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Abstract: What patterns of economic relations arise when people are altruistic rather than strategically self-interested? This paper introduces an altruism network into a simple model of choice among partners for economic activity. With concave utility, agents effectively become inequality averse towards friends and family. Rich agents preferentially choose to work with poor friends despite productivity losses. Hence, network inequality—the divergence in incomes within sets of friends and family—is key to how altruism shapes economic relations and output. Skill homophily also plays a role; preferential contracts and productivity losses decline when rich agents have poor friends with requisite skills.

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I Introduction

Social relations structure many economic transactions. Informal lending tracks family and friendships, job referrals of family and friends are an integral part of the labor market, and family firms are ubiquitous in both developing and developed economies.[1] Much analysis of socially-based economic transactions employs the tools and perspective of non-cooperative game theory. In "relational contracting" for example, parties engage in a repeated game and the contract is "informally enforced" by the credible threat of ending the relationship, finding another partner, or entering the market (e.g., Ghosh and Ray (1996), Kranton (1996a, 1996b), Baker, Gibbons, and Murphy (2002)). Informal lending is sustained by the credible withdrawal of further loans and of social support by not only the cheated party but by the larger community (Jackson, Rodriguez-Barraquer, and Tan (2012)). The value of partnerships is bounded by the largest possible social punishment (Ambrus, Mobius, and Szeidl (2014)). This paper takes a different tack and asks what patterns emerge when people are modeled as altruistic and directly affected by the welfare of friends and family. This study then considers how this human feature shapes economic relations.[2]

This paper considers how altruism for others—for family, friends, co-ethnics, and even compatriots—shapes contracting and investment, especially in the face of economic downturns. We investigate the implications of altruism for the choice between arms-length economic relations and economic relations with friends and family. The analysis reveals the main drivers of what we call *preferential contracts*, economic relations that yield altruistic gains but lower levels of output. We show that the interplay between the income distribution and the altruism network shapes preferential contracting. With decreasing marginal utility of consumption, altruistic agents effectively become inequality averse towards their friends and family. In an economic downturn impacting the poor, investors are more willing to sacrifice economic gains in order to support their poorer friends and family. Thus, preferential contracting occurs more often when *network income inequality*,

[1]See, for example, respectively Ambrus, Mobius, and Szeidl (2014), Karlan et al. (2009), Calvó-Armengol and Jackson (2007), Bertrand and Schoar (2006).

[2]Foster and Rosenzweig (2001) is the only paper of which we are aware with both altruism and strategic interaction. The economic literature incorporating altruism, starting with Becker (1974), is discussed below.

which we define, is higher.

This study thus presents a different picture of social and economic relations, especially following shocks to incomes. In the literature on informal contracts, risk sharing, and favor exchange, the "enforceability constraint" puts bounds on exchanges especially for large shocks, since large obligations give parties the incentive to renege.[3] The modeling and analysis in the present paper flip these predictions. Here, shocks to the income distribution which increase the inequality among friends and family leads to more preferential contracting. Rich agents are more likely to engage family and friends the more their incomes diverge.

Detailed empirical studies indicate that people do indeed, at a personal cost, provide favorable economic treatment to disadvantaged family members. Kramarz and Skans (2014), using Swedish data, find that parents appear to trade off their own wages for their children's employment. Children are more likely to be employed at their parent's plant when the child has otherwise weak job prospects (e.g., low grades, economic downturns). Parents' wage growth drops exactly when the child enters the plant, despite that the firm's profits are growing. Using data on Danish family firms, Bennedsen and Wolfenzon (2007) causally identifies the negative consequences from hiring a new CEO from within the family. The CEO likely has substandard skills since, after coming on board, the drop in firm profitability is substantial, and the effect is pronounced in fast-growing industries and industries with highly skilled labor force.[4]

Altruism has appeared in economic analyses at least as far back as Becker (1974). Early studies focus on the nuclear family, and subsequent work shows caring relationships and support often include extended family, friends, and neighbors (Cox and Fafchamps (2007)). Bourlès, Bramoullé, and Perez-Richet (2017) provides the first analysis of altruism in networks, and we adopt similar assumptions on altruistic preferences.[5]

[3]See for example Coate and Ravallion (1993) for bilateral insurance and Bloch, Genicot, and Ray (2008) for insurance in a network. See Dixit (2003) for contract enforcement inside and outside a community. Wealthy individuals, who have less benefits from the on-going relationship exit the family or community (Munshi and Rosenzweig (2016), Barron, Guo, and Reich (2020)).

[4]Emigrants who invest in businesses and financial instruments (e.g. diaspora bonds) in their country-of-origination, especially following disasters or during economic crises, are another example of people forgoing higher investment returns in order to aid those to whom they feel a connection (Ketkar and Ratha (2007)).

[5]See Galperti and Strulovici (2017), Ray and Vohra (2020), and Vásquez and Weretka (2020) for recent

The present paper considers how altruism shapes economic relations such as investment and employment. We employ a reduced form model of production which requires combining individual resources such as skilled labor and specialized capital. Particular pairings then produce different levels of output. The analysis studies the choice among possible partnerships in a simple model with altruism towards friends and family and an ex-ante income distribution. Engaging a "qualified" agent yields the highest possible economic return; engaging an unqualified friend entails an economic loss but a gain in altruism payoffs.[6] The altruism network thus forms a network model of a new sort of taste-based discrimination, where agents have preference for hiring a particular set of others depending also on their incomes and their skills.[7]

We consider two types of economies which differ on whether friends and skills overlap - what we call *skill homophily*. In the first case, representing a highly specialized large economy, agents have no friends who are qualified to produce the high levels of output. Investors with a production opportunity then must choose between a qualified agent and an unqualified friend. Since investors are effectively inequality averse, they ultimately choose between a qualified agent and their poorest friends. In the special case of constant absolute risk aversion, we identify a network measure of inequality that relates directly to the level of preferential contracting. This measure captures the overall probability there is a given difference between investors' incomes' and those of their friends. The greater the tendency for friends to have similar income levels, *income homophily*, the lower is this overall probability and the less frequent is preferential contracting. Furthermore, the minimum income among friends is what matters; preferential contracting can be quite prevalent even with high overall income homophily.

In the second case, agents can have qualified partners among their friends, and we find a non-monotonic relationship between income homophily and preferential contracting.

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studies of altruism.

[6]Examples include (i) employing a family member versus a more qualified worker, (ii) contracting with a relative or friend's firm versus a more technologically appropriate firm, and (iii) investing in friends' or families' business ventures versus investing in a firm with the highest return to capital.

[7]In Becker (1971), employers have disutility from hiring workers in particular social groups. Goldberg (1982) shows how utility gains lead to nepotism. In the present paper, predicted hiring patterns depend on the income and skill distributions within a social network.

When rich agents are only linked to rich agents, there is no preferential contracting. When rich agents have some relatives and friends who are poor, they are more likely to engage in preferential contracting. However, when rich agents have many poor friends, there is likely a poor friend who is qualified and hence the rate of preferential contracting falls. Thus, in an economy where agents could have qualified friends, preferential contracting is largest with intermediate range of income homophily.

The paper proceeds as follows: Section II provides the basic model of altruism and contracting. Sections III and IV consider the two types of economies. The Conclusion discusses directions for future research in light of the results.

II The Model: Altruism and Contracting

We introduce a model to study how altruism shapes investment and contracting patterns. In this model, agents care about other agents, referred to collectively as their *friends*. A subset of agents has production opportunities, and they choose with whom to engage in economic activity. Choosing friends, while possibly less productive, increases utility through altruistic returns.

Agents, Utility, and Altruism. Society is composed of a set of N agents, with $|N| = n$. Each agent i has initial income y_i and final consumption worth c_i which includes gains from any partnership with another agent. Each agent has a strictly increasing and strictly concave private utility function over own consumption $u : \mathbb{R}_+ \to \mathbb{R}$. Each agent i also possibly cares about the utility of other people. Following Becker (1974) and Bourlès, Bramoullé, and Perez-Richet (2017), agent i's overall utility is

$$v_i(c_i, \mathbf{c}_{-i}) = u(c_i) + \sum_{j \neq i} \alpha_{ij} u(c_j),$$

where $\alpha_{ij} \in [0, 1[$ describes the strength of i's altruism towards j. Agents i and j are *friends* if $\alpha_{ij} > 0$, and $N_i = \{j | \alpha_{ij} > 0\}$ denotes i's set of friends. Let $\boldsymbol{\alpha} = (\alpha_{ij})_{i,j}$ denote the altruism network, i.e., the collection of altruistic ties.

We develop a measure of network income inequality as follows. Consider a set of agents A and each $i \in A$, and let $y(N_i)_{min}$ be the lowest income among i's friends. For a given income difference $x \geq 0$, let $F(x; A)$ denote the proportion of agents in A for whom $y_i - y(N_i)_{min} \leq x$. When the altruism network is fixed, $F(x; A)$ is a simple fraction of agents A for any given x. Altruism links could also be modeled as a realization of a random network which relates the probability of friendships to individuals' income levels. For instance, the probability of link between i and j could be a decreasing function of $|y_i - y_j|$.[8] Network inequality $F(x)$ is then a distribution which derives from this random process.

Economic relations. A subset of agents M—*investors*—have the chance to partner with another agent to produce output. For each investor, each production opportunity arrives with an identified *qualified agent* who has particular skills or other idiosyncratic features which, in partnership with the investor, produces output 2π. Partnering with an unqualified agent yields output of only $2f\pi$ where $f < 1$. Let $s_{ij} \in [0, 1]$, *skills links*, be the probability that agent i has a production opportunity and agent j is qualified to work with agent i. Let $\boldsymbol{s} = (s_{ij})_{i,j}$ be the collection of skill links, i.e., the *skill network*. Let S_i denote the agents who could be qualified to work with agent i, i.e., $S_i = \{j | s_{ij} > 0\}$. The probability that agent i is an investor is $\sum_j s_{ij}$, so the set of investors is then $M = \{i | \sum_j s_{ij} > 0\}$. We consider a period of time with one production opportunity, and hence $\sum_{i,j} s_{ij} = 1$. Section III studies networks in which friends are never qualified, $N_i \cap S_i = \varnothing$. This case could represent, for instance, a society where people's friendships are never based on education, business, or professional backgrounds. Section IV considers variation in what we call *skill homophily*, where friends are more or less likely to be qualified partners, defined formally below.

Partnerships and preferential contracting. Investors choose with whom to partner, and we assume that output is shared equally. Equal sharing could arise from social norms (Young and Burke (2001)) or from frictions in bargaining (Bramoullé and Goyal (2016)). We assume that any two agents who engage in production cannot transfer income or any gains to third parties. This non-transferability could be due to high transactions costs,

[8] See, for example, Lusher, Koskinen, and Robbins (2012) and Powell et al. (2005) for homophily as the absolute difference of a continuous variable.

the impossibility of monetizing non-pecuniary gains and/or social norms which reduce the value of transfers (see, e.g. Prendergast and Stole (2001)); even if some transfers were possible, the forces at play hold to the extent monetary transfers involve frictions.[9] With non-transferable economic returns, the choice of a partner is the only margin through which an investor can affect others' utility.

We call a partnership between agent i and an unqualified friend a *preferential contract*. Conditional on the realization of a production opportunity for investor i with qualified agent j, let $q_{ij} = 0$ if investor i partners with j and let $q_{ij} = 1$ if i partners instead with an unqualified friend. Then $q_i = \sum_j s_{ij} q_{ij}$ denotes the ex-ante probability investor i chooses a preferential contract, and $q = \sum_i q_i$ denotes the overall ex-ante probability of preferential contracting.

Our objective is to analyze the pattern of preferential contracting under different economic and social conditions. When does an investor engage in preferential contracting? How does this decision depend on income-based homophily and skill homophily? How do shocks to the income distribution affect preferential contracting levels?

III Friends Are Never Qualified

We first study a society where $N_i \cap S_i = \varnothing$. We analyze the incentives of a specific investor i to contract with a friend rather than a qualified agent j and then consider the overall probability of preferential contracts.

A Individual Investor Decision

Consider investor i and a qualified agent j. If i partners with j, i earns overall utility

$$v_i = u(y_i + \pi) + \sum_{l \in N_i} \alpha_{il} u(y_l).$$

[9] Similar assumptions underlie Bramoullé and Goyal (2016), Jackson, Rodriguez-Barraquer, and Tan (2012) and Duernecker and Vega-Redondo (2018).

If i partners with an arbitrary friend k, i's overall utility is

$$v_i = u(y_i+f\pi)+\alpha_{ik}u(y_k+f\pi)+\sum_{\substack{l\in N_i\\ l\neq k}}\alpha_{il}u(y_l) = u(y_i+f\pi)+\alpha_{ik}[u(y_k+f\pi)-u(y_k)]+\sum_{l\in N_i}\alpha_{il}u(y_l)$$

The friend k which maximizes this latter utility is the solution to

$$\max_{k\in N_i}\alpha_{ik}[u(y_k+f\pi)-u(y_k)]. \tag{1}$$

The investor's choice among her friends involves two considerations. First, the investor gains more when she chooses a friend k towards whom she has higher altruism (higher α_{ik}). She also gains more from choosing a friend k is poorer (lower y_k), since u is strictly concave. Hence, there is a trade-off between i's altruism and a friend's gain in utility, which is higher when the friend is poorer. If investor i has the same level of altruism towards all friends, contracting with the poorest friend gives the highest utility.

In what follows, let k_i^* denote a solution to (1) and call k_i^* agent i's *preferred friend*. While there might be several agents k_i^*, we refer to this agent in the singular without loss of generality. Investor i's overall utility from choosing to partner with k_i^* is

$$v_i(k_i^*) \equiv u(y_i+f\pi)+\alpha_{ik_i^*}[u(y_{k_i^*}+f\pi)-u(y_{k_i^*})]+\sum_{l\in N_i}\alpha_{il}u(y_l).$$

Comparing $v_i(k_i^*)$ to the utility earned when contracting with a qualified agent j, i will contract with her preferred friend if and only if

$$\alpha_{ik_i^*}[u(y_{k_i^*}+f\pi)-u(y_{k_i^*})] \geq u(y_i+\pi)-u(y_i+f\pi). \tag{2}$$

While not yet imposed, in much of the analysis below, we will assume that altruism is not so strong that an investor hires a richer, unqualified friend; that is, if $y_{k_i^*} > y_i$, i would opt for a qualified agent j.

We derive q_i, the overall probability that i engages in preferential contracting: Given some inequality (I), let $\mathbb{1}(I) = 1$ if inequality (I) is satisfied and 0 otherwise. From the text above, we have:

Lemma 1 *The probability that i engages in preferential contracting is*

$$q_i = \left(\sum_j s_{ij} \right) \mathbb{1} \left(\alpha_{ik_i^*}[u(y_{k_i^*} + f\pi) - u(y_{k_i^*})] \geq u(y_i + \pi) - u(y_i + f\pi) \right). \tag{3}$$

We now consider how this probability relates to underlying model parameters.

Proposition 1 *Suppose $N_i \cap S_i = \varnothing$. The probability that investor i engages in preferential contracting, q_i, increases weakly if*

(a) Less output is lost from contracting with an unqualified agent (f increases).

(b) The investor has greater altruism toward her preferred friend ($\alpha_{ik_i^*}$ increases).

(c) The income of investor i increases and/or the income of her preferred friend decreases (y_i increases and/or $y_{k_i^*}$ decreases).

Proof of Proposition 1. (a) and (b) follow from the direct impacts of f and $\alpha_{ik_i^*}$. (c) follows from the concavity u: higher y_i decreases $[u(y_i + \pi) - u(y_i + f\pi)]$, and lower $y_{k_i^*}$ increases $\left[u(y_{k_i^*} + f\pi) - u(y_{k_i^*})\right]$. ■

Proposition 1 gives the basic forces driving preferential contracting. The incentives for preferential contracting directly increase if, first, the foregone output is reduced and, second, investor i cares more about her friends. Third, as a consequence of altruism and concave utility, investors are essentially inequality averse towards their friends. The incentives for preferential contracting therefore increase if i becomes richer and/or if her friends become poorer.

B Altruism Networks and Preferential Contracting

This section studies the relationship between contracting, the altruism network, and the income distribution.

B.1 Altruism and Income Distribution

We first consider changes to incomes, as might occur in times of economic expansion or contraction. If investors become richer and their friends become poorer, Proposition 1 shows that preferential contracting increases. However, the result is silent on situations where all incomes increase or decrease, with possibly countervailing incentives for investors to hire friends.

We identify circumstances where changes to the income distribution lead all investors to expand or reduce preferential contracting. Suppose that individuals have Constant Absolute Risk Aversion (CARA) utility $u(y) = -e^{-Ay}$. Consider first changes to initial incomes which preserve ranks in the income distribution. For shocks which lead to an overall reductions in incomes, let $y_i' = y_i - x(y_i)$ with $x(.) > 0$ and continuously differentiable on $\mathbb{R}_+$. If $x' < 0$ the loss is larger for poorer agents while if $0 < x' < 1$ income loss is larger for richer agents. In both cases, if $y_k < y_i$ then $y_k' < y_i'$. Assume that investors never hire a richer friend who is unqualified, which holds when investors are richer than their preferred friend $k_i^* : \forall i \in M, y_i > y_{k_i^*}$ and $y_i' > y'_{k_i^*}$.[10]

Proposition 2 *Suppose $N_i \cap S_i = \varnothing$ and suppose that investors never hire unqualified friends whose income is higher than their own. Under CARA utility, rank-preserving negative income shocks increase (decrease) preferential contracting for all investors when the shocks affect the poor (rich) more and have no impact on preferential contracting when the shocks are common.*

Proof of Proposition 2. Applying CARA utility to inequality (2), taking logs, and simplifying, i hires a friend if and only if

$$y_i - y_{k_i^*} \geq \frac{-\ln(\alpha_{ik_i^*})}{A} + \frac{1}{A}[\ln(e^{-Af\pi} - e^{-A\pi}) - \ln(1 - e^{-Af\pi})]. \tag{4}$$

The result follows from the change in the left-hand-side difference in incomes in (4) from (a) a common shock ($y_i' = y_i - x_0,$), (b) a negative shock which affects the poor more

[10] It also holds when investors can be poorer then their preferred friends. For instance under CARA, investors never give a preferential contract to a richer friend if $\bar{\alpha}f/(1-f) < 1$ where $\bar{\alpha} = \max_{i\in M, j\in N_i} \alpha_{ij}$.

($y_i' - y_{k_i^*}' \geq y_i - y_{k_i^*}$ under the assumption an investor would only hire a poorer friend), and (c) a negative shock which affects the rich more, decreasing the income difference. ■

We can characterize the impact of positive income shocks through similar arguments. Positive shocks which affect the rich more lead to an expansion of preferential contracting for all investors. Positive shocks which affect the poor more, while still preserving income rank, lead to a reduction in preferential contracting for all investors.[11]

B.2 Income Shocks and Network Inequality

Studying rank-preserving income changes provides conditions under which incentives for all investors move in the same direction. In general, income rank is not necessarily preserved during economic booms or busts. Some agents might have increased incentives to hire friends since relative incomes diverge, while others have reduced incentives.

To focus on the overall impact of possibly arbitrary changes in the income distribution, we consider a benchmark special case in which investors are symmetric but for their income levels and those of their friends. Assume all investors have the same level of altruism towards friends, an assumption we call *equal altruism*; $\alpha_{ij} \in \{0, \alpha\}$ for all i,j. For all investors i, the preferred friend k_i^* is then i's poorest friend whose income is denoted, as defined above, $y(N_i)_{min}$. Suppose further all investors are equally likely to have a production opportunity $\forall i \in M, \sum_j s_{ij} = 1/|M|$, an assumption we call *equal opportunities*. Let $\Delta \equiv \frac{-\ln(\alpha)}{A} + \frac{1}{A}[\ln(e^{-Af\pi} - e^{-A\pi}) - \ln(1 - e^{-Af\pi})]$. Note that Δ decreases when α or f increases. Moreover, $\lim_{\alpha \to 0} \Delta = \lim_{f \to 0} \Delta = +\infty$, and hence $\Delta > 0$ when α is not too high or f is not too small, and we consider only parameters in this range.

Proposition 3 *Consider CARA utility and $N_i \cap S_i = \varnothing$. Suppose $\alpha_{ij} \in \{0, \alpha\}$ for all i,j, and $\forall i \in M, \sum_j s_{ij} = 1/|M|$. Then the overall probability of preferential contracting is*

$$q = \frac{1}{|M|} \sum_{i \in M} \mathbb{1}[y_i - y(N_i)_{min} \geq \Delta] = 1 - F(\Delta; M).$$

[11] Proposition 2 extends to Decreasing Absolute Risk Aversion (DARA). Under DARA, poor agents' utility becomes more concave. With small payoffs and negative shocks, a common shock or a shock affecting the poor more increase preferential contracting for all investors.

Proof of Proposition 3. By Lemma 1,

$$q = \sum_{i \in M} q_i = \sum_{i \in M} \left(\sum_j s_{ij} \right) \mathbb{1}[\alpha_{ik_i^*}[u(y_{k_i^*} + f\pi) - u(y_{k_i^*})] \geq u(y_i + \pi) - u(y_i + f\pi)].$$

By Lemma 2 and with assumptions $\forall i \in M, \sum_j s_{ij} = 1/|M|$, we have $q = \frac{1}{|M|} \sum_{i \in M} \mathbb{1}[y_i - y_{k_i^*} \geq \Delta]$. ■

Proposition 3 relates the probability of preferential contracting directly to our measure of network inequality: $1 - F(\Delta; M)$ is equal to the proportion of investors whose income difference with their poorest friends is greater than or equal to a threshold value $\Delta > 0$. The probability of preferential contracting, $1 - F(\Delta; M)$, then varies inversely with income homophily. Preferential contracting is prevalent when investors have friends who are much poorer than themselves. For instance, suppose that income is binary, $y_i \in \{y_L, y_H\}$, and that $0 < \Delta < y_H - y_L$. In that case, $y_i - y_{k_i^*} \geq \Delta$ if and only if investor i is rich, $y_i = y_H$ and k_i^* is poor, $y_{k_i^*} = y_L$. By Proposition 3, the probability of preferential contracting is then simply equal to the proportion of investors who are rich and have a poor friend.

We illustrate Propositions 2 and 3 in Figure 1 using simulations of a random network model with 50 rich and 50 poor agents. We assume CARA utility, equal altruism, and equal opportunities. The income of a rich agent is picked uniformly at random in $[20, 25]$. The income of a poor agent is picked uniformly at random in $[10, 15]$. We assume utility function parameters such that $\Delta = 16$. We consider shocks affecting poor agents only, of sizes increasing from 0 to 10. We consider two possible stochastic networks. For *no income homophily* (plain curves), any two agents can be connected with probability 0.1. In expectation, any agent is connected with about 10 friends and connections are independent of income. For *homophily* (dashed curve), we posit any two agents in the same income class are connected with probability 0.18 while any two agents in different incomes classes are connected with probability 0.02. In expectation, a rich agent is thus connected with about 9 rich friends and 1 poor friend. In each case, we pick $1,000$ networks at random and compute the probability of preferential contracting q for each network. Note that with these parameter values, preferential contracting will only occur between a rich investor and

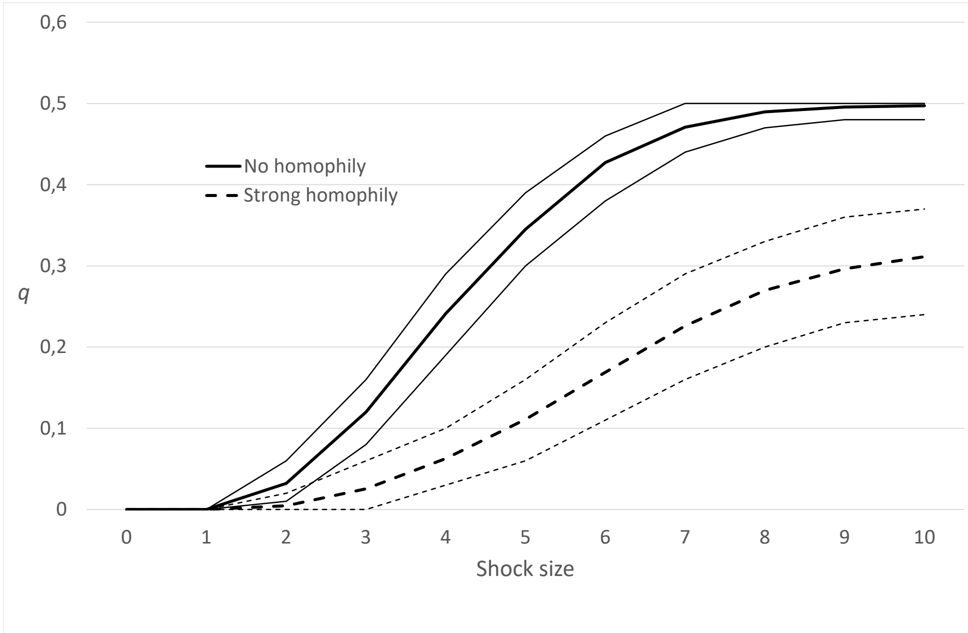

Figure 1: Preferential Contracting and Shocks when No Friends are Qualified

a poor friend, and hence $q \leq 0.5$. We depict how the average value of q across all simulated networks varies with shock size, as well as a 95% confidence interval.

The average probability of preferential contracting is increasing with shock size, consistent with Proposition 2. Preferential contracting is a marginal phenomenon when shocks are small, but becomes prevalent when shocks are large. The maximal value of q is reached with no income homophily and large shocks. Consistent with Proposition 3, the probability of preferential contracting is lower when there is income homophily. Yet, this probability is still quantitatively quite high. A rich investor needs only one poor-enough friend in order to engage in preferential contracting.

The relationship between income homophily and preferential contracting, however, is more complex is a society where friends can be qualified. Hiring a poor qualified friend is the best an investor can do, earning both altruistic returns and high economic returns. Having a large number of poor friends would then reduce preferential contracting. We explore this possibility in the next section.

IV Friends Can Be Qualified

Suppose now that investors can have qualified friends. Skill homophily—the relationship between friendships and productivity—is now key to preferential contracting. When $\boldsymbol{\alpha}$ is fixed we say $\boldsymbol{s'}$ exhibits lower skill homophily than $\boldsymbol{s}$ if $\sum_{j\notin N_i} s'_{ij} \geq \sum_{j\notin N_i} s_{ij}$ for all i and for all i $\forall j \in N_i, s'_{ij} \leq s_{ij}$, that is, under $\boldsymbol{s'}$ for every agent i, i's friends are less likely to be qualified and agents who are not i's friends are more likely to be qualified.

A Individual investor decision

Consider investor i's decision with whom to contract when i has a qualified friend j.

Suppose, first, that j is i's preferred friend k_i^*. In this case, monetary and altruistic incentives are aligned: investor i chooses to contract with k_i^* and

$$v_i(k_i^* = j) \equiv u(y_i + \pi) + \alpha_{ik_i^*} u(y_{k_i^*} + \pi) + \sum_{\substack{l\in N_i \\ l\neq j=k_i^*}} \alpha_{il} u(y_l).$$

Suppose next that j is not i's preferred friend k_i^*. Investor i faces the trade-off between the relatively greater altruistic returns from contracting with k_i^* and higher economic returns from hiring j. Investor i will hire k_i^* if and only if

$$\begin{aligned} v_i(k_i^* \neq j) \equiv u(y_i + f\pi) + \alpha_{ik_i^*} u(y_{k_i^*} + f\pi) + \alpha_{ij} u(y_j) + \sum_{\substack{l\in N_i \\ l\neq j,k_i^*}} \alpha_{il} u(y_l) \geq \\ u(y_i + \pi) + \alpha_{ik_i^*} u(y_{k_i^*}) + \alpha_{ij} u(y_j + \pi) + \sum_{\substack{l\in N_i \\ l\neq j,k}} \alpha_{il} u(y_l), \end{aligned}$$

which is equivalent to

$$\alpha_{ik_i^*}[u(y_{k_i^*} + f\pi) - u(y_{k_i^*})] - \alpha_{ij}[u(y_j + \pi) - u(y_j)] \geq u(y_i + \pi) - u(y_i + f\pi) \qquad (5)$$

Since $\alpha_{ij} > 0$, inequality (5) is strictly more demanding than inequality (2); if investors do not contract with a qualified friend, they will not contract with unqualified friends.

Deriving q_i, we extend Lemma 1 and Proposition 1 as follows:

Lemma 2 *Suppose that investors can have qualified friends. Then*

$$\begin{aligned} q_i \;=\;& \left(\sum_{j \notin N_i} s_{ij}\right) \mathbb{1}\left(\alpha_{ik_i^*}[u(y_{k_i^*} + f\pi) - u(y_{k_i^*})] \geq u(y_i + \pi) - u(y_i + f\pi)\right) \\ &+ \sum_{\substack{j \in N_i \\ j \neq k_i^*}} s_{ij} \mathbb{1}\left(\alpha_{ik_i^*}\left[u(y_{k_i^*} + f\pi) - u(y_{k_i^*})\right] - \alpha_{ij}\left[u(y_j + \pi) - u(y_j)\right] \geq u(y_i + \pi) - u(y_i + f\pi)\right) \end{aligned} \tag{6}$$

Relative to equation (3), equation (6) includes an additional term for the possibility that the qualified agent j is i's friend.

All the results of Proposition 1 hold, as shown below, and we derive three new results which relate to qualified friends. First, q_i increases weakly when y_j (the income of the qualified friend) increases. By the concavity of u, the altruistic gain from contracting with qualified friend j is lower when y_j is higher, increasing the incentive to contract with the preferred (unqualified) friend. Second, this loss is also reduced when i cares less about j. Third, q_i increases weakly decreases when skill homophily is lower.

Proposition 4 *The probability that investor i contracts with an unqualified friend, q_i, increases weakly if*

(a) There is less output loss from contracting with an unqualified agent (f increases).

(b) The investor cares more about her preferred friend and/or less about a non-preferred friend ($\alpha_{ik_i^*}$ increases and/or α_{ij} decreases).

(c) The income of the investor increases, the income of her preferred friend decreases and/or the income of a non-preferred friend increases (y_i increases, $y_{k_i^*}$ decreases and/or y_j increases).

(d) The skill links change from s to s' such that s' displays less skill homophily.

Proof of Proposition 4. Like in Proposition 1, (a) and (b) follow from the direct impacts of f, $\alpha_{ik_i^*}$, and α_{ij}, and (c) holds due to the concavity of u. (d) Since $\alpha_{ij}[u(y_j+\pi)-u(y_j)] \geq$

0, the first binary indicator in (6) is always greater than or equal to the second. Therefore, probabilities which transfer weights from the second term to the first term increase q_i. ■

Proposition 4 indicates a form of competition between i's friends. Hiring a richer qualified friend, i does not suffer a loss in productivity, but hiring a poorer unqualified friend i gains altruistic utility. Thus, incentives to hire a unqualified friend are related to the income distribution among i and her friends.

B Preferential Contracting, Income, and Skill Homophily

We examine the importance of the income distribution, income homophily, and skill homophily in a stylized economy where all agents are equally likely to be qualified for any investor but some agents are rich and others are poor. Investors then could have both rich and poor qualified friends. The economy is a random graph model (along the lines of the simulated economy above) with the possibility of qualified friends.

We find that as income differences increase, there is more preferential contracting. Since investors are effectively inequality averse, they choose to partner with their unqualified poor friends over their qualified rich friends. Furthermore, we find a non-monotonic relationship between income homophily and preferential contracting. When rich investors have no poor friends, there is little preferential contracting. As the rich have greater numbers of friends among the poor, preferential contracting increases. When rich investors have many poor friends, however, preferential contracting falls because there is a higher likelihood that a poor friend is also qualified.

Consider a population of agents who are either *poor* or *rich*, with income $y_i \in \{y_L, y_H\}$, respectively, where $y_L < y_H$. Let λ denote the fraction of poor agents, $n_P = \lambda n$ denote the number of poor agents, and $n_R = (1-\lambda)n$ denote the number of rich agents. We consider an altruism network which is random conditional on incomes.[12] Any two poor agents are friends with probability ρ_P, a rich and a poor agent are friends with probability ρ, two rich agents are friends with probability ρ_R, and the formation of friendships are independent events. The parameter ρ controls the expected number of links between poor

[12] This network is a classic extension of Erdős-Renyi random graphs, see e.g. Golub and Jackson (2010).

and rich agents, and hence varies inversely with the level of homophily. We assume equal altruism, α, and we assume equal opportunities. We further assume that any agent $j \neq i$ is equally likely to be a qualified agent for i; $s_{ij} = \frac{1}{n(n-1)}$ for $i \neq j$. Thus, the skill links are independent of incomes and of friendships. However, as the probabilities ρ, ρ_P, and ρ_R increase, agents have more friends overall, and thus agents are more likely to have qualified friends (skill homophily increases).

We first look at how preferential contracting depends on the income distribution, holding the altruism network fixed. We then analyze increases in connectedness which determines income and skill homophily. For simplicity, we assume that $\pi \ll y$ implying that $u(y + f\pi) - u(y) \approx f\pi u'(y)$. Also, denote by $u'_L = u'(y_L)$ and $u'_H = u'(y_H)$ with $u'_L > u'_H$.

B.1 Altruism and Income Distribution

We proceed by considering i's decision to engage a friend when (a) the realized qualified agent j is not a friend and when (b) the realized qualified agent j is a friend.

Suppose first that $j \notin N_i$. We focus on the interesting case where altruism is not so strong that a poor investor hires an unqualified poor friend nor a rich investor hires a rich friend. The condition we impose is thus $\alpha \leq \frac{1-f}{f}$, since a poor investor would hire an unqualified poor friend if and only if

$$\alpha[u(y_L + f\pi) - u(y_L)] \geq u(y_L + \pi) - u(y_L + f\pi) \Leftrightarrow \alpha f \pi u'_L > (1-f)\pi u'_L \Leftrightarrow \alpha \geq \frac{1-f}{f} \quad (7)$$

with a parallel condition for a rich investor hiring a rich friend. The only preferential contracts that would arise are between rich investors and their poor friends, since if rich investors do not contract with rich friends, poor investors would not either. A rich investor preferentially contracts with a poor friend if and only if

$$\alpha[u(y_L + f\pi) - u(y_L)] \geq u(y_H + \pi) - u(y_H + f\pi) \Leftrightarrow \alpha \geq \frac{1-f}{f}\frac{u'_H}{u'_L}. \quad (8)$$

Second, suppose that i's realized qualified agent j is a friend of i, $j \in N_i$. If j is poor, then i contracts with j since productivity and altruism incentives are aligned. If j is rich,

i prefers to contract with a poor unqualified friend if and only if

$$\begin{aligned} \alpha[u(y_L + f\pi) - u(y_L)] &\geq u(y_H + \pi) - u(y_H + f\pi) + \alpha[u(y_H + \pi) - u(y_H)] \Leftrightarrow \\ \frac{\alpha f}{(1 - f + \alpha)} &\geq \frac{u'_H}{u'_L} \end{aligned} \tag{9}$$

These arguments lead to the following result for how preferential contracting depends on the income distribution through the ratio of marginal utilities $\frac{u'_H}{u'_L}$. When the rich become richer or the poor becomes poorer, this ratio decreases and preferential contracting expands.[13]

Proposition 5 *Assume that $y_i \in \{y_L, y_H\}$, $\pi \ll y$, and $\alpha \leq \frac{1-f}{f}$ so that any preferential contracts are between rich investors and poor friends. Consider an investor i and qualified agent j:*
(1) (Strong preferential contracting) If $\frac{u'_H}{u'_L} \leq \frac{\alpha f}{1-f+\alpha}$, a rich investor prefers to hire a poor unqualified friend if j is not a poor friend.
(2) (Weak preferential contracting) If $\frac{\alpha f}{1-f+\alpha} \leq \frac{u'_H}{u'_L} \leq \frac{\alpha f}{1-f}$, a rich investor prefers to hire a poor unqualified friend only when j is not a friend.
(3) If $\frac{u'_H}{u'_L} \geq \frac{\alpha f}{1-f}$, there is no preferential contracting.

Figure 2 illustrates Proposition 5. The region below $u'_H = \frac{\alpha f}{1-f+\alpha} u'_L$ gives the combinations (u'_L, u'_H) of strong preferential contracts; inequality is so large that i only contracts with an unqualified poor friend. The lightly shaded region gives the combinations (u'_L, u'_H) of weak preferential contracts; inequality is still large enough that i forgoes contracting with a qualified stranger in order to contract with an unqualified poor friend, but i would hire a qualified rich friend.

[13] Proposition 5 directly implies that q is a weakly decreasing, piece-wise constant function of $\frac{u'_H}{u'_L}$ for any realization of the random network model.

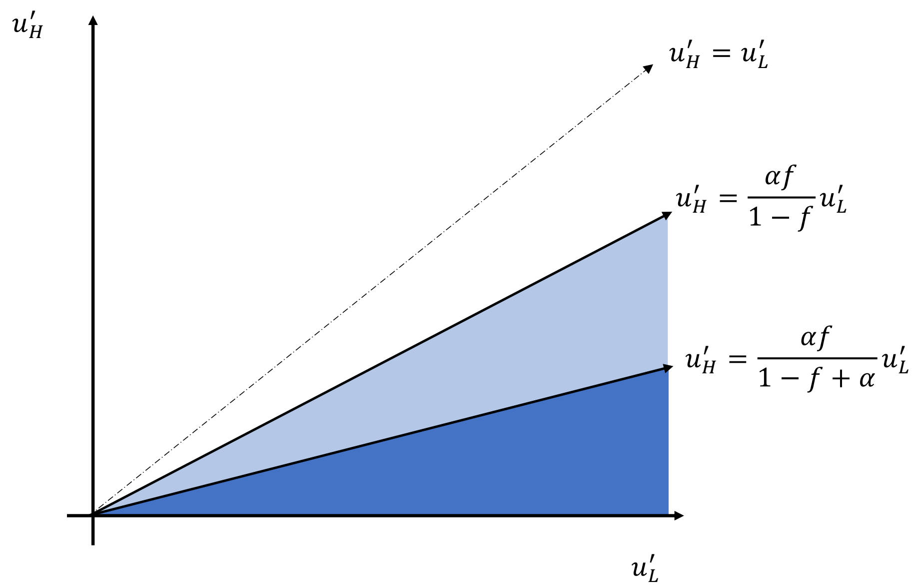

Figure 2: Thresholds for Weak and Strong Preferential Contracting when Friends can be Qualified

B.2 Income Homophily

We now consider how the expected probability of preferential contracting depends on the parameters of the random graph model. We find a non-monotonic relationship between the probability of connection between a rich and a poor agent, ρ, and the extent of both weak and strong preferential contracting. When ρ is small, rich investors have few poor friends, hence there is little scope for preferential contracting. As ρ increases, rich investors have more poor friends, who are equally likely to be (un)qualified as any other agent, and the probability of preferential contracting increases. As ρ approaches 1, rich investors have many poor friends and therefore are more likely to have a qualified poor friend with whom to contract. For both strong and weak contracting, the probability of preferential contracts is non-monotonic in ρ, since as ρ increases, skill homophily increases and income homophily decreases. The general result follows:[14]

Proposition 6 *Suppose agents are poor or rich, $y_i \in \{y_L, y_H\}$, $\pi \ll y$, $\alpha \leq \frac{1-f}{f}$, and friendship links are random conditional on incomes.*
(a) Under strong preferential contracting,

$$\mathbb{E}(q) = (1-\lambda)(1-(1-\rho)^{n_P}) - (1-\lambda)\frac{\rho n_P}{n-1}, \tag{10}$$

(b) Under weak preferential contracting,

$$\mathbb{E}(q) = (1-\lambda)(1-(1-\rho)^{n_P})\left(1-\rho_R\frac{n_R-1}{n-1}\right) - (1-\lambda)\frac{\rho n_P}{n-1}. \tag{11}$$

In both cases, $\mathbb{E}(q)$ is first increasing in ρ from $\mathbb{E}(q)=0$ at $\rho=0$ and then decreasing.

Proof of Proposition 6. Consider strong preferential contracts. A rich agent has exactly k poor friends with probability $\binom{n_P}{k}\rho^k(1-\rho)^{n_P-k}$, and none of her poor friends is qualified

[14] Simulations also readily illustrate how $\mathbb{E}(q)$ varies with ρ under strong preferential contracting and weak preferential contracting. Consider $n_R = n_P = 50$, with $\rho_R = 0.5$ in the latter case. Since only rich investors offer preferential contracts, $q \leq 0.5$, and $\mathbb{E}(q)$ reaches at its maximum a significant fraction of this largest possible value, about 95% for strong contracting at $\rho \approx 0.09$ and about 70% at $\rho \approx 0.08$ for weak contracting.

with probability $\frac{n-1-k}{n-1}$. Thus

$$\mathbb{E}(q) = (1-\lambda)\sum_{k=1}^{n_P}\binom{n_P}{k}\rho^k(1-\rho)^{n_P-k}\left[\frac{n-1-k}{n-1}\right].$$

Since $\sum_{k=1}^{n_P}\binom{n_P}{k}\rho^k(1-\rho)^{n_P-k} = 1-(1-\rho)^{n_P}$ and $\sum_{k=1}^{n_P}k\binom{n_P}{k}\rho^k(1-\rho)^{n_P-k} = \rho n_P$, substituting and simplifying yields (10). As a function of ρ:

$$(\mathbb{E}(q))'(\rho) = (1-\lambda)\left[n_P(1-\rho)^{n_P-1} - \frac{n_P}{n-1}\right]$$

Therefore, $\mathbb{E}(q)$ increases from $\mathbb{E}(q)(0) = 0$ to a maximal value then decreases to $\mathbb{E}(q)(1) = (1-\lambda)\left[1-\frac{n_P}{n-1}\right]$.

Consider weak preferential contracts. A rich agent has exactly k poor friends and l rich friends with probability $\binom{n_P}{k}\rho^k(1-\rho)^{n_P-k}\binom{n_R-1}{l}\rho_R^l(1-\rho_R)^{n_R-l}$. Substituting and simplifying yields (11). As a function of ρ

$$(\mathbb{E}(q))'(\rho) = (1-\lambda)\left[(1-\rho_R\frac{n_R-1}{n-1}n_P)(1-\rho)^{n_P-1} - \frac{n_P}{n-1}\right]$$

Therefore, $\mathbb{E}(q)$ increases from $\mathbb{E}(q)(0) = 0$ to a maximal value then decreases to $\mathbb{E}(q)(1) = (1-\lambda)\left[1-\frac{n_P+\rho_R(n_R-1)}{n-1}\right]$. ■

Proposition 6 shows how both income and skill homophily affect the probability of preferential contracts. The first term in equation (10) is equivalent to $1-F(\Delta)$ where $\Delta = y_H - y_L$, the proportion of investors whose income difference with at least one friend is $(y_H - y_L)$. This is the probability of preferential contracting that arises in an economy where friends are never qualified. The second term gives a reduction in the probability of preferential contracting thanks to skill homophily, in this case poor qualified friends. The terms in equation (11) have a similar interpretation; the first term is now discounted by the likelihood of rich qualified friends.

V Conclusion

The above analysis shows how altruism can shape economic relations. In contrast to strategic self-interest, altruism leads agents to engage their poorest friends and family in economic activities. With diminishing marginal utility, altruistic agents act like they are inequality-averse. Thus, the divergence in incomes within an altruism network is the key statistic in predicting the prevalence of preferential contracting. When no friends have the requisite skills for a high-output partnership, agents trade off productivity for the altruistic gains of employing a poor friend. Shocks which amplify income differences, and especially hit the poor, increase preferential contracting rates. When some friends could have the requisite skills, agents have a more difficult choice: between a skilled partner, an unskilled poor friend, and a skilled friend who is not as poor. Preferential contracting increases when richer agents are more likely to have poor friends, but ultimately decreases as this probability rises, since poor friends are then also likely to be skilled.

More generally, our analysis suggests fundamental interconnections between the economic and social aspects of transactions. Contracts here play a dual role. They contribute to economic output and, in specific circumstances, are part of the informal safety net. Contracting patterns have both economic determinants (e.g. income shocks, production technologies) and social determinants (structure of the altruism network). The analysis and results thus could guide future research on social ties and economic activity, related to several strands of the literature.

Family firms play a first-order role in economies, with about thirty percent of large firms in wealthy countries under family control (La Porta, Lopez-de Silanes, and Shleifer (1999)). The literature on family firms presents efficiency reasons for hiring family and friends, including information advantages and social norms which substitute for weak legal institutions. Yet, evidence is mixed that family firms are more productive (Bertrand and Schoar (2006)). As discussed in the Introduction, studies suggest that productivity losses arise when family of the firm's founder succeeds as the firm's CEO (Pérez-González (2006), Bennedsen and Wolfenzon (2007), Morck, Stangeland, and Yeung (2007)). Our analysis suggests that hiring family members could be a much wider phenomenon, involving the extended family especially in large firms. Our results yield specific predictions on how hiring depends on the altruism among family members, the family income distribution, individual skills, and the business cycle.

Furthermore, the results from our model of partnerships suggest possible effects of altruism on the business cycle. Family-based safety nets could mobilize during downturns, with negative effects on output. Preferential contracting could therefore have a multiplier effect: Negative shocks may lead to an increase in preferential contracting, which further reduces economic output. More generally, changes in such preferential contracting could amplify or dampen variations in aggregate economic output.

Finally, the analysis suggests patterns for many situations where people help their family and friends through business interactions. Wealthy parents may rent an apartment to their child at below the market rent; family and friends can help kick-start businesses and financially support others' artistic endeavors at a loss relative to other investments; entrepreneurs and academics team up because of social affinities rather than for purely productive reasons.[15] That is, people engaging in many market transactions actually have altruistic, non-market motives. Our analysis suggests that such transactions track altruism links along with the divergence in incomes. This possibility could be tested in network data, using our measure of network inequality.

[15] AlShebli, Rahwan, and Woon (2018) finds ethnic homophily among collaborators in science is high but publications with ethnically diverse authors have more impact.

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