; Kardos et al., 2024; Locey et al., 2011, 2013; Osiński, 2009; Rachlin & Jones, 2008; Vekaria et al., 2017) reinforce the conclusion that prosociality decreases with increased social distance.

The ephemerality results from PD and PGG experiments indicate the importance of reciprocity in explaining prosocial behavior. Parallel evidence can be found in studies that ask subjects to record how much they would contribute in a PGG for different levels of contribution from the rest of the group (Fischbacher et al., 2001; Thöni & Volk, 2018). These studies find that a large

proportion of subjects—around 60% (Thöni & Volk, 2018)—can be described as “conditional cooperators” who condition their contributions on the contribution of their partners. Similarly, reciprocity strategies like tit-for-tat and grim reaper are common in infinitely repeated PD experiments, and the proportion of subjects playing these strategies increases with the gains to cooperation and the continuation probability (Dal Bó & Fréchette, 2019). I found no studies of dictator games or ultimatum games that manipulated repetition while alternating the roles (such that reciprocity could function). Some games compare dictator game gifts to trust game transfers. This is not a perfect comparison because, in most dictator games, the value of the gift does not expand as the transfer does in the trust game. Still, the striking difference between the average dictator gift—just under 30% (Doñate-Buendía et al., 2022; Engel, 2011)—and the average trust game transfer—50% (N. D. Johnson & Mislin, 2011)—hints at the importance of reciprocity. Additionally, a few studies comparing trust game behavior to dictator game behavior do expand the gift value for comparability, and the average transfer remains significantly larger than the average gift (Ambec et al., 2019; Ashraf et al., 2006; Cox, 2004).

A negative effect of market framing is apparent in the PD and UG experiments I found. The effect disappears though for the PGG and the DG. These null results are attributable to a couple of large studies that found no effect (Cartwright & Drouvelis, 2024; Columbus et al., 2020) and one large study that found a positive effect (Dufwenberg et al., 2022). A number of other studies with different game structures (Bartling et al., 2015; Gasiorowska et al., 2012; Vohs, 2015; Vohs et al., 2006) find that market frames or money primes decrease prosociality. Several studies explore the effects of bilateral market or auction contexts on individuals’ willingness to accept payment to forego prosocial behavior. The most prominent of these is Falk and Szech’s “Morals and Markets,” in which subjects are made to choose between a monetary payment and the life of a mouse (2013).

They find that more people sacrifice mice for money in bilateral and multilateral market environments than in a non-market environment. However, surplus size, competition, and repetition vary across their treatments in addition to the market framing, muddling the causal interpretation. A number of similar experiments have tested individuals' willingness to accept payment to forego other prosocial acts (such as donating to a charity or avoiding a negative externality), some of which found a negative effect of market contexts (Bartling et al., 2015; Irlenbusch & Saxler, 2019; Kirchler et al., 2016; Ziegler et al., 2024) and some of which did not (Bartling et al., 2023). Overall, the effects of explicit market framing—though far from ubiquitous—tend to be negative. This evidence of a context-specific cultural effect of markets aligns with the theoretical prediction that the market environment selects for self-interest.

The experimental literature on the effects of competition is too sparse to include in the meta-analysis, but the available evidence suggests that individual-level competition tends to promote self-interest. In the UG, competition among proposers or responders heavily skews the resulting distribution of the endowment against the competitors, shifting behavior toward the equilibrium predicted of self-interested players (Fehr & Schmidt, 1999; Fischbacher et al., 2009; Roth et al., 1991). In a DG experiment where dictators with larger than average payoffs were rewarded with an additional round, the average gift decreased, revealing how competition for survival depresses prosociality (Schotter et al., 1996).²³ In an experiment where subjects could pay a point to reduce another's payoff by four points, a monetary prize for the highest earners in a group induced increased expenditure on “burning” their partners—i.e. competition prompted antagonism (Barker & Barclay, 2016). On the other hand, intergroup competition in PGG earnings tends to increase contribution (e.g., Rapoport & Bornstein, 1987; Tan & Bolle, 2007), as the evolutionary theory

²³ Schotter et al. also observe a small effect in an ultimatum game, but only the proposers faced the competitive selection pressure.

predicts. Even when no monetary incentives are attached, public rankings of the highest earners or the most altruistic (Duffy & Kornienko, 2010) can drastically affect prosocial behavior. Competition and market framing do not, however, necessarily erode away all prosociality (e.g., Bartling et al., 2015).

Experimental evidence on the effects of mutualism is also scant. A couple of studies find that positive market interactions are associated with increased prosociality in subsequent games (G. S. Choi & Storr, 2020; Dufwenberg et al., 2022). Also, subjects who play a cooperative video game together are less antagonistic (Jerabeck & Ferguson, 2013; Velez et al., 2016) and sometimes more prosocial (Waddell & Peng, 2014) in subsequent experiments than those who play competitive or separate video games. These scattered findings do not allow for us to weigh in on the effects of mutualism with much confidence, but they do present some evidence of a negative effect on antagonism (in line with theoretical predictions) and a positive effect on prosociality (contrary to theoretical predictions). Notably, all these effects are observed in the context of repeated interactions.

5.2 Market cultures

Across my main analyses and robustness checks, only one of six regression specifications show any effect of GDP per capita and the prevalence of wage labor on prosociality (Table A2).²⁴ At the country level, modern degree of market exposure appears unrelated to prosociality. This contrasts strongly with Henrich et al.'s findings that markets are strongly positively associated with proso-

²⁴ The only specification where the null is rejected is the pooled regression of within- and between-study effects using a larger meta-dataset including studies from the Cooperation Databank where I control for urbanization (but not for the interaction of market exposure and urbanization).

ciality in small-scale societies (2004; 2010).²⁵ There are several potential explanations of the null result.

Most obviously, it could indicate that markets have no cultural effects on prosociality in the experimental setting. If behavior is highly context-dependent, market exposure will only affect the evolution of market behavior; in this case, the null result could indicate that subjects recognize the experimental game as a non-market environment. Alternatively, the null result could be attributable to heterogeneous effects pushing in different directions. The results of the alternative regression specifications in Table A2 provide some limited evidence of this. When study fixed effects are omitted and urbanization is included, prosociality increases (decreases) with market exposure (urbanization). So, perhaps the anonymity of modern society pushes prosociality down, but the mutualism of markets pushes it up (contrary to the theoretical prediction). These effects are not present though in regressions of within-study effects.

Another potentially important source of heterogeneity is the social, psychological, and economic attributes of the markets that different subjects in different countries are exposed to. If the market interactions of villagers in Henrich et al.'s experiments (2004; 2010) tend to be personal and durable than the market interactions of urbanites in WEIRD countries, then these different types of markets may exert different pressures on social preferences. Subjects from different countries may also associate the game with different real-life situations (e.g. food sharing, resource management, markets), leading to noisier results. For instance, villagers who rarely use money might be especially prone to associate games that have monetary payoffs with markets whereas the sociality of the game environment may be a more salient cue for urbanites who are habituated

²⁵ This discrepancy is at least partly explained by the different measures of market exposure. When I constrain my cross-country regression to Henrich et al.'s data, the positive effects of markets vanish.

to the use of money. Each of these possible confounding factors could be tested using games that vary both context and culture, as I discuss the following subsection.

Aside from these potential sources of heterogeneity, the null results could also be a product of the level of analysis. Evolutionary selection of cultural traits can occur at the individual level, the communal level, the cultural level, or the national level. Thus, individual, communal, cultural, and national market exposure may all produce different cultural or behavioral effects. In fact, Henrich and his coauthors find that within cultures, between-community and between-individual variance in prosociality is not explained by variance in market exposure (2004, p. 35-37). Several other studies also find no evidence of intra-cultural, inter-communal effects of market exposure (Gurven et al., 2008, 2015; Lamba & Mace, 2011). One study of intra-cultural, inter-communal effects in Greenland found that market integration is associated with less prosociality toward in-group members and more prosociality toward out-group members (Agneman & Chevrot-Bianco, 2023). Another inter-communal study of commons management in Ethiopia outcomes found a positive effect of market exposure (Rustagi et al., 2010). Evidence of intra-communal, inter-individual effects is also mixed, with some studies finding a positive relationship (Bauchet et al., 2020; Rustagi, 2024) and others finding no relationship (Gurven et al., 2015). Rustagi shows that the positive relationship he finds between individual market exposure and prosociality hinges on contract incompleteness in the market setting—if contracts are complete, prosociality is unnecessary for the functioning of the market, and the association disappears (2024).

Overall, the inconsistent experimental findings preclude any general claims of universal effects of market exposure on prosociality and suggest that the cultural effects of markets may depend on the form and role of markets in society.

5.3 Future research

The meta-analysis and theoretical synthesis presented here illuminate several important gaps in the experimental literature. Future experimental research in these areas could significantly advance our understanding the cultural and contextual effects of markets on prosociality.

Repeated DG and UG experiments with alternating roles and varied could vary the number of rounds or probability of continuation to explore the dynamics of reciprocity and the evolution of fairness norms in these settings. More experiments that vary the competitive or mutualistic environment in which subjects play games with distinctively prosocial, antagonistic, or self-interested behavior could help flesh out the effects of competition and mutualism on social preferences. Subjects could compete individually or collectively for the opportunity to continue playing (like Schotter et al. (1996)), or they could compete for an additional prize for the top individual or the top group. Or the entire session's probability of continuation could be determined by their collective payoff. In these varied environments, perhaps subjects could play a modified PGG where endowments could be held, contributed to the classic public good, or spent lowering the payoffs of everyone else. Public good contribution would indicate prosociality, non-contribution would indicate self-interest, and expenditure to reduce others' payoffs would indicate antagonism.

Experiments that explored interaction effects between context and culture could be particularly enlightening. This would simply require implementing varied context treatments in subject pools from diverse cultural backgrounds. Such studies could answer a number of important questions. Do individuals from larger, more anonymous societies act more prosocial in anonymous and ephemeral interactions than individuals from smaller-scale societies (as the theory of the evolution of anonymous prosociality would suggest)? What about in personal and durable interactions? Do people who are more exposed to markets react differently to explicit market frames than those who

are less exposed to markets? Does the explicit market frame have the same effect on prosociality in societies where market interactions tend to be anonymous and ephemeral compared to societies where market interactions tend to be personal and durable? How much does context matter compared to culture? Are there certain contexts in which cross-cultural behavior converges and others where it diverges? Experiments aimed at these kinds of questions could be deeply insightful not just with respect to the effects of markets on prosociality but for human behavioral ecology in general.

5.4 Implications

Some might question the importance of the relationship between markets and prosociality since, as Smith points out (1776/1976, pp. 477–478), ideal markets do not need prosociality to promote collective material well-being. Here are four reasons why the effects of markets on prosociality matter: First, in the case of incomplete contracts, efficiency may depend on prosociality among contracting parties. Second, markets with externalities generate deadweight loss if actors are purely self-interested. Third, if markets do affect prosocial behavior, the effects may spill over into domains beyond the market where prosociality is important. Fourth, even if all such problems were solved by aligning incentives, such a society—the perfect invisible hand society of atomized individual utility maximizers—may generate less well-being than a society teeming with prosociality (holding surplus and distribution constant) due to the well-being gains associated with social relationships (Diener & Seligman, 2002; Lyubomirsky et al., 2005) and the warm glow of giving (An-

dreoni, 1990). In other words, sociality and prosociality (which, due to the nature of empathy and reciprocity, often go hand in hand) may²⁶ be desirable even apart from any material gains.

Understanding the relationship between markets and prosociality allows us to more intentionally shape the institutions, structures, and environments of our societies to promote individual and collective well-being. Insights into the behavioral ecology of prosociality illuminate more potential solutions to collective action problems. The conclusion of this essay is not that anonymous, ephemeral, and competitive interactions are inherently undesirable but rather that the potential behavioral consequences of these contextual characteristics should be taken into account when designing economic institutions.

²⁶ There is a dark side of prosociality that should not be neglected. Systems of oppression and stratification rely on prosociality among the privileged to generate, stabilize, and exacerbate asymmetries of power and privilege. This manifestation of parochial altruism is clearly undesirable.

Appendix

Table A1: Unweighted meta-regression results

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Coefficient estimates represent the within-study effects of market-related contexts and market exposure on prosocial behavior in the experiment, estimated via ordinary least squares with study fixed effects.

	Prosociality				
	PD	PGG	DG	UG	All
Anonymity	-26.30*** (3.72)	-22.89*** (2.65)	-8.68*** (1.56)	-5.31*** (1.15)	-18.59*** (1.55)
Ephemerality	-30.83*** (7.14)	-12.76*** (2.88)	<i>NA</i>	<i>NA</i>	-18.77*** (3.63)
Market frame	-13.99*** (5.44)	-1.80 (3.23)	-4.83 (3.38)	-12.48 (5.63)	-7.12*** (2.42)
log GDP per capita	-4.62 (3.5)	0.16 (0.74)	-0.84 (0.69)	0.35 (0.83)	-0.27 (0.47)
Wage labor	-0.09 (0.43)	0.14** (0.07)	-0.12* (0.06)	0.03 (0.08)	0.04 (0.04)

Table A2: Cross-country market-exposure results for additional specifications

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Coefficient estimates in the first three columns represent the within-study effects. Coefficient estimates in the last three columns represent pooled within- and between-study effects. All regressions are estimated via weighted least squares. The additional studies included in columns 4, 5, and 6 are all PD and PGG experiments from the Cooperation Databank (Spadaro, Tiddi, et al., 2022). GDP per capita (2015 USD), wage labor (wage and salaried workers, % of population 15+), and urbanization (% of population) values are obtained from the World Bank for each country in each study for the year closest to the study's publication.

	Prosociality					
log GDP per capita	-0.14 (0.44)	-0.42 (0.62)	1.07 (1.66)	0.55 (0.47)	2.87*** (0.77)	0.42 (2.08)
Urbanization		0.03 (0.04)	0.20 (0.19)		-0.22*** (0.06)	-0.51** (0.24)
UrbanXlog(GDPp c)			-0.02 (0.02)			0.04 (0.03)
Wage labor	0.04 (0.04)	0.09 (0.06)	0.30** (0.14)	0.07 (0.04)	0.31*** (0.07)	0.21 (0.19)
Urbanization		-0.06 (0.04)	0.04 (0.07)		-0.24*** (0.06)	-0.28*** (0.09)
UrbanXwage			-0.00 (0.00)			0.00 (0.00)
Studies	79	79	79	556	556	556
Treatments	356	356	356	851	851	851
Observations	42771	42771	42771	120228	120228	120228
Study FE	yes	yes	yes	no	no	no
Year FE	no	no	no	yes	yes	yes
Game FE	yes	yes	yes	yes	yes	yes

Table A3: Studies included in the meta-analysis

Anon (anonymity), Eph (ephemerality), Frame (market frame), and Expos (market exposure) indicate which market-related variables of interest the study is used to analyze, and PD, PGG, DG, and UG indicate which games are played in the study. For the titles of each paper, see the full table in the supplementary online materials.

Authors	Year	Anon	Eph	Frame	Expos	PD	PGG	DG	UG
Abatayo, Lynham, & Sherstyuk	2018	X					X		
Adres, Vashdi, & Zalmanovitch	2016				X		X		
Anderson, DiTraglia, & Gerlach	2011				X		X		
Anderson, Rodgers, & Rodriguez	2000				X			X	
Andreoni	1988		X				X		
Andreoni & Miller	1993		X			X			
Andreoni & Petrie	2004	X					X		
Arceo Gomez, Campos Vazquez, Medina Cortina, & Velez Grajales	2018	X							X
Arechar, Dreber, Fudenberg, & Rand	2017	X				X			
Arechar, Kouchaki, & Rand	2018		X			X			
Ashraf, Bohnet, & Piankov	2006				X			X	
Barreda-Tarrazona, Jaramillo-Gutiérrez, Pavan, & Sabater-Grande	2017		X			X			
Batson & Moran	1999			X		X			
Battiston & Gamba	2020	X					X		
Bayer	2016		X				X		
Bazart, Lefebvre, & Rosaz	2022	X					X		
Bernold, Gsottbauer, Ackermann, & Murphy	2014			X			X		
Bezu & Stein	2013	X						X	
Binzel & Fehr	2013	X						X	
Blackwell & McKee	2011				X		X		

Authors	Year	Anon	Eph	Frame	Expos	PD	PGG	DG	UG
Blanco, Haller, Lopez, & Walker	2016				X		X		
Bland, Bochet, Nikiforakis, & Zhang	2023		X			X			
Blonski, Ockenfels, & Spagnolo	2011		X			X			
Boarini, Laslier, & Robin	2009				X				X
Bochet & Putterman	2009	X					X		
Bochet, Page, & Putterman	2006	X					X		
Bohnet & Frey	1999	X						X	
Bohnet & Frey	1995	X						X	
Boone & Macy	1999		X			X			
Bosch-Domènech, Nagel, & Sánchez-Andrés	2010	X						X	
Bose & Sgroi	2019	X					X		
Botelho, Hirsch, & Rutstrom	2000				X				X
Bouas & Komorita	1996	X				X			
Bouwmeester, Verkoeijen, Aczel, Barbosa, et al.	2012				X		X		
Brañas-Garza, Cobo-Reyes, Espinosa, Jiménez, et al.	2010	X						X	
Brandts & Schwieren	2009			X			X		
Brandts, Rott, & Sola	2015	X					X		
Brandts, Saijo, & Schram	2004		X		X		X		
Braver & Wilson	1986	X				X			
Brick, Visser, & Van der Hoven	2015	X					X		
Brosig, Ockenfels & Weimann	2003	X					X		
Buchan, Grimalda, Wilson, Brewer, et al.	2009				X		X		
Buchanan, McMahon, Simpson, & Wilson	2017	X						X	

Authors	Year	Anon	Eph	Frame	Expos	PD	PGG	DG	UG
Buhrmester, Goldfarb, & Cantrell	1992	X						X	
Burlando & Hey	1997		X		X		X		
Burnham	2003	X						X	
Camera, Casari, & Bigoni	2010	X				X			
Candelo, Eckel, & Johnson	2018	X						X	
Cappelen, Moene, Sørensen, & Tungodden	2013				X			X	
Cardenas	2011	X					X		
Cárdenas, Chong, Ñopo, Horowitz, & Lederman	2009				X	X			
Cardenas, Dreber, von Essen, & Ranehill	2014				X		X		
Cardenas, Rodriguez, & Johnson	2011	X			X		X		
Carpenter, Daniere, & Takahashi	2004				X		X		
Cartwright & Drouvelis	2024			X			X		
Cason & Khan	1999	X					X		
Casoria & Ciccone	2021		X			X			
Castro	2008				X		X		
Catola, Guarnieri, Pizziol, & Rapallini	2024				X		X		
Chandrasekhar, Kinnan, & Larreguy	2018	X						X	
Chao & Shin	2026				X	X			
Charness & Gneezy	2008	X						X	
Chaudhuri	2018		X				X		
Chaudhuri, Graziano, & Maitra	2006				X		X		
Chen	1996	X					X		
Chen & Komorita	1994	X					X		
Chen & Tang	2009				X				X

Authors	Year	Anon	Eph	Frame	Expos	PD	PGG	DG	UG
Cherry, Kallbekken, Kroll, & McEvoy	2013			X			X		
Chuah, Hoffmann, Jones, & Williams	2009				X				X
Clark & Sefton	2001				X	X			
Co-chard, Couprie, & Hopfensitz	2016	X				X			
Collins, Hammah, & Lightle	2018			X				X	
Columbus, München, & Gerpott	2020			X		X			
Cook, Yamagishi, Cheshire, Cooper, et al.	2005		X		X	X			
Cooper, DeJong, Forsythe, & Ross	1996		X			X			
Cortés Aguilar, Palacio García, & Parra Carreño	2014		X				X		
Cox & Stoddard	2015		X				X		
Croson	1996		X				X		
Dal Bó	2005		X			X			
Dal Bó & Fréchette	2019		X			X			
Dal Bó & Fréchette	2011		X			X			
Dawes, McTavish, & Shaklee	1977	X				X			
Dawes, van de Kragt, & Orbell	1988	X				X			
de Haan & van Veldhuizen	2015			X		X			
D'Exelle & Riedl	2010	X						X	
Dorrough & Glöckner	2019				X		X		
Dreber, Ellingsen, Johannesson, & Rand	2012			X		X			
Duffy & Feltovich	2002	X				X			
Dufwenberg & Muren	2006	X						X	

Authors	Year	Anon	Eph	Frame	Expos	PD	PGG	DG	UG
Dufwenberg, Johansson-Stenman, Kirchler, Lindner, & Schwaiger	2022			X				X	
Dung	2015				X		X		
Dvorak & Fehrler	2024	X				X			
Eichenberger & Oberholzer-Gee	1998	X						X	
Ellingsen, Johannesson, Mollerstrom, & Munckhammar	2012			X		X			
English	2012				X		X		
Englmaier & Gebhardt	2016	X					X		
Etang, Fielding, & Knowles	2011	X						X	
Fehr & Gächter	2000		X				X		
Fiedler, Hellmann, Dorough, & Glöckner	2023				X			X	
Fosgaard, Fosgaard, & Foss	2017			X			X		
Fox & Guyer	1978	X				X			
Frey & Bohnet	1997	X				X			
Frey & Bohnet	1995	X						X	
Frohlich & Oppenheimer	1998	X					X		
Gächter & Fehr	1999	X					X		
Gächter & Herrmann	2009				X		X		
Gächter, Fehr, & Kment	1996	X					X		
Gasiorowska, & Helka	2012			X				X	
Gasiorowska, Chaplin, Zaleskiewicz, Wygrab, & Vohs	2016			X				X	
Ghidoni & Suetens	2022		X			X			
Gnagey, Grijalva, & Rong	2018	X						X	
Goeree, McConnell, Mitchell, Tromp, & Yariv	2010	X						X	
Goerg & Walkowitz	2010				X		X		

Authors	Year	Anon	Eph	Frame	Expos	PD	PGG	DG	UG
Goette, Huffman, & Meier	2012	X				X			
Greiner & Levati	2005		X				X		
Greiner, Caravella, & Roth	2014	X							X
Greiner, Güth, & Zultan	2012	X						X	
Grimalda	2006				X		X		
Grimalda, Pondorfer, & Tracer	2016	X				X			
Grund, Harbring, & Thommes	2018		X				X		
Grund, Harbring, & Thommes	2015		X				X		
Gunessee, Xie, & Lane	2020	X						X	
Gurven, Zanolini, & Schniter	2008	X						X	
Haan, Kooreman, & Riemersma	2006	X					X		
Hammah, Weber, & Woon	2011	X					X		
Haruvy, Li, McCabe, & Twieg	2017	X					X		
Hayashi, Ostrom, Walker, & Yamagishi	1999				X	X			
He, Offerman, & van de Ven	2017	X				X			
Hemesath	1994				X	X			
Hemesath & Pomponio	1998				X	X			
Henrich, Boyd, Bowles, Camerer, Fehr, & Gintis	2004				X		X		
Henrich, Ensminger, McElreath, Barr, et al.	2010				X			X	
Herrmann, Thöni, & Gächter	2008				X		X		
Hillis & Lubell	2015	X					X		
Hoenow & Pourviseh	2024	X					X		
Hoffman, McCabe, Shachat, & Smith	1994			X					X

Authors	Year	Anon	Eph	Frame	Expos	PD	PGG	DG	UG
Holm & Danielson	2005				X			X	
Horak & Arya	2020				X				X
Insko, Hoyle, Pinkley, Hong, et al.	1987	X				X			
Irwin, Mulder, & Simpson	2014				X		X		
Isaac & Walker	1988	X					X		
Isaak, Schwieren, & Iida	2022				X		X		
Jacquet, Hauert, Traulsen, & Milinski	2011	X				X			
Jakiela	2015				X			X	
Jensen, Farnham, Drucker, & Kollock	2000	X					X		
Johnson	2016	X							X
Kachelmeier & Shehata	1997	X			X		X		
Kamei	2019		X				X		
Kartal & Müller	2025	X				X			
Kay, Wheeler, Bargh, & Ross	2003			X					X
Kerr, Garst, Lewandowski, & Harris	1997	X					X		
Keser & van Winden	2000		X				X		
Kiesler, Sproull, & Waters	1996	X				X			
Kim, Choi, Lee, Lee, & Choi	2017				X			X	
Kinukawa, Saijo, & Une	2000	X					X		
Klinowski	2018				X			X	
Kocher & Matzat	2016		X				X		
Kocher, Cherry, Kroll, Netzer, & Sutter	2008				X		X		
Kölle, Quercia, & Tripodi	2025		X			X			
Koukouvelis, Levati, & Weisser	2012		X				X		
Kovacs, Dunaïski, Galizzi, Grimalda, et al.	2024				X			X	

Authors	Year	Anon	Eph	Frame	Expos	PD	PGG	DG	UG
Krysowski & Tremewan	2021	X						X	
Kumakawa	2013	X					X		
Kuroda, Li, Shachat, Wei, & Zhu	2021				X	X			
Lamba & Mace	2010	X							X
Lazear, Malmendier, & Weber	2012	X			X			X	
Leibbrandt, Ramalingam, Sääksvuori, & Walker	2015				X		X		
Leider, Mobius, Rosenblat, Do	2008	X						X	
Lian & Zhou	2015		X				X		
Liberman, Samuels, & Ross	2004			X	X	X			
Ligon & Schechter	2012	X						X	
Lindskold & Finch	1981	X				X			
Lönnqvist, Verkasalo, Wichardt, & Walkowitz	2013				X		X		
Lotito, Migheli, & Ortona	2013	X					X		
Lu, Zhang, & Xu	2016	X				X			
Martinsson & Villegas-Palacio	2010	X					X		
Martinsson, Pham-Khanh, & Villegas-Palacio	2013	X			X		X		
Maslet, Noussair, Tucker, & Villeval	2001				X		X		
Mengel & Peeters	2011		X				X		
Mischkowski & Glöckner	2016			X	X		X		
Mohlin & Johannesson	2008	X						X	
Molleman & Gächter	2018				X	X			
Morehous	1966		X			X			
Mori	1994	X				X			
Munier & Zaharia	2002				X				X
Munroe	2018				X			X	

Authors	Year	Anon	Eph	Frame	Expos	PD	PGG	DG	UG
Nihonsugi	2016		X				X		
Nikiforakis	2008		X				X		
Noussair & Tucker	2005	X					X		
O'Garra & Alfredo	2019	X					X		
Orbell, van de Kragt, & Dawes	1988	X				X			
Oskamp & Perlman	1966	X				X			
Ostrom & Walker	1989	X					X		
Peeters & Vorsatz	2012		X				X		
Peters, Ünür, Clark, & Schulze	2004	X					X		
Pillutla & Chen	1999			X			X		
Proto, Rustichini, & Sofianos	2019		X			X			
Proto, Sgroi, & Nazneen	2019	X				X			
Putterman, Tyran, & Kamei	2011				X		X		
Raihani, Mace, & Lamba	2013				X			X	
Rankin	2006	X						X	
Rege & Telle	2004	X					X		
Rochat, Dias, Liping, Broesch, et al.	2009				X			X	
Rodebaugh, Klein, Yarkoni & Langer	2011	X					X		
Rojas & Cinner	2020			X			X		
Romano, Sutter, Liu, Yamagishi, & Balliet	2021				X		X		
Romero & Rosokha	2023		X			X			
Rosenbaum, Billinger, Stieglitz, Djumanov, & Atykhanov	2012				X				X
Rosenbaum, Billinger, Twerefou, & Isola	2016				X		X		
Roth	1995	X							X

Authors	Year	Anon	Eph	Frame	Expos	PD	PGG	DG	UG
Roth, Prasnikar, Okuno-Fujiwara, & Zamir	1991				X				X
Samek & Sheremeta	2014	X					X		
Sanchez-Pages & Turiegano	2010				X	X			
Sarker, Poon, Haque, & Herath	2023	X					X		
Schmidt, Carsten, & Zultan	2005	X							X
Sell, Chen, Holmes, & Johansson	2002				X		X		
Small & Loewenstein	2003	X						X	
Smith, Lagarde, Blaauw, Goodman, et al.	2012				X			X	
Suneja & Das	2023	X				X			
Tan & Bolle	2007		X				X		
Tanner, Lusk, & Tyner	2005				X		X		
Thompson, Kray, & Lind	1998	X					X		
van de Kragt, Dawes, Orbell, Braver, & Wilson	1986	X				X			
van der Heijden & Moxnes	1999				X		X		
Van Lange, Klapwijk, & Van Munster	2011		X				X		
Van Vugt & Iredale	2013	X					X		
Vu	2016	X					X		
Weber, Schulz, Beranek, Lambarraa-Lehnhardt, & Gächter	2023				X		X		
Weimann	1994		X				X		
Werthmann, Weingart, & Kirk	2010	X			X		X		
Whitt & Wilson	2007				X			X	
Wichman	1970	X				X			
Wilson & Sell	1997	X					X		
Wong & Hong	2005	X				X			

Authors	Year	Anon	Eph	Frame	Expos	PD	PGG	DG	UG
Yamagishi	1988				X		X		
Yamagishi & Sato	1986	X					X		
Yamagishi, Makimura, Foddy, Matsuda, et al.	2005				X		X		
Yamagishi, Mifune, Liu, & Pauling	2008				X		X		
Yang, Wu, Zhou, Mead, et al.	2013			X				X	
Zhu, Keller, Gummerum, & Takezawa	2010				X			X	
Zizzo & Tan	2007				X	X			
Zultan	2012	X							X

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