Chen, Xi; Zhang, Xiaobo

Conference Paper

Relative income, network interactions and social stigma

IAMO Forum 2010, Halle (Saale), June 16 – 18, 2010: Institutions in Transition - Challenges for New Modes of Governance

Provided in cooperation with:
Leibniz Institute of Agricultural Development in Central and Eastern Europe (IAMO)

Suggested citation: Chen, Xi; Zhang, Xiaobo (2010) : Relative income, network interactions and social stigma, IAMO Forum 2010, Halle (Saale), June 16 – 18, 2010: Institutions in Transition - Challenges for New Modes of Governance, http://hdl.handle.net/10419/52702

Relative Income, Network Interactions and Social Stigma

Xi Chen
Department of Applied Economics and Management
Cornell University
xc49@cornell.edu
http://web.cenet.org.cn/web/ecocxi/

Xiaobo Zhang
Development Strategy and Governance Division
International Food Policy Research Institute
x.zhang@cgiar.org
http://www.ifpri.org/srstaff/ZhangX.asp

This Version: May, 2010

"Institutions in Transition–Challenges for New Modes of Governance"

16-18 June 2010 | Halle (Saale), Germany

Relative Income, Network Interactions and Social Stigma †

Xi Chen **Xiaobo Zhang**
Cornell University **IFPRI**

ABSTRACT

Blood donation with compensation is considered as a social stigma. However, more people in the reference group donate blood often leads to less moral concern and more followers. Therefore, the behavior is likely to be influenced through one's interactions with neighbors, friends and relatives. Meanwhile, relative income may affect the motives for blood donation through increasing mistrust and stress. The motives might be stronger for households of lower social rankings. Utilizing three-wave census-type panel data in 18 villages in rural western China, two identification strategies, instrumental variable and network-based identification, are implemented to estimate the effect of social interactions. Both community-specific and household-specific relative income measures are employed to test whether blood donation is more sensitive towards the less well-off in a society. We find strong evidence in support of the effects of social interactions, no matter whether instrumental variables or network centrality measures are adopted. Household-specific measures of relative income show more salient effects on blood donation than community-specific inequality.

Keywords: Blood Donation, Social Interactions, Inequality, Relative Income, China

JEL: I32, J22, D13, D63

† *Xi Chen acknowledges generous financial support from the National Science Fund of China (NSFC), Doctoral Research Grant from the Institute for the Social Sciences (ISS) at Cornell University, and data collection support provided by the Development Strategy and Governance Division (DSGD) at IFPRI, China Academy of Agricultural Sciences, and Guizhou University. Xi Chen and Xiaobo Zhang are grateful to Ravi Kanbur for invaluable comments, guidance and encouragement. This paper also benefited from helpful discussion and invaluable comments from Christopher Barrett, Robert Frank, and David Sahn. Audiences in our sessions in AAEA 2009 annual meetings, 2009 Summer Applied Micro Workshop, Fall 2009 Graduate International Development Seminar, Fall 2009 Interdisciplinary China Workshop, and 2009 Spring Econ Development Seminar participants at Cornell University are acknowledged. We thank Dingju Cheng for her excellent assistance in the social network data collection. The views expressed herein and any remaining errors are the author's and do not represent any official agency.*

"*Everyone was rendered both victim and supporter of the system.*" Václav Havel, 1978

1. INTRODUCTION

A longstanding assumption in neoclassic economics is that an agent's utility depends solely on the absolute well-being,[1] and the recent literature on relativity has mainly referred *keeping up with the Joneses* to rich people in developed countries.[2] The empirical studies on the poor, particularly in developing countries, are more scant. However, recent evidence from developing countries has shown that relative concern over the others' consumption matters.[3] This reality has focused attention on positional goods, though relative concern is reflected in more dimensions than positional spending.

Though considered a vehicle facilitating social networks and an attempt to gain higher social status in the environment without formal insurance, too many resources allocated to positional goods might contribute to an overall welfare loss. The fact that "positional externalities" compel villagers to spend lavishly in festivals, funerals, gift giving, house building and weddings to avoid been isolated from local social networks is thus a problem that is particularly acute for households living close to subsistence.

Meanwhile, highly unequal income distribution in a society may lead to instability in social capital[4] through rising mistrust and stress or declining social cohesion, which expose households

[1] However, Smith implicitly put forward the idea in *The Wealth of Nations* in 1776, where he claimed that people should be endowed with the ability to appear in public without shame. Since Veblen's seminal work in 1899, a few people started to believe that utility or happiness depends in part on the comparison of one's own consumption to that of others, which was first formally modeled by Duesenberry (1949) in his relative income hypothesis. Since the 1970's, compelling evidence on relative concern has been accumulated (Easterlin, 1974; Sen, 1983; Frank, 1985; Van de Stadt et al., 1985).

[2] For example, Frank (1997) notes that in the US counties with high income inequality, intense competition for social status leads to higher median housing prices, higher personal bankruptcy rates, and a higher incidence of divorce. Bowles and Park (2002) find that total working hours were positively associated with higher inequality in OECD countries over time. Other evidence includes Clark and Oswald (1996), Solnick and Hemenway (1998), Neumark and Postlewaite (1998), Stutzer (2004), Luttmer (2005). Frank and Levine (2008) further find that relative concern could well explain the link between inequality and observed disparities in international savings rates, which were not predicted by traditional consumption theories. Frank and Levine (2008) define "Expenditure Cascade" in an economy where every agent except the richest one judges own behavior according to others closest above them.

[3] Evidence from designer-label goods consumption in Bolivia (Kempen, 2003), festivals' budget in India (Banerjee and Duflo, 2007), "splendid" funerals in Ghana (*Economist*, 2007), relative deprivation and migration in Mexico (Stark et al., 1991), bride-prices and dowries in south Asia and Africa (Rao, 1993; Dekker and Hoogeveen 2002), marriage payments in Bangladesh (Anderson, 2007), and community level consumption in Nepal (Fafchamps and Shilpi, 2008) show strong support for relative concern. Fafchamps and Shilpi (2008) further notice that isolation from market is associated with a significant increase in relative concern.

[4] Kawachi and Kennedy (1999) summarize plausible mechanisms linking income inequality and outcomes, which include erosion of social capital and stressful social comparisons.

at the risk of self-financing when faced with shocks. Relative income may be of great importance in determining an individual's access to local resources that are scarce within a backward community. These possible concerns might drive people to climb social ladders through exchanging blood for cash. Community specific inequality measures may restrict our attention to the impact of inequality that everyone is equally faced with. Household-specific relative income measures, to the contrary, have two immediate advantages over community-specific inequality measures: one, it allows us to move from community to household level data, avoiding the ecological fallacy; two, a specific pathway implicated in the relationship between income inequality and blood donation can be empirically evaluated.

Poorer households are usually forced to distract higher shares of income from limited resources, which renders a stronger feeling of being surpassed on the social ladder. Empirical evidence has shown a negative relationship between relative deprivation and health-compromising behavior (Deaton, 2001; Li and Zhu, 2006; Ling, 2009; Chen and Zhang, 2009a). Among them, Chen and Zhang (2009) provide preliminary evidence on the link between relative deprivation and blood donation. However, the effects of relative income are questionable since social interactions in the same econometric specification are not well identified. In this paper, more reasonable instrumental variables will be implemented to identify the real effect of social interactions on blood donation decisions. Luckily, our dataset also have detailed information on gift-exchange network for some villages, which facilitates improved identifications even compared with the instrumental variable strategy.

Though special in several ways[5], does blood donation include regular elements of labor supply? If so, empirical specification should take into consideration those major factors in the labor market. Opportunities for households to increase farm income are limited in remote rural China, while the inequality of non-farm earnings is particularly severe. The equal blood compensation each time for the poor and the rich but diverging labor wage renders the poor more incentive to donate blood. However, if in the long term health cost is higher for the poor because

[5] Kanbur (2004) argues that the blood donation market is special in three ways: one, concerns over abject poverty and extreme inequality in this market make the public feel uncomfortable or even outrageous, which is absent in a regular good market; two, those who act in the market might not be the weak agents who bear the consequences of actions; three, possible extreme outcomes accounts for another concern. Repeated blood donation might undermine donors' long-term wellbeing and lead to persistent poverty because of its lasting harmful effects. For example, the HIV/AIDS epidemic is proved exacerbated following blood plasma donation in insanitary conditions, such as Henan province in China. Among women of reproductive age, blood donation might undermine cognitive performance and work productivity of mothers and children.

of their severer vulnerability to illness, it is likely that the rich donate more blood. Besides, travel distance and costs should also be counted.

This paper aims to address two issues. First, blood donation is often considered as a social stigma, more people donate blood generally leads to less moral concern and more followers. Therefore, the behavior might be influenced through social interactions with neighbors, friends and relatives. Two identification strategies, instrumental variable and network-based identification, will be implemented; second, relative income may affect the motives for blood donation through mistrust and stress. The motives might be sensitive to the distribution. Relative income measures, including community-specific inequality and household-specific relative deprivation, will be tested.

To our knowledge, this is among the first studies to addressing the economic and social meaning of blood donation to the poor. While blood donation behavior has been documented in sociological, philosophical, ethical, anthropological literatures and popular novels, we have not seen any paper in economics focusing on this behavior. Meanwhile, while all the relevant literature explores individual cases, this paper is primarily based on a household level census panel data as well as long-term gift-exchange network data. Extensive information on blood donation and social interactions among other things enable us to identify the effect of social interactions and relative income properly.

The rest of this paper is organized as follows: In section 2, the recent surge in social interactions, relative concern and blood donation in rural China is documented; section 3 describes the three-wave census type survey and gift-exchange network data; section 4 derives illustrative models for blood donation. The identification of social interactions and measures of relative income are laid out. Based on that, our empirical strategies are provided and major data issues are discussed; section 5 reports estimation results; finally, section 6 concludes with future directions.

2. SOCIAL INTERACTIONS, RELATIVE CONCERN AND BLOOD DONATION IN RURAL CHINA

Economic reform in China began with the agricultural reform in the late 1970s after the release of production incentives which greatly benefited farmers. Since then, farmers have been faced with increasing price fluctuations in the input and output market as a result of decollectivization. More market fluctuation and less arable land per capita due to increasing population make agricultural production risky and unprofitable. Ironically, it might be the economic liberalization, which once droved the reform process, that deprives the poor of power to retain their blood, leaving them profound frustration over its absence.[6] However, are agricultural factors the only possible reasons behind the lasting blood donation? In other words, do social factors matter, such as social interaction in the network and relative concern over economic and social status?

In recent decades, economic and structural transformation in China has been followed by escalation in conspicuous consumptive investment, particularly housing, but no increases in productive investment that would secure durable increases in welfare (Brauw and Rozelle, 2008). Relative share of rural residents' incomes allocated to gift-giving, dowry, bride price, and funerals, are considered vehicles for social prestige that might challenge social status (Yan, 1996; Liu, 2000). Such spending also facilitates social networks, which may be relied upon for mutual assistance, personal financing, or other forms of help. However, welfare consequences of "positional externalities" associated with status seeking are severe for Chinese households living close to subsistence. The highly ritualized practices of gift-giving compel villagers to offer gifts in order to avoid isolation from local networks. Generally, farm income is limited and nonfarm income is unequal and favors the rich. The isolated geography further deprives equal opportunities to migrate out, and dense population aggravates status seeking activities. Brown et al. (2008) recorded oral evidence during field work that inflows of remittances to some households set in motion status contests with adverse consequences for the others through long-term blood donation.

In China, blood is mainly supplied by voluntary donations. However, in Guizhou, Henan, and some other remote rural areas, blood banks provide cash compensation to blood donors.[7] Once the plasma is removed, the blood is re-infused. It is prohibited to donate blood more than once every two weeks (Asia Catalyst, 2007). Recently, Guizhou province has been a new supplier of blood plasma for the heel of the Henan Province in China (Yin, 2006). In 2006, there were 25 blood plasma stations in Guizhou, which supplied 40% of total blood plasma in China, rendering

[6] In August 2004, the State Administration of Taxation issued a new stipulation that the purchase of human blood is not subject to tax-free agricultural produce and should not be calculated at 13 % of the purchase price for the deduction of purchases VAT as applied to agricultural produce. Shao (2006) asks what makes human blood an "agricultural product" in the first place.

[7] In rural Guizhou, donors get 80 RMB nutrition subsidy in cash for the plasma contained in 500 cc of blood.

it the largest market. Blood banks in Guizhou regulate that people more than 50 years old, less than 50kgs (male), less than 45kgs (female), or seriously disabled are not eligible to donate blood plasma. However, the regulation that is generally the most effective is through preventing seriously disabled blood donor.[8]

In Puding county in Guizhou, the blood bank was shut down in 2006 due to Hepatitis C contamination and predatory behavior of over extracting blood plasma. Some residents continued to rely on donating blood, often traveling out to make donations. Since 2007, local blood banks send 100RMB cash prizes to registered donors at the end of each year in order to meet the fast increasing market demand for blood plasma. Meanwhile, donors are required to donate once every 15 days at a fixed volume of 580cc. Cash penalty is applied for each day that registered blood donors delay their donation. Due to the current incentive scheme, there is almost no difference in blood donation frequency between busy season and slack season. Blood donors usually travel once every 15 days to the blood bank to donate.

From our dataset, it is also observed that the majority of blood donors in a family are women, which might reflect labor division to accommodate agricultural production or off-farm work, as the opportunity cost for men engaging in these two activities are higher than women. Meanwhile, once a family starts to donate blood, in very few cases it quits. Therefore, there is much smaller variation over time in blood donation than cross-sectional variation.

3. DATA

The dataset for this study comes from three waves of census-type rural household survey conducted by ourselves in three administrative villages (including 18 natural villages) in Puding County, Western China.[9] Located in the central part of the poorest Guizhou province, Puding is a median level county in Guizhou. It is geographically isolated and multi-ethnic.[10] Guizhou now provides the largest market share of blood plasma in China.

Initially, reference groups are defined according to natural villages, which are evolved naturally without political command but through generations of residence. In Guizhou,

---

[8] Regulations through other channels are not efficient because people in Guizhou are normally shorter and lighter than people in many other provinces. Faced with the huge demand for blood, it is not easy to enforce the age and weight regulations. For more information, refer to China HIV/AIDS Information Network http://www.chain.net.cn/.

[9] This survey was jointly conducted by the International Food Policy Research Institute (IFPRI), Chinese Academy of Agricultural Sciences (CAAS), and Guizhou University.

[10] More than 20 ethnic groups are living in Puding county, including Han, Miao, Buyi, Gelao, and yi. In total, ethnic minorities comprise about 20% of population.

geographic segregations formed by the unique Karst landform further isolate social interactions. Reference groups have 42 households on average, which form a close link connecting each other. Usually, the majority of residents retain certain kinds of kinship within a natural village. Moreover, we combine natural villages together for some ethnic minority villages because of their strong internal ties.[11]

For the first wave, all 801 households were surveyed at the beginning of 2005. The survey collects detailed information on household demographics, income, consumption, transfers, expenditures and incomes related to gift-giving, weddings, funerals, and blood donation. Most information is collected for each household member, including members that were working outside the county at the time of survey. Though sensitive, information on blood donation is accurate and reliable since it accounts for large share of household income, and our local student surveyors and residents show mutual trust.

A follow-up survey of the same households was administered in early 2007 and 833 households was interviewed. However, the local blood bank was shut down in 2006 due to Hepatitis C contamination and predatory behavior of over extracting blood plasma. Thus, much fewer local residents were able to continue except that some people travelled out to donate. The local blood bank has recovered since 2008.

In January 2010, the third wave follow-up survey was conducted for the 18 natural villages and 872 households were interviewed. Further information on each of the family members donating blood was collected. Meanwhile, a ten-year gift-exchange data for each household in three natural villages are collected. Gift-exchange data were recorded during major social occasions, including male members' wedding, female members' wedding, funeral, coming-of-age ceremony, child birth ceremony, and house-moving ceremony. Gift-receiving records are usually kept for a long time in order to pay back accordingly when celebrations in other families are held.[12] Household social links between the three villages and the other fifteen surveyed villages nearby were also captured. The data collection alleviated missing relations linking outside and avoided implicitly ranking relationships, mixing real and potential Links, and

[11] Recent migration exerts little influence on reference groups. First, more often only some members migrate, and they often do not come back in several years. Second, even migrants themselves are not likely to change reference groups because of the Hukou system and other discriminating policies. In urban China, rural migrants usually join migrants' social networks, differing from urban networks.

[12] If all family members are illiterates, a group of two or three educated relatives usually help record and check gift-giving on the celebration days.

ambiguously treating receiving and giving out resources. We identified around 353 households in total, which make 3150 links connecting gift senders and gift receivers. The information on social connections will be used to identify heterogeneous social influence imposed by households.

4. ILLUSTRATIVE MODEL AND EMPIRICAL STRATEGY

In the first subsection an illustrative model for blood donation under social norm is set up. In the next two subsections, identification of social interactions and relative income are laid out respectively. Finally, econometric specifications incorporating the identification of the two effects are shown in the fourth subsection, in which major data issues are discussed.

4.1 Social Norms, Relative Wage, and Blood Donation

In this subsection, we develop a model of blood donation in a social norm. Blood donation should be subject to rules for labor supply. Suppose there is a continuum of households in an economy. Each household decides how long to work in the labor market (l_i) and how long to spend on blood donation (b_i). Normalizing working hours, we assume all households spend one time unit in the labor market and $h_i(h_i = b_i / l_i, h_i \in [0, H), h_{i\max} = H)$ time unit on blood donation, and they are heterogeneous in labor efficiency (θ_i). θ_i is distributed between $\theta_{\min}$ and $\theta_{\max}$ under the cumulative distribution function $F(\theta)$. Let us consider a household decision model (Hideaki, 2009) with exogenous wage rate:

$$\max_{h_i} \ U(c(h_i, \theta_i, w, \varphi), S(h_i, \bar{h}))$$

$$s.t. \ c \le (1 + h_i \varphi)\theta_i w$$

Where $\mathrm{U}(\cdot)$ is the utility function, c denotes consumption, $U_c > 0, U_{cc} < 0$. $S(\cdot)$ is the social stigma function which represents disutility from blood donation, $U_S < 0$, $U_{SS} < 0$. As the standard setup, $U_{cS} = U_{Sc} < 0$, which means 1) the greater the disutility is from blood donation, the lower is the marginal utility of consumption; 2) the marginal disutility from blood donation becomes greater as consumption increase. In other words, the wealthier people suffer more from an increasing social stigma than their lower income counterparts. $\bar{h}$ is the average level of blood donation in the reference group. Blood donation is assumed to be φ times as efficient as regular labor supply. w is the wage rate for a unit of labor in efficiency terms. A person with labor efficiency θ_i receives $\theta_i w$ from a unit labor provision and $\varphi\theta_i w$ from a unit blood donation.[13] Therefore, φ represents relative price of blood donation to labor supply ($\varphi = \varphi\theta_i w / \theta_i w$). The social stigma function $S(\cdot)$ satisfies $S_h > 0$, $S_{hh} > 0$, $S_{\bar{h}} < 0$, $S_{h\bar{h}} < 0$. We further assume that a person does not feel guilty if one does not donate blood regardless of the average level of blood donation in the reference group, which means $S(0, \bar{h}) = 0$. The first order condition for an interior solution is:

$$\varphi\theta_i w \frac{\partial U(c(h_i, \theta_i, w, \varphi), S(h_i, \bar{h}))}{\partial c} + \frac{\partial U(c(h_i, \theta_i, w, \varphi), S(h_i, \bar{h}))}{\partial S} \frac{\partial S(h_i, \bar{h})}{\partial h_i} = 0 \qquad (1)$$

Which solves optimal level of blood donation $h^*(\theta_i, \bar{h}, w, \varphi)$ given the labor efficiency (θ_i), the average level of blood donation in the reference group ($\bar{h}$), and the wage level (W). The second order condition is satisfied. To derive the impact of the social norm on blood donation, we differentiate LHS of (1) with respect to $\bar{h}$, which yields

$$\varphi\theta_i w U_{cc} c_h \frac{\partial h_i(\theta_i, \bar{h}, w, \varphi)}{\partial \bar{h}} + \varphi\theta_i w U_{cS} [S_h \frac{\partial h_i(\theta_i, \bar{h}, w, \varphi)}{\partial \bar{h}} + S_{\bar{h}}] + U_S [S_{hh} \frac{\partial h_i(\theta_i, \bar{h}, w, \varphi)}{\partial \bar{h}} + S_{h\bar{h}}]$$
$$+ U_S S_h [U_{Sc} c_h \frac{\partial h_i(\theta_i, \bar{h}, w, \varphi)}{\partial \bar{h}} + U_{SS} (S_h \frac{\partial h_i(\theta_i, \bar{h}, w, \varphi)}{\partial \bar{h}} + S_{\bar{h}})] = 0$$

Collecting the term $\partial h_i / \partial \bar{h}$, we get

$$\frac{\partial h_i(\theta_i, \bar{h}, w, \varphi)}{\partial \bar{h}} = -\frac{\varphi\theta_i w U_{cS} S_{\bar{h}} + U_S S_{h\bar{h}} + S_h U_{SS} S_{\bar{h}}}{\varphi\theta_i w U_{cc} c_h + \varphi\theta_i w U_{cS} S_h + S_{hh} U_S + S_h U_{Sc} c_h + (S_h)^2 U_{SS}} = -\frac{\varphi\theta_i w U_{cS} S_{\bar{h}} + U_S S_{h\bar{h}} + S_h U_{SS} S_{\bar{h}}}{SOC} > 0$$

It means that an increase in blood donation in the neighborhood induces *i* to donate more blood. Differentiating LHS of (1) with respect to w yields

$$\varphi\theta_i U_c + \varphi\theta_i w [U_{cc} (c_h \frac{\partial h_i}{\partial w} + c_w) + U_{cS} S_h \frac{\partial h_i}{\partial w}] + U_S S_{hh} \frac{\partial h_i}{\partial w} + S_h [U_{Sc} (c_h \frac{\partial h_i}{\partial w} + c_w) + U_{SS} S_h \frac{\partial h_i}{\partial w}] = 0$$

Collecting the term $\partial h_i / \partial w$, we get

$$\frac{\partial h_i}{\partial w} = -\frac{[\varphi U_c + \varphi\theta_i w U_{cc}(1 + h_i\varphi) + S_h U_{Sc}(1 + h_i\varphi)]\theta_i}{\varphi\theta_i w U_{cc} c_h + \varphi\theta_i w U_{cS} S_h + U_S S_{hh} + S_h U_{Sc} c_h + (S_h)^2 U_{SS}} = -\frac{[\varphi U_c + \varphi U_{cc} c + S_h U_{Sc}(1 + h_i\varphi)]\theta_i}{SOC}$$

$$sign(\frac{\partial h_i}{\partial w}) = sign(\frac{\partial h_i}{\partial \theta_i}) = sign[\varphi U_c + \varphi U_{cc}(1 + h_i\varphi)\theta_i w + S_h U_{Sc}(1 + h_i\varphi)] \qquad (2)$$

[13] All the households in our census-type survey are faced with only one blood market that sets up a unique blood compensation price, while human resources vary a lot among people and areas. It implies an equalized "fluid labor" wage and unequal labor wages.

which means that the impact of wage rate (w) increase on blood donation is undetermined. First, rising wage rate increases blood donation through higher utility from consumption; second, rising income and consumption induce a fall in marginal utility of consumption; third, a rise in consumption makes marginal disutility of the social stigma greater. Thus, only if the second and the third negative effects can offset the first positive effect, we are able to conclude that blood donation drop with rising wage rate.

Comparing (2) and (3), we have larger absolute values of the second term and the third term in (2). When $\partial h_i / \partial w < 0$ and $\partial h_i / \partial \varphi > 0$ simultaneously hold, people with higher relative labor efficiency (wage) or higher wage rate are less likely to supply blood. This still requires a large decreasing marginal utility of consumption (U_{cc}) and a large increasing marginal disutility of the social stigma (U_{Sc}). The large marginal disutility of the social stigma is usually associated with wealthier people since they suffer more from an increasing social stigma than their lower income counterparts. However, the rich are less sensitive to relative labor efficiency improvement.

$$\frac{\partial h_i}{\partial \varphi} = -\frac{[\varphi U_c + \varphi U_{cc}(\varphi h_i)\theta_i w + S_h U_{Sc}(h_i \varphi)]\theta_i w}{SOC \cdot \varphi}$$

$$sign(\frac{\partial h_i}{\partial \varphi}) = sign[\varphi U_c + \varphi U_{cc}(\varphi h_i)\theta_i w + S_h U_{Sc}(h_i \varphi)] = sign[U_c + \varphi U_{cc} h_i \theta_i w + S_h U_{Sc} h_i] \qquad (3)$$

Meanwhile, if φ is small, i.e. relative price of blood donation to labor supply is small, then it is more likely that $\partial h_i / \partial \varphi > 0$, and blood donation will become a less attractive income generating alternative.

Considering the corner solutions for h , if an individual spends time H donating blood ($h \to H$), according to Kuhn-Tucker condition we have

$$\varphi \theta_i w \frac{\partial U(c(H, \theta_i, w, \varphi), S(H, \bar{h}))}{\partial c} + \frac{\partial U(c(H, \theta_i, w, \varphi), S(H, \bar{h}))}{\partial S} \frac{\partial S(H, \bar{h})}{\partial h_i} \geq 0$$

where the labor efficiency is low enough that the marginal utility of consumption by increasing blood donation dominates the marginal disutility originated from the social stigma for the whole range of h . Let $\underline{\theta}$ denote the lower threshold level of labor efficiency below which the individual spends the largest amount of time donating blood. The above equality holds with $\underline{\theta}$.

In contrast, if the labor efficiency is high enough that the marginal utility of consumption is dominated by the marginal disutility from the social stigma for the whole range of h , the following inequality holds. Let $\bar{\theta}$ denote the higher threshold level of labor efficiency above which the individual spends no time donating blood. The following equality holds with $\bar{\theta}$.

$$\varphi\theta_i w\frac{\partial U(c(0,\theta_i,w,\varphi),S(0,\bar{h}))}{\partial c}+\frac{\partial U(c(0,\theta_i,w,\varphi),S(0,\bar{h}))}{\partial S}\frac{\partial S(0,\bar{h})}{\partial h_i}\leq 0$$

Finally, to achieve interior market equilibrium of the social norm, an ex ante expectation of the average level of blood donation (participation rate and level) should coincide with the resulting average blood donation given that expectation.

$$\bar{h}=\int_{\theta_{\min}}^{\theta_{\max}} h(\theta,\bar{h},w,\varphi)dF(\theta)$$

where $\theta_{\min}<\underline{\theta}<\bar{\theta}<\theta_{\max}$. Meanwhile, a stable equilibrium of the social norm requires that $\partial h_i/\partial\bar{h}<1 \quad \forall\theta_i,\bar{h},w$.

4.2 Identification of Social Interactions on Blood Donation

This paper focuses on identifying how social interactions affect blood donation. Generally speaking, a problem in specifying a model of social influence on behavior has to do with proper identification of the specified relationships, meaning that the parameters of the model are uniquely determined by a dataset. The identification problem in social influence arises since behavior is determined by behavior, which brings a circularity of cause and effect (Manski, 1993; Manski, 2000).

In our estimation of social influences, household blood donation is a linear function of the average blood donation among other households in the cohort. Suppose that a household i has relevant characteristics x_i, and other households in the cohort have similar attributes. The blood donation behavior of household i is determined by what the peers do. The econometric specification is the following,

$$y_i=a+b_1E[y_i\mid x_i]+b_2x_i+\varepsilon_i$$

Taking expectations, if $b_1\neq 1$, then we have

$$E[y_i\mid x_i]=a+b_1E[y_i\mid x_i]+b_2x_i\Rightarrow E[y_i\mid x_i]=\frac{a}{1-b_1}+\frac{b_2}{1-b_1}x_i$$

Plugging into the econometric specification, we can estimate $a/(1-b_1)$ and $b_2/(1-b_1)$, but we cannot separately identify parameters a, b_1 and b_2. Adding in more variables does not help, since more variables bring more parameters to identify. As Manski (1993, 2000) points out, instrumental variables might be able to resolve the problem, since part of the difficulty arises from endogeneity of the behavior that enters into both sides of the econometric equation.

$$y_i = \frac{a}{1-b_1} + \frac{b_2}{1-b_1} x_i + \varepsilon_i$$

The reflection problem stems from the fact that household i's peers are not identified directly but assumed to be similar to i. However, unique to social network studies, information on social structure can help identify those parameters. Specifically, if we explicitly track i's peers, then that information can be used to identify a model (Anselin, Florax and Rey, 2004). Jackson (2008) formulates the following linear interaction of behaviors and ignores constant terms and node-specific characteristics.

$$y_i = \alpha\sigma \sum_j g_{ij} y_j + \varepsilon_i$$

where each individual's behavior is a weighted average of peers' behavior. g_{ij} is a entry in the adjacency matrix G denoting whether there is a link between household i and j. If $(I - \alpha\sigma G)$ is invertible, then

$$Y = (I - \alpha\sigma G)^{-1} \varepsilon$$

where y and ε are the corresponding vectors. We can identify $\alpha\sigma$ if we have knowledge of the adjacency matrix and the covariance matrix of the error term $E[\varepsilon\varepsilon^T]$. Here the critical precondition for identification is that the adjacency matrix is asymmetric, i.e. a link from i to j does not necessarily mean a link from j to i.

A summary of centrality concepts is provided in Appendix II. In the empirical tests, Bonacich (1987) centrality is used to compare the results with IV estimations. The Bonacich centrality vector is defined as

$$C = [I - \alpha\sigma G]^{-1} J$$

where I is a NxN identity matrix, and J is a Nx1 column vector of ones. An adjacent NxN matrix of 1 and 0 denotes direct connections between each pair of agents. Meanwhile, the matrix is asymmetric that a link from i to j has different meaning than the link from j to i. The terms in the diagonal are all assumed to be zero.

The classical centrality index includes information on connections but not intensity of those connections. However, intensity weighted centrality can be calculated based on a modification of the algorithm. In the results, two centrality measures and their impacts on blood donation behavior are compared. Since we only have extensive social network data for three out of eighteen villages surveyed, our samples have to be narrowed down when we further identify the impact of social interactions on blood donation.

4.3 Relative Income Measures

Besides social interactions, we pay special attention to identifying the impact of relative incomes on blood donation. Previous studies use different measures of relative income. For instance, Gerdtham and Johannesson (2004) use mean and median income of a reference group as a proxy for relative income. Li and Zhu (2006) apply rank and an interactive term between rank and Gini coefficient to capture relative income. Eibner and Evans (2005) apply a measure of relative deprivation.

Relative deprivation was originally proposed by Runciman (1966), who argues that one is deprived if the others in the group possess something that one does not have. Easterlin (1974) proposed a simple model to incorporate consumption norms into the individual's utility maximization framework whereby utility of individual *i* depends on *i*'s consumption relative to a weighted average of other people's consumption. Yitzhaki (1979) develops the definition by viewing income as personal possessions and deriving the relationship between relative deprivation and income inequality. Chakravarty (1990) defined relative deprivation as "utility foregone" because of not possessing the economic variables under consideration. Similar to Easterlin (1974), Cooper et al. (2001) propose a model whereby individual's utility depends on the absolute quantity and the quality of a good consumed as well as on the quantity and quality of status good consumed relative to reference or peer group members. Wildman (2003a, 2003b) shows the relationship among average health, health inequalities, absolute level of income, and income inequalities, and links absolute and relative income hypotheses in the production of health.

In Yitzhaki (1979) and Wildman (2003a), the level of deprivation experienced by an individual i with income y relative to another individual with income z is formulated as,

$$D(i; y) = z - y \quad \text{if} \;\; y < z \quad \text{or}$$

$$D(i;y)=0 \qquad \text{if } y \geq z$$

Based on this form, one would feel more deprived as the number of individuals in society with higher income z increases. Thus, an overall measure of deprivation for the individual i is given by summing the differences in income and weighting it with the proportion of people with higher income than the individual i. Accordingly, Li and Zhu (2006) define relative deprivation of absolute income (RDA) and relative deprivation over individual income (RDI) as,

$$RDA_i = \frac{1}{N_i}\sum_j (y_j - y_i) \quad \forall y_j > y_i$$

Through normalization by N_i, the total number of people in their reference groups, RDA adopts normalized total income of other group members who earn more than i does to measure the relative deprivation of person i with income y_i. One concern with RDA is that it does not take into account differences in the scale of the income distribution across reference groups. In other words, if everyone's income doubles, relative deprivation will double as well. This would be a problem as we are using a panel dataset to measure relative deprivation over time, and incomes are not adjusted for inflation. Even if people view within-reference group income differences in proportional terms, RDA still overstates relative deprivation of individuals in high-income reference groups. To improve upon it, RDI is defined as the ratio of RDA relative to person i's own income.

$$RDI_i = RDA_i / y_i$$

Intuitively following the measure of Gini coefficient, Wildman (2003b) proposes a measure of relative deprivation for an individual with income y at the provincial level and stratifies it by urban and rural regions as follows:

$$d_y(F) = \mu[1-F_1(y)] - y[1-F(y)]$$

where μ denotes mean income and the population is ranked by income. $F_1(y)$ is the cumulative proportion of total income up to the income y and $F(y)$ is the cumulative proportion of the population up to the individual with income y.

Deaton (2001) proposes a measure of relative deprivation for an individual *i* with income x at the provincial level and stratifies it by urban and rural regions:

$$(1/\mu)\int_x^{x^T}(y-x)dF(y) \quad \text{or} \quad (1/\mu)[1-F(x)][\mu^+(x)-x]$$

where μ denotes mean income for those in the reference group, x^T is the highest income in the group. F(y) is the cumulative distribution of incomes among individuals in the group, and $\mu^+(x)$ is the average income of those with income higher than the individual with income x. In sum, the measure is the normalized difference between the average income of those with higher income and income x weighted by the proportion of those with income higher than the individual i. Deaton (2001) index is similar to RDI but divided by mean reference group income instead of y_i. RDI is sometimes preferred to Deaton index as it is less sensitive to the income distribution.

All relative income measures above presume that the distance between two agents matters, either in proportional or absolute terms. However, studies on animals suggest rank over distance in importance. To test whether it takes effect on human beings, individual’s rank over incomes within the reference group are used (Eibner and Evans, 2005; Li and Zhu, 2006). Unlike most of the other measures, rank is unaffected by changes in the shape of the income distribution. Thus, unlike the other measures, rank does not reflect differences in income inequality across groups. In other words, Rank ignores the magnitude of income differences among individuals and incorporates less information on relative deprivation.

In a densely populated and isolated rural society, residents usually compare themselves with others within the village. Thus, we are able to define reference groups and construct relative deprivation indexes accordingly.

4.4 Empirical Strategy

This paper focuses on estimating the effect of relative income and social interactions on household blood donation. Most of the empirical studies on social interaction and relative concern rely on sampling in a cross-sectional context, which impedes them from capturing a full dynamic picture of relative status within groups. Our study alleviates these problems by utilizing a three-wave census type panel data set, in which all households from 18 villages were surveyed in 2004, 2006 and 2009.

Meanwhile, strategies are implemented to deal with simultaneity, as a household’s blood donation behavior might indirectly affect the overall blood donation in the reference group. For instance, previous blood donation in the reference group is used to estimate their impacts on the household blood donation in the following period.[14]

Further, two strategies are applied to identify reference groups. First, identification based on natural villages is adopted, which might be less problematic in our context due to the remote mountainous location that isolates social interactions. Instrumental Variable estimation is then applied to deal with unobserved factors that blur our estimations. The validity of this treatment is based on the assumption that the researcher a priori knows the group with whom a person may interact (Manski, 2000). However, local residents might influence each other across natural villages, and the mutual influences for each pair of households are expected to be heterogeneous. Therefore, more information on social interactions is needed to identify the effect of social preference. We improve upon the first identification strategy through collecting long-term network data on gift exchanges. The value of gifts displays existence and intensity of social connection, while gifts across villages are also captured to obtain the complete picture of social interactions.

We first estimate two logit models for household blood donation participation decisions:

$$P(BD_{i,r,t}=1)=\Phi(MBD_{r,t-1}, Inc_{i,r,t}, Incsq_{i,r,t}, Inequ_{r,t}, Inequ_{r,t}*Rank_{i,r,t}, Rwage_{r,t}, Travel_{r,t}, \mathrm{X}_{i,r,t}) \quad (4)$$

$$P(BD_{i,r,t}=1)=\Phi(MBD_{r,t-1}, Inc_{i,r,t}, Incsq_{i,r,t}, RD_{i,r,t}, Rwage_{r,t}, Travel_{r,t}, \mathrm{X}_{i,r,t}) \quad (5)$$

where $BD_{i,r,t}$ denotes whether or not a household *i* in village *r* donates blood at time t. $Rwage_{r,t}$ denotes the ratio of local wage to blood donation compensation for each village r at time t. $Travel_{r,t}$ denotes travel time from each village to the local blood bank, which captures non-money blood donation cost.[15] $\mathrm{X}_{i,r,t}$ is composed of a set of household and village control variables, including household head's gender, age, education, ethnicity, cadre and party membership, share of the elderly in the households, year and village fixed effects. Shocks, such as family member death, serious diseases, natural disasters, and livestock death, are included. Blood donation compensation is excluded from measures of income, inequality, and relative deprivation.

[14] We assume that individual behavior varies with the median feature of group behavior. It is close to the real world that people normally follow the general public around them.

[15] Blood donation behavior is usually concentrated where local transportation condition permits. Even in an administrative village, transportation condition varies a lot among natural villages. In natural villages with better road access, farmers use carts to transport people to the county seat and the nearby blood bank, while for ethnic minority groups living in the mountains, people are generally unable to regularly donate blood.

$Inc_{i,r,t}$ denotes household per capita income i in village r at time t, and $Incsq_{i,r,t}$ represents its square term.[16] Some people may believe that frequent blood donation is the consequence of low income and poverty, so $Inc_{i,r,t}$ is defined to test this hypothesis. The square term $Incsq_{i,r,t}$ is also included to capture potential concave relationship between per capita income and blood donation, since marginal increase in probability of blood donation might decrease with income to a certain level before going negative.

Studies exploring the effects of aggregate income and income inequality on aggregate outcomes often find significant impact of income inequality. Household-level studies that control for household income, in contrast, may not show a relationship between income inequality and outcome at all. The convex relationship between income and outcome might erroneously appear as a causal relationship between inequality and outcome. Controlling for income and its square at the household level is vital to identifying the concave effect of income as well as impact of inequality.

Inequality may lead to instability in social capital through rising mistrust and stress or declining social cohesion, which expose households at the risk of self-financing when faced with shocks. Meanwhile, relative income may be of great importance to determine an individual's access to local resources that are scarce within a backward community. These possible concerns might drive people to climb social ladders through exchanging blood for cash.

The first specification includes a community specific measure of income inequality $Inequ_{r,t}$, the Gini coefficient, to test whether severe inequality within a society leads to more blood donation participation, holding absolute income constant. The hypothesis suggests that inequality affects all members in a society equally, irrespective of their social rankings.

A further hypothesis states that inequality has more harmful effects on blood donation towards people in a lower social hierarchy.[17] In the first specification, $Inequ_{r,t} * Rank_{i,r,t}$ is adopted to test this hypothesis. A positive coefficient is expected if the hypothesis is proved.

[16] If a person is turned away because he/she looks sick, this could simultaneously affect his/her income as the same appearance makes them look ill. Though it is believed that very few people were ever turned back from donating blood, it should be better to replace income with predicted wages from a mincerian type wage equation.

[17] The impact of inequality on blood donation may be further complicated due to the fact that a more unequal income distribution might reduce stress, distrust and the resulting blood donation among the middle class but aggravate it in the two tails of the distribution. Meanwhile, heterogeneity might take effect that some people are highly competitive and others are conformists, and people differ in their pride and compassion towards the poor around them.

However, since rank does not include information on exact income disparity among households in a group other than an ordinal ranking, neither does it reflect income inequality across groups, major relative deprivation indexes $RD_{i,r,t}$ (e.g. Wildman, 2003b; Deaton, 2001) are utilized in the second specification to test the effect of inequality with cardinal feature. Overall, relative deprivation measures aid us in more accurately testing whether an individual's income relative to others in the reference group, rather than relative position, matters to blood donation.

In (4) and (5), we also explore the effect of social interactions on blood donation decision, besides the abovementioned effects of relative income measures. To improve the empirical identification of the effect, two strategies are implemented: one, median blood donation participation rate in the natural village[18] $MBD_{r,t-1}$ is instrumented by prior period average income and other parameters that may affect this choice, such as the distance of major clinics; two, network data based on long-term gift exchanges within and between villages are collected to identify the effect of social interactions, which directly addresses the identification problem.

In other scenarios, $BD_{i,r,t}$ denotes values of blood donation (Appendix III-1) or share of family members donating blood. Correspondingly, $MBD_{r,t-1}$ denotes median values of blood donation (Appendix III-1) or mean number of family members donating blood.

$$P(BD_{i,r,t}=1)=\Phi(Cen_{r,t}, Inc_{i,r,t}, Incsq_{i,r,t}, Inequ_{r,t}, Inequ_{r,t}*Rank_{i,r,t}, Rwage_{r,t}, Travel_{r,t}, \mathrm{X}_{i,r,t}) \quad (6)$$

$$P(BD_{i,r,t}=1)=\Phi(Cen_{r,t}, Inc_{i,r,t}, Incsq_{i,r,t}, RD_{i,r,t}, Rwage_{r,t}, Travel_{r,t}, \mathrm{X}_{i,r,t}) \quad (7)$$

In (6) and (7), the blood donation participation, values of donation or share of family members donating blood serve as dependent variables $BD_{i,r,t}$. Different measures of centrality $Cen_{r,t}$ are based on a long-term gift-exchange network that incorporates the information on whether gift senders donate blood and/or how much they donate. It is believed that relatives, friends and neighbors of varying closeness should differ in their impacts against targeted households. Their different impacts can be characterized by whether any gift link exists for each pair of households and the values of gifts, since gift-exchange accounts for a large share of expenditure in the poor region and should be a good proxy for closeness.

In Table 8 six measures of centrality are utilized to capture their effects on blood donation participation. Measure 1 is a normalized centrality measure weighted by whether a gift sender is

[18] The household's blood donation is excluded from calculating median level blood donation in the reference group.

also a blood donor. Measure 2 differs from Measure 1 in that it treats gift-exchange in each year as a complete network. Measure 3 utilizes values of gifts to calculate centrality and weights them by whether a gift sender is also a blood donor. Measure 4 through Measure 6 respectively follow the same logic in calculating centrality but weight them by values of blood donation. In Table 9, the four centrality measures include Measure 2, Measure 1, Measure 5 and Measure 4.

Table 10 presents the effect of social interactions and relative incomes on share of family members donating blood (i.e. blood donation intensity). The estimations follow (6) and (7), and the centrality measures follow Measure 2 and Measure 5 but weighted by the number of family members donating blood in the gift senders' family.

In the Appendix, tobit estimations for values of blood donation are laid out, which follow the same identification strategies and measures of centrality.[19] Compared to number of family members donating blood, they both measure intensity of blood donation. The local blood donation regulation strongly discourages people from quitting, and they easily rely on this activity once participate in. The regulation also limits frequency of donation and compensation each time. Therefore, the major difference in the value of blood donation is reflected by the number of family members that donate blood. However, value of blood donation is not as accurate, which makes number of family members donating blood an excellent proxy. Total values of blood donation are generally estimated according to compensation each time, frequency of donation and number of family members donating blood. For one thing, part of the differences in values of blood donation comes from including/excluding travel costs and the resulting donation compensation. For another, each year some households start to donate while some quit, which is reflected in the values of blood donation. Therefore, estimations on values of blood donation complement estimations on share of family members donating blood.

5. EMPIRICAL RESULTS

Table 7 provides us with empirical test of blood donation decision using full sample data from 2004, 2006 and 2009 survey. Binary choice model estimations explore factors influencing whether a household donate blood or not. Simple logit estimations are implemented from column I to IV, and column V and VI further instrument median blood donation participation rate in the

[19] Since zero values are dominant, percentage change in donation value between 2004 and 2006 is not defined. Thus, we use level rather than log value as suggested by Wooldridge (2001).

natural village by travel time to the local hospital and average income for the prior period in the natural village to estimate its impact on household blood donation participation. The results consistently show its significantly positive effect, i.e. the more households around donate blood, the more likely this household follows. Both inequality and relative income measures show more pressure towards households in the lower social hierarchy, which is consistent with column I to VI that the rank-Gini interactive term and major relative deprivation indexes are positively significant. The official stipulation prohibits the elderly from donating blood, which corresponds to their significantly lower probability of donation in our estimation. Both 2006 and 2009 have seen decreasing trend of blood donation compared to 2004, however, the trend is not significant in the IV estimations. Moreover, the trend is less salient for 2009 than 2006, which shows somewhat recovery of local blood market from the blood contamination incident in 2006.

Table 8 and Table 9 utilize gift-based network data from a sub-sample of three villages to identify the effect of social interactions. In Table 8, social interactions in all columns, measured by blood donation and weighted by classical centrality, show significantly positive impact on a household's blood donation. Meanwhile, it is important to note that the classical community-specific Gini coefficient has no significant impact on blood donation. Even if Gini coefficient is interacted with rank to measure the heterogeneous pressure in the distribution, it is still insignificant. However, this does not mean that a more unequal society has no significant effect on blood donation. To the contrary, deeper economic stratification drives people at the bottom to exchange more blood for money. In all scenarios in Table 9, social interactions significantly induce households to engage in blood donation. Concerning relative income measures, both household-specific Deaton and Wildman relative deprivation indexes significantly predict blood donation, verifying the linkage between status concern and blood donation. One exception is the rank measure. It is predictably insignificant as it does not include any information on how far in terms of income a household is from the richer households, which is the core of relative deprivation measures. Accordingly, neither the interactive term between rank and Gini coefficient captures income shortfall and the resulting feeling of relative deprivation.

As argued that compensation from blood donation may suffer from various errors, share of family members who donate blood serves to proxy the intensity of blood donations within a household. Table 10 compares results for full-sample estimation with sub-sample estimation. In the full sample estimation, mean number of blood donors for a household in a village is instrumented by travel time to the major clinics nearby. Centrality in the sub-sample estimations, measured by number of blood donors in a household and weighted by network connections, is used to identify the effect of social interaction. In all scenarios applying either of the two identification strategies, social interactions impose significantly positive impact on the share of family members donating blood. Once again, higher values of all measures of relative incomes significantly lead to higher share of family members donating blood.

Minority status should not lead to lower blood donation upon controlling for major factors (such as travel time to the local blood bank) and well identify social norm. Most ethnic minority groups live in the mountains region due to their traditional culture and historical conflict with the Han group. The geographic condition, rather than their ethnic identities, prevents them from climbing down and donating blood. It is also found that residents in more developed regions are less likely to donate blood, which might be caused by more work opportunities available, though there also presents easy access to the local blood bank.

Throughout all estimations the ratio of local wage in the busy season to blood donation compensation is insignificant, which is also true when wage in the busy season is replaced by wage in the slack season. It is consistent with the situation that blood donation compensation has been much larger than market wage for a long time period. Meanwhile, since 2007 the blood donation compensation has nearly doubled. As a result, rapid wage increase in the recent years does not offset blood donation. The much more attractive short term payoff from blood donation binds the local labor market.

Shocks such as family member death[20], big disease, natural disaster, livestock death, and major stealing do not drive people into donating (more) blood, even if we combine all shocks together as one dummy variable. It suggests that blood donation compensation may have special usage, such as positional competition, extending informal social network, and cigarette and wine consumption.

Before panel data model estimations, Hausman tests for fixed/random effect are conducted. Results consistently show that random effect suits the data better, since households' blood donation variations over time are small, while cross-sectional variations are much higher. In

---

[20] It is true in some cases that family member death can be out of expectation, while in other cases, such as in the traditional Chinese culture with rooted tradition to save, family members die in old ages with large amount of precautionary savings paying for funeral fees and possible medical treatment. Meanwhile, people exchange gifts in social events such as weddings, funerals, college entry, and house building (Table 5). Therefore, sometimes we may observe that shock and social event occurrences are smoothed without significant impact on blood donation.

other words, between effects are much larger than within effects. Therefore, random effect models are adopted. After random effect estimation, serial correlation test for the random effect model are conducted, and we cannot reject the null hypothesis that no significant serial correlation exists. It is reasonable that the survey only spans for six years.

In Appendix III, factors influencing value of blood donation are tested. Column I through IV apply simple tobit model, while column V and VI further instrument median blood donation participation rate in the natural village by travel time to the local hospital and average income for the prior period in the natural village to estimate its impact on household blood donation value. The median value of blood donation from the peers still significantly increases this household's donation value, as more donation around means less ethical concern for blood donation itself. Table 11 verifies the effect of network-based social interactions on blood donation value. Meanwhile, neither Gini coefficient nor Deaton RD index saliently predicts donation value.

6. CONCLUSIONS AND FURTHER DISCUSSIONS

Recent evidence from developing countries has shown that relative concern over the others matters. For one thing, highly unequal income distribution in a society may lead to instability in social capital through rising mistrust and stress or declining social cohesion, which expose households at the risk of self-financing when faced with shocks. Relative income may be of great importance in determining an individual's access to local resources that are scarce within a backward community; for another, though considered a vehicle facilitating social networks and an attempt to gain higher social status in the environment without formal insurance, too many resources allocated to positional goods might contribute to an overall welfare loss. The fact that "positional externalities" compel villagers to spend lavishly in festivals, funerals, gift giving, house building and weddings to avoid been isolated from local social networks is thus a problem that is particularly acute for households living close to subsistence.

Is there a pathway through which social interactions and concerns for relative income affect blood donation decisions? Though considered a social stigma, more people in the reference group donate blood often leads to less moral concern and more followers. Therefore, the behavior is likely to be influenced through one's interactions with neighbors, friends and relatives. Meanwhile, relative income may affect the motives for blood donation through increasing mistrust and stress. The motives might be stronger for households of lower social rankings.

Utilizing three-wave census-type panel data in 18 villages in rural western China, two identification strategies, instrumental variable and network-based identification, are implemented to estimate the effect of social interactions. Both community-specific and household-specific relative income measures are employed to test whether blood donation is more sensitive towards the less well-off in a society. Because of close ties among friends, relatives and neighbors, isolation from outside market, mountainous geographic conditions among villages, and rapid economic and social transformation with worsening inequality, the region for our study serves as an excellent destination to observe relative concern and social behavior in readily identifiable reference groups.

Empirical results show consistent evidence for the effects of social interactions, no matter whether instrumental variables or network centrality measures are adopted. Household-specific measures of relative income show more salient effects on blood donation than community-specific inequality. The significance of household-specific measures warns us that if we do not incorporate the idea of these measures, redistribution policies might be deviated to the wrong route.

Future directions might include: one, fellow residents and cadres may impose different influences on a household's blood donation decision. In the literature, the former is social pressure, while the latter is social imitation. We might consider separately indentify the two social interactions; two, we will consider identifying direct effect of gift-giving over blood donation. To achieve that, big events such as birth, marriages and funerals could serve as instruments for give giving; finally, if people were ever turned back from donating blood because they look sick, this could simultaneously affect their incomes as the same appearance makes them look ill. To get around this potential concern, we consider replace income with predicted wages from a mincerian type wage equation.

REFERENCES

Anagnost, S. 2006. “Strange Circulations: the Blood Economy in Rural China,” *Economy and Society*, 35:4, 509-529.

Anderson, S., 2007. “The Economics of Dowry and Bride Price.” *Journal of Economic Perspectives* 21(4): 151-74.

Anselin, L., R. Florax and S. Rey. 2004. “Advances in Spatial Econometrics. Methodology, Tools and Applications.” Berlin: Springer-Verlag.

Arrow K. 1972. “Gifts and Exchange,” *Philosophy and Public Affairs*, 1, 4, pp. 343-362.

Asia Catalyst. 2007. “AIDS Blood Scandals: What China Can Learn from the World’s Mistakes,” *Research Report*, September.

Banerjee, A. V. and E. Duflo. 2007. “The Economic Lives of the Poor,” *Journal of Economic Perspectives* 21(1):141-167.

Basu, K. 2001. “Sexual Harassment: A Study of Coercion and Voluntariness,” Mimeo, Cornell University.

Bonacich, P. 1987. “Power and Centrality: A Family of Measures.” *The American Journal of Sociology*, Vol. 92, No. 5. pp. 1170-1182.

Bowles, S. and Y. Park. 2002. “Emulation, Inequality, and Work Hours: Was Thorstein Veblen Right?” Santa Fe Institute mimeograph.

Brown, P., E. Bulte, and X. Zhang. 2008. “Positional Spending and Status Seeking in Rural China,” unpublished working paper.

CHAIN, 2006: “Mai Xue Lao Ren De Yan Lei He Wei Sheng Guan Yuan De Bao Ma: Guizhou Sheng ‘Xue Jiang Jing Ji’ You Si,” (in Chinese), http://www.chain.net.cn.

Chakravarty, S. R. 1990. “*Social Ethical Index Numbers*,” Springer, Berlin, 1990.

Chen. X. and X. Zhang, 2009. “Blood for Social Status: A Tale of Three Villages in Rural China,” Paper presentation at Agricultural & Applied Economics Association (AAEA) 2009 Annual Meeting, Milwaukee.

Clark, A. and A. Oswald. 1996. “Satisfaction and Comparison Income,” *Journal of Public Economics*, 61, pp. 359-381.

Deaton, A. 2001. “Relative Deprivation, Inequality, and Mortality,” *NBER Working Paper* #8099, Cambridge, MA: National Bureau of Economics Research.

Deaton, A. 2003. “Health, Inequality, and Economic Development,” *Journal of Economic*

Literature 41, 113-58.

De Brauw, A. and S. Rozelle. 2008. "Migration and household investment in rural China," *China Economic Review*, Elsevier, vol. 19(2), pages 320-335, June.

Dekker, M. and H. Hoogeveen. 2002. “Bridewealth and Household Security in Rural Zimbabwe,” *Journal of African Economies* 11(1): 114-145.

Duesenberry, J. 1949. “*Income, Saving, and the Theory of Consumer Behavior,”* Cambridge, Mass.: Harvard University Press.

Easterlin, R. 1974. “Does Economic Growth Improve the Human Lot? Some Empirical Evidence,” in *Nations and Households in Economic Growth*, ed. by David, P. and Reder, M., pp. 89-126. Academic Press, New York.

Fafchamps, M. and F. Shilpi. 2008. "Subjective welfare, isolation, and relative consumption," *Journal of Development Economics*, Elsevier, vol. 86(1), pages 43-60, April.

Frank, R. 1985. “*Choosing the Right Pond*,” New York: Oxford University Press.

Frank, R. 1997. “The Frame of Reference as a Public Good,” *The Economic Journal*, 107: 1832-1847.

Frank, R. and A. Levine. 2008. “Expenditure Cascades**,”** working paper, Cornell University.

Freeman, L. 1979. “Centrality in social networks: Conceptual clarification.” *Social Networks*, Vol. 1, 215-239.

Gerdtham, Ulf-G., Johannesson, Magnus, 2004. “Absolute income, relative income, income inequality, and mortality,” *Journal of Human Resources* 39 (1), 228–248.

Goto, Hideaki. 2009. “Social Norms, Distributional Shifts of Adult Labor Efficiency, and Child Labor,” *Working Paper #16*, National Graduate Institute for Policy Studies, Japan.

Jackson, M. 2008. “Social and Economic Networks,” Princeton University Press.

Kanbur, R. 2004. “On Obnoxious Markets,” in S. Cullenberg and P. Pattanaik (editors), *Globalization, Culture and the Limits of the Market: Essays in Economics and Philosophy*. Oxford University Press.

Kempen L. 2003. “Status consumption and ethnicity in Bolivia: evidence from durables ownership,” *International Journal of Consumer Studies*, vol. 31, Issue 1, 76-89.

Li, H., and Y. Zhu. 2006. “Income, Income Inequality, and Health: Evidence from China,” *Journal of Comparative Economics*, vol. 34, Issue 4, 668-693.

Ling, D. 2009. “Do the Chinese ‘Keep Up with the Joneses’? Implications of Growing Economic Disparities and Relative Deprivation on Health Outcomes among Older Adults in China,” *China Economic* Review, vol. 20, Issue 1, 65-81.

Liu, X. 2000. “*In One’s Own Shadow: An Ethnographic Account of the Condition of Post-Reform China*,” Berkeley: University of California Press.

Luttmer, E. 2005. “Neighbors as Negatives: Relative Earnings and Well-Being,” *Quarterly Journal of Economics* 120: 963-1002.

Manski, C.F. 1993. “Identification of Endogenous Social Effects: The Reflection Problem.” *Review of Economic Studies* 531-542.

Manski, C. 2000. “Economic Analysis of Social Interactions,” *Journal of Economic Perspectives*, American Economic Association, vol. 14(3), 115-136.

Neumark, D. and A. Postlewaite. 1998. “Relative income Concerns and the Rise in Married Women’s Emplyment,” *Journal of Public Economics*, 70, pp. 157-183.

Rao, V. 1993. “The Rising Price of Husbands: a Hedonic Analysis of Dowry Increases in Rural India,” *Journal of Political Economy,* 101: 666-677.

Rawls, J. 1971. “*A Theory of Justice*,” Cambridge, MA: Harvard University Press.

Runciman, W.G. 1966. “*Relative Deprivation and Social Justice,”* London: Routledge & Kegan Paul.

Sen, A. 1983. Poor, relatively speaking, *Oxford Economic Papers*. New Series, Vol. 35, No. 2, pp. 153-169.

Sen, A. 1985. “The Moral Standing of the Market,” in Paul, E.F., Miller, F.D. Jr, Paul, J. (Eds), *Ethics and Economics*, Basil Blackwell, Oxford.

Shao, J. 2006. “Fluid Labor and Blood Money: The Economy of HIV/AIDS in Rural Central China,” *Cultural Anthropology,* Volume 21 Issue 4, 535-569.

Solnick, S. and D. Hemenway. 1998. “Is More Always Better? A Survey on Positional Concerns,” *Journal of Economic Behavior and Organization*, 37(3), 373-383.

Stark, O. and J.E. Taylor. 1991. “Migration incentives, Migration Types: The Role of Relative Deorivation,” *Economic Journal* 101: 1163-11178.

Steiner, P. 2003. “Gifts of Blood and Organs: the Market and “Fictitious” Commodities,” *Revue française de sociologie*, Volume 44, 147-162.

Stutzer, A. 2004. “The Role of Income Aspirations in Individual Happiness,” *Journal of Economic Behavior and Organization* 54(1): 89-110.

The Economist. 2007. “Can Ghanaians afford such splendid funerals?” May 24.

Titmus, R. 1970. “*The Gift Relationship*,” Allen and Unwin, London UK; Reprinted 1997., LSE Books, London, UK.

Van de Stadt, H., A. Kapteyn, and S. Van de Geer. 1985. “The Relativity of Utility: Evidence from Panel Data,” *Review of Economics and Statistics*, 67(2), pp. 179-187.

Veblen, T. 1899. “*The Theory of the Leisure Class*,” MacMillan, New York.

Wildman, J. 2003a. “Modeling Health, Income and Income Inequality: the Impact of Income Inequality on Health and Health Inequality,” *Journal of Health Economics,* 22: 521-538.

Wildman, J. 2003b. “Income Related Inequalities in Mental Health in Great Britain: Analyzing the Causes of Health Inequality over Time.” *Journal of Health Economics,* 22: 295-312.

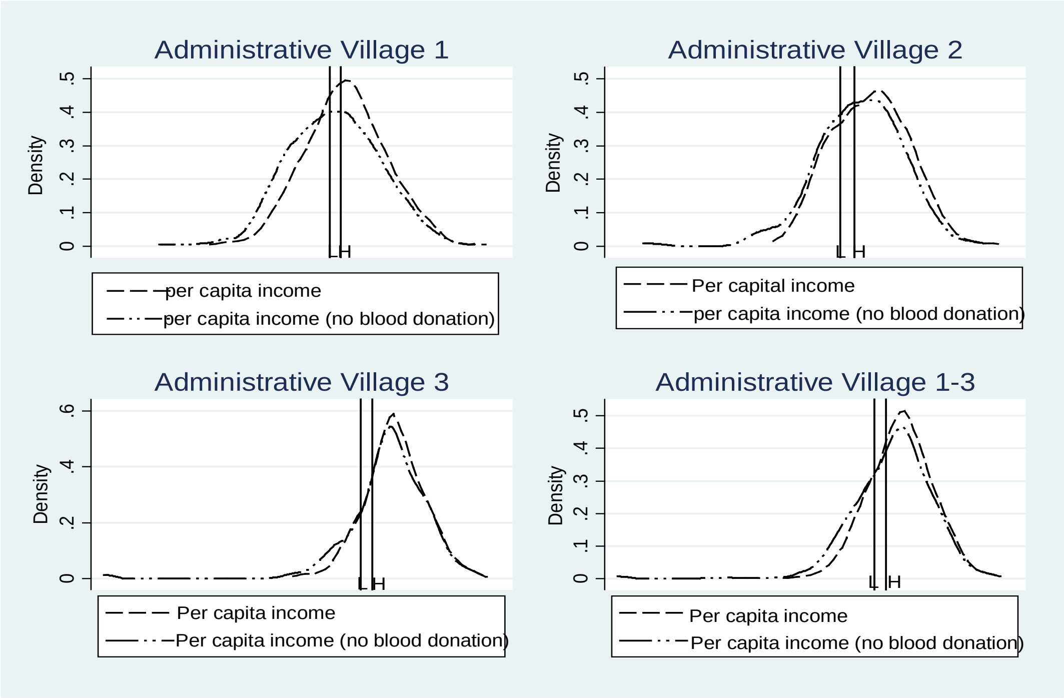
Xing, L., S. Fan, X. Luo, and X. Zhang. 2006. “Village Poverty and Inequality in Western China,” *DSGD discussion papers No. 31,* International Food Policy Research Institute (IFPRI).

Yan, Y. 1996. “*The Flow of Gifts: Reciprocity and Social Networks in a Chinese Village,*” Stanford: Stanford University Press.

Yin, H. 2006. “Guizhou Xuejiang Jingji Yousilu: An Alarming Chronicle of ‘Blood Plasma Economy’ in Guizhou Province,” *Nanfengchuang* (in Chinese), http://www.nfcmag.com/ReadNews.asp?NewsID=5831.

Yitzhaki, S. 1979. “Relative Deprivation and the Gini Coefficient,” *Quarterly Journal of Economics* 93(2), 321-24.

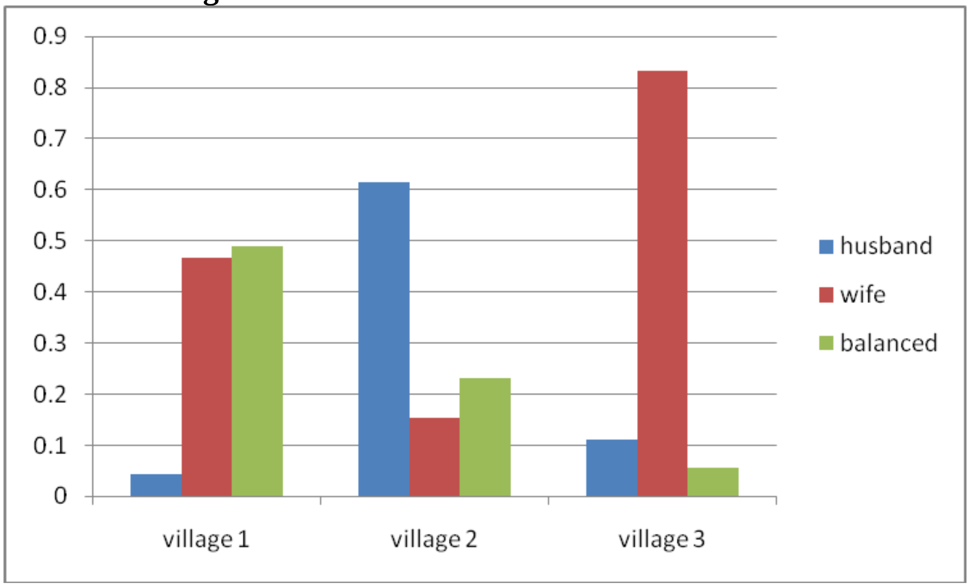
Figure 1 Distribution of Per Capita Income Including/ Excluding Blood Donation



Source: Authors' 2004 survey data

Note: Two vertical lines, "L" and "H", refer to the low (668RMB) and high (892RMB) poverty lines.

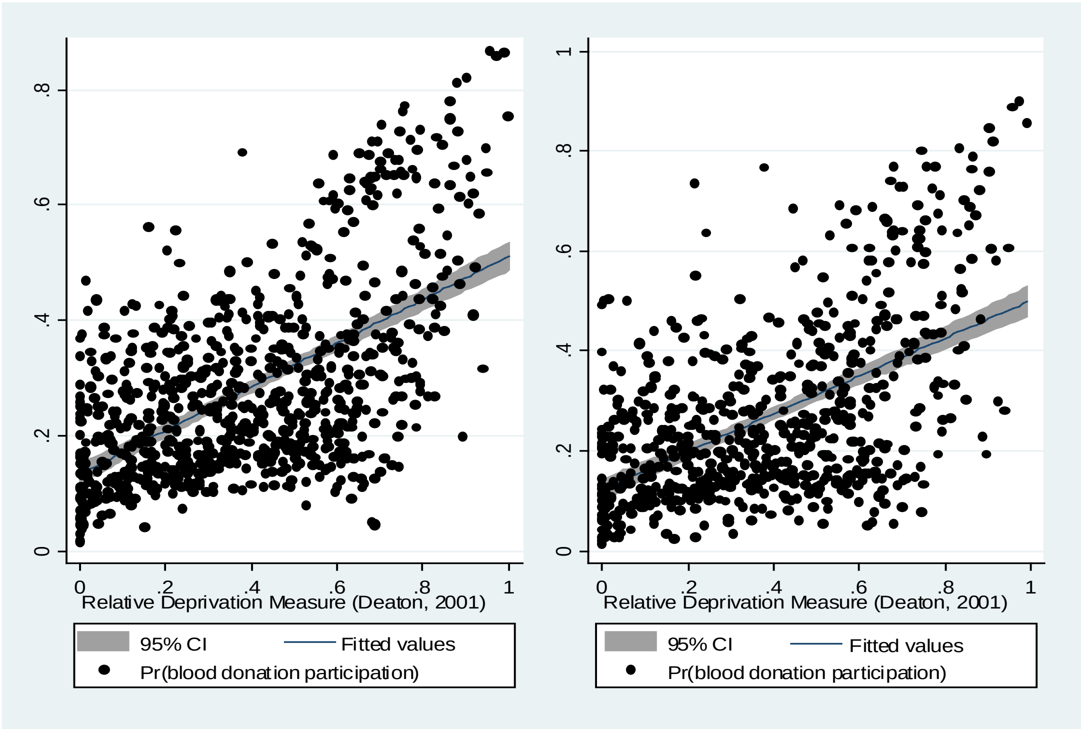
Figure 2 Division of Labor in Blood Donation



Source: Authors' 2009 survey data

Note: The three bars in each group correspond to "mainly husband (or male members) donates blood", "mainly wife (or female members) donates blood", and "husband (or male members) and wife (or female members) donate equally donate blood". The pattern reflects different labor market situation in three villages.

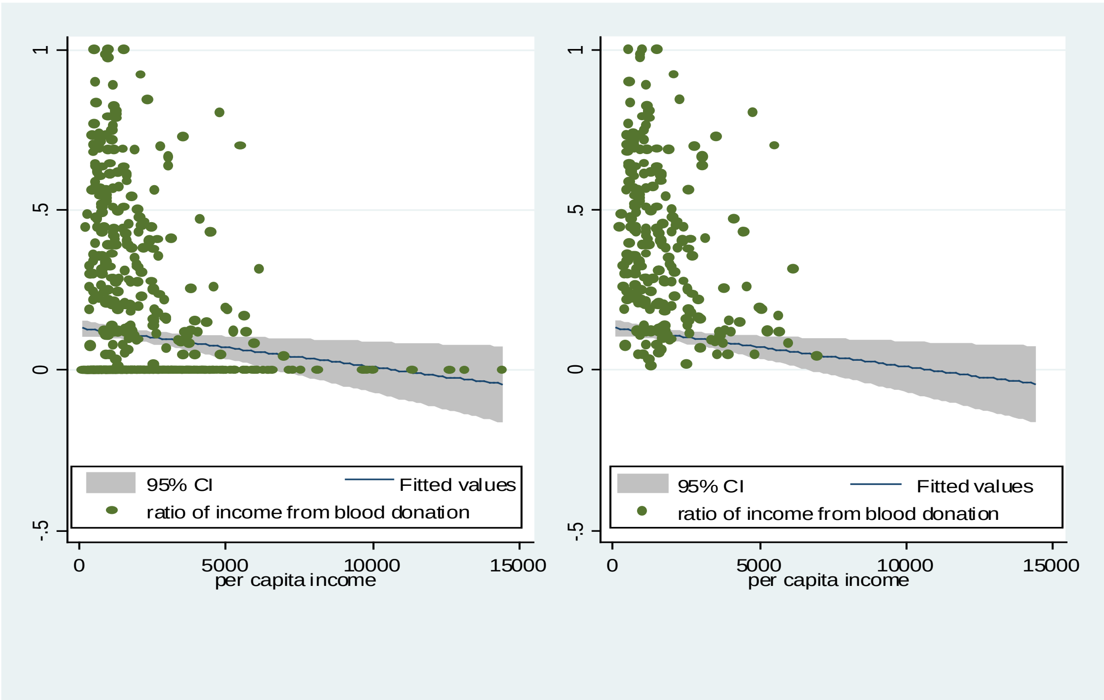
Figure 3 Relative Deprivation and Blood Donation Participation



Source: Authors' survey data

Note: The left figure and right figure respectively show their relationship using equation (7) without / with potential effects of shocks and social events.

Figure 4 Income Ratio of Blood Donation and Per Capita Income



Source: Authors' survey data

Note: The left figure includes households that do not donate blood.

Table 1 Summary Statistics by Three Administrative Villages

	Village 1	Village 2	Village 3	Total
Number of natural villages	9	5	4	18
Distance to county seat (km)	10	8	2.5	6.8
Number of households	257	151	393	801
Total population	1089	535	1449	3073
Share of minority households (%)	76.6	12.6	6.7	30.8
Share of household members aged 60 and above (%)	14.2	17.9	12.5	14.1
Share of households with migrants (%)	30.7	55	43.3	41.4
Share of household members who migrate (%)	12.3	13.5	12	12.4
Male head of household (%)	93.5	94.8	91.6	92.8
Education of household head (years)	2.87	3.06	3.98	4.44
Household average year of schooling	2.19	2.67	3.67	2.97
Per capita cultivated land (mu)	0.87	0.86	1.1	0.98
Percentage of flat land (%)	40	20.7	80	53.4
Land rental rate (Yuan per mu)	30	50	100	60
Share of households with TV (%)	39.3	39.7	61.6	50.3
Share of households with bicycles or motorcycles (%)	2.3	3.3	19.3	10.9
Share of households with phones (%)	8.9	15.2	23.4	17.2
Having difficulty with access to drinking water	79.4	80.1	39.2	59.9
Share of households with local non-farm jobs (%)	49.5	43.7	66.5	56.6
Share of households with self-employment (%)	7.4	3.3	7.4	6.6
Share of households with blood donations (%)	40.9	29.1	19.6	28.2

Source: Authors' survey data

Table 2 Poverty and Income Inequality by Three Administrative Villages (2004-2009)

	Admin Village 1			Admin Village 2			Admin Village 3			Total		
	2004	2006	2009	2004	2006	2009	2004	2006	2009	2004	2006	2009
Per capita annual income (RMB)	1009	1111	1262	1274	1638	1655	1749	2420	2442	1404	1817	1907
Income inequality (Gini)	42.4	45.3	46.5	42.3	52.0	61.8	40.2	42.8	50.9	43.1	48.2	55.2
Income inequality excluding blood donation (Gini)	46.6	46.9	47.4	44.7	52.5	63.5	42.4	43	51.4	46.3	49	56.6
Income below low poverty line of 668 RMB (%) (P0)	37.6	37.9	20.5	30.1	32.4	23.5	13.2	12.6	9.1	24.8	25.1	15.3
poverty-gap below low poverty line (P1)	14.2	15.4	8.8	9.2	11	11.6	4.4	4.3	4.5	8.7	9.4	7.1
squared poverty-gap below low poverty line (P2)	7.2	8.9	5.4	3.7	5.5	7.9	2	2	3.3	4.1	5.1	4.7
Income below high poverty line of 892 RMB (%) (P0)	54.1	52.5	30.7	41.1	44.1	33.3	23.4	21.1	13.1	37.3	36.3	22.4
poverty-gap below high poverty line (P1)	22.4	23.3	13	15.8	17.9	16.1	8.1	7.5	6.1	14.5	15	10.1
squared poverty-gap below high poverty line (P2)	12.2	13.6	7.8	7.7	9.6	10.5	3.9	3.7	4.2	7.5	8.3	6.4

Source: Authors' survey data

Table 3 Income and Consumption by Three Administrative Villages (2004-2009)

	Admin Village 1			Admin Village 2			Admin Village 3			Total		
	2004	2006	2009	2004	2006	2009	2004	2006	2009	2004	2006	2009
Main Sources of Income (Percent)												
Farming	26.3	26.7	23.7	31.0	37.4	29.5	37.0	31.5	26.1	33.3	31.4	33.1
Livestock	12.3	13.3	13.1	9.1	10.9	10.8	6.0	3.4	2.1	8.1	6.8	6.9
Local non-farm and self-employment	18.2	13.8	13.1	6.4	16.7	13.9	32.3	39.9	35.0	24.0	30.0	23.8
Remittance from migrants outside the county	7.8	22.4	11.6	10.9	10.2	9.4	7.3	10.7	6.6	8.0	13.1	8.8
Disaster relief, anti-poverty programs, deforestation subsidies	5.1	2.9	6.1	2.5	6.9	5.8	1.9	0.5	4.8	2.8	2.0	5.4
Gift income	3.2	4.5	4.7	11.7	11.6	8.4	4.9	11.1	10.7	5.6	9.1	8.2
Blood donation income	13	4.6	7.2	15.7	1.7	4.7	7.6	0.7	1.6	10.9	2.2	4.1
Main Expenditures (Percent)												
Food	53.8	51.1	48.1	47.1	42.9	36.5	45.4	38.5	34.3	47.8	42.2	35.5
Clothing	4.4	4.4	4.6	3.1	3.7	4.1	4.0	4.9	4.1	4.0	4.6	4.2
Fuel	5.9	6.4	6.7	5.4	6.9	7.3	10.2	9.5	8.0	8.4	8.3	7.5
Telephone	1.1	2.1	5.3	1.3	2.4	3.8	1.5	3.5	6.4	1.4	3.0	5.5
Medical care	14.1	16.7	15.1	24.7	16.8	16.9	15.2	15.2	11.2	16.4	15.8	13.5
Education	9.0	10.0	9.6	7.9	12.2	14.0	8.8	12.3	14.1	8.7	11.7	12.9
Gift and festival spending	6.4	9.2	10.1	6.8	13.9	16.1	8.9	15.9	17.5	7.9	13.9	15.2

Source: Authors' survey data

Table 4 Number of Household Members Donating Blood by Three Villages (2009)

Admin Village	No Blood Donor	One Blood Donor	Two Blood Donors	Total # Households
1	257	23	22	302
2	134	10	3	147
3	405	17	1	423
Total # Households	796	50	26	872

Source: Authors' survey data

Table 5 Gift Expenditure and Blood Donation Compensation by Three Villages (2004-2009)

	Admin Village 1			Admin Village 2			Admin Village 3			Total		
	2004	2006	2009	2004	2006	2009	2004	2006	2009	2004	2006	2009
Participation rate in donating blood (%)	40.9	12.8	18.1	29.1	5.7	9.3	19.5	3.8	4.6	28.2	7.2	8.7
Mean per capita blood donation (RMB)	197	56.6	178.0	235.5	22.4	93.7	113.4	11	33.0	163.2	28.6	93.8
Cash compensation (nutrition subsidy) for blood donation (per 500cc)	80	80	150	80	80	150	80	80	150	80	80	150
Participation rate in gift giving (%)	59.1	85.1	95.0	57	91.8	94.8	66.7	95.4	97.0	62.4	91.2	96.0
Median per capita gift expenditure (RMB)	16	62.5	125	20	150	200	80	250	571.4	33.3	150	300
Median gift to direct relatives (RMB per occasion)	30	50		30	50		50	100		40	60	
Median gift to friends/neighbors (RMB per occasion)	10	20	40	15	30	50	25	50	80	20	30	50
Times of Sending out gifts	-	13.6	11.0	-	8.4	13.8	-	11.1	23.1	-	11.4	17.6

Source: Authors' survey data

Table 6 Median Marriage and funeral Expenditures (RMB) (1996-2009)

Year	Wedding: Groom's Family				Wedding: Bride's Family			Funeral
	Brideprice	Gift to bride	Ceremony	Total Expenditure	Dowry	Ceremony	Total Expenditure	Total Expenditure
1996	2500	2000	2000	6500	0	1000	1000	1750
1997	3000	1800	2000	6800	1000	0	1000	3000
1998	3500	2000	2250	7750	1100	500	1600	3000
1999	2000	1800	2000	5800	300	0	300	3200
2000	3000	2000	2500	7500	2000	150	2150	3000
2001	3000	3000	3000	9000	2000	0	2000	3000
2002	4800	4250	2400	11450	400	0	400	2850
2003	3000	3500	3000	9500	1900	500	2400	3850
2004	8000	2500	3500	14000	-**	-**	-**	6000
2005	9500	5250	3700	18450	2000	0	2000	5000
2006	8800	5600	3750	18150	2250	3500	5750	5000
2007	1000	10750	5500	17250	2000	4000	6000	7100
2008	1000	12000	6500	19500	2000	4000	6000	9180
2009	1000	12000	6200	19200	1600	4000	5600	7400

Source: Authors' survey data
** Using Recall data from the 2007 survey and 2009 survey.*
*** No wedding was held for that category during that year.*

Table 7 Effect of Social Interactions and Relative Income on Blood Donation Participation (Full Sample, 2004-2009)

	I logit	II logit	III logit	IV logit	V IV+probit	VI IV+probit
Median blood Donation Participation Rate	1.238***	1.174***	1.148***	1.391***	4.452***	4.198***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Per capita income	-0.197***	0.217	-0.072	-0.147*	-0.007**	-0.02***
	(0.00)	(0.28)	(0.51)	(0.08)	(0.87)	(0.00)
Squared Per capita income	0. 003	-0.014	0.001	0.002	0.000	0.000
	(0.20)	(0.33)	(0.67)	(0.42)	(0.94)	(0.72)
minority	-0.941***	-0.982***	-0.990***	-1.052***	-0.158	-0.202
	0.00	0.00	0.00	0.00	(0.42)	(0.19)
Share of the elderly	-1.272***	-1.351***	-1.286***	-1.300***	-0.376**	-0.395**
	0.00	0.00	0.00	0.00	(0.02)	(0.01)
wage Blood compensation Ratio	1.158*	0.758	0.793	1.014	0.553***	0.573***
	(0.06)	(0.24)	(0.21)	(0.11)	(0.01)	(0.01)
Gini	-1.165				-2.653***	-2.609***
	(0.40)				(0.00)	(0.00)
Gini*rank	0.004*				0.004***	0.005***
	(0.06)				(0.00)	(0.00)
Deaton RD		1.974***				
		0.00				
Wildman RD			0.001**			
			(0.02)			
rank				0.003***		
				(0.01)		
year=2006	-2.174***	-2.052***	-1.950***	-2.079***	-0.319	-0.39
	(0.00)	(0.00)	(0.00)	(0.00)	(0.35)	(0.14)
Year=2009	-1.586***	-1.274***	-1.127***	-1.335***	0.15	0.063
	(0.00)	(0.00)	(0.00)	(0.00)	(0.67)	(0.81)
Observations	2448	2448	2448	2448	2448	2448

1. p values in parentheses
2. * significant at 10%; ** significant at 5%; *** significant at 1%
3. Blood donation compensation is excluded from measures of income, inequality, and relative deprivation. In column V and VI median rate of blood donation in the reference group is suspected to be endogenous and instrumented by travel time to the local hospital and average income for the prior period in the reference group.
4. Administrative village fixed effects, shocks (family member death, natural disaster, livestock death and big disease), household head characteristics (education, gender, marriage status, age, cadre and party membership), household characteristics (household size and travel time to the local blood bank) are included but not reported here.

Table 8 Effect of Network-based Identification of Social Interactions on Blood Donation Participation (Sub-sample, 2004-2009)

	I	II	III	IV	V	VI
	logit	logit	logit	logit	logit	logit
Centrality Measure 1	0.008*					
	(0.05)					
Centrality Measure 2		0.015***				
		(0.00)				
Centrality Measure 3			0.007*			
			(0.07)			
Centrality Measure 4				0.000**		
				(0.01)		
Centrality Measure 5					0.000***	
					(0.01)	
Centrality Measure 6						0.000*
						(0.06)
Per capita income	-0.172	-0.124	-0.186	-0.163	-0.152	-0.197
	(0.22)	(0.39)	(0.19)	(0.25)	(0.28)	(0.16)
Squared Per capita income	0.005	0.004	0.006	0.004	0.005	0.006
	(0.24)	(0.35)	(0.22)	(0.29)	(0.29)	(0.21)
Share of the elderly	-1.722*	-1.702*	-1.731*	-1.648*	-1.721*	-1.676*
	(0.07)	(0.07)	(0.07)	(0.08)	(0.07)	(0.08)
Gini	1.814	1.6643	1.576	2.880	3.891	0.612
	(0.59)	(0.46)	(0.67)	(0.40)	(0.35)	(0.88)
Gini*rank	-0.000	0. 003	-0.001	-0.000	0.001	-0.001
	(0.97)	(0.58)	(0.88)	(0.99)	(0.79)	(0.78)
wage Blood compensation Ratio	1.134	1.652	1.059	1.188	1.551	1.171
	(0.44)	(0.28)	(0.47)	(0.41)	(0.30)	(0.42)
year=2006	-2.451**	-3.096***	-2.409**	-2.519***	-2.977***	-2.449**
	(0.01)	(0.00)	(0.02)	(0.01)	(0.00)	(0.01)
Year=2009	-0.834*	-1.361***	-0.773	-1.190**	-1.585***	-0.866*
	(0.08)	(0.00)	(0.11)	(0.01)	(0.00)	(0.07)
Observations	618	618	618	618	618	618

1. p values in parentheses
2. * significant at 10%; ** significant at 5%; *** significant at 1%
3. Blood donation compensation is excluded from measures of income, inequality, and relative deprivation.
4. Definitions for the centrality measures can are on page 20.
5. Administrative village fixed effects, shocks (family member death, natural disaster, livestock death and big disease), household head characteristics (education, gender, marriage status, age, cadre and party membership), household characteristics (household size and travel time to the local blood bank) are included but not reported here.

Table 9 Effect of Network-based Identification of Social Interactions and Relative Income on Donation Participation (Sub-sample, 2004-2009)

	I logit	II logit	III logit	IV logit	V logit	VI logit	VII logit	VIII logit	IX logit	X logit	XI logit	XII logit
Centrality Measure 2	0.013***	0.013***	0.015***									
	(0.01)	(0.01)	(0.00)									
Centrality Measure 1				0.007*	0.007*	0.007*						
				(0.06)	(0.07)	(0.09)						
Centrality Measure 5							0.000**	0.000**	0.000**			
							(0.02)	(0.02)	(0.01)			
Centrality Measure 4										0.000**	0.000**	0.000**
										(0.03)	(0.03)	(0.02)
Per capita income	0.378	-0.093	-0.034	0.339	-0.066	-0.076	0.371	-0.112	-0.053	0.362	-0.103	-0.052
	(0.22)	(0.62)	(0.73)	(0.24)	(0.72)	(0.61)	(0.21)	(0.55)	(0.71)	(0.19)	(0.58)	(0.73)
Squared Per capita income	-0.009	0.001	0.003	-0.008	0.002	0.004	-0.009	0.001	0.004	-0.009	0.001	0.004
	(0.57)	(0.75)	(0.50)	(0.61)	(0.67)	(0.37)	(0.58)	(0.78)	(0.43)	(0.56)	(0.79)	(0.46)
Deaton RD	3.459***			3.252***			3.42***			3.354***		
	(0.00)			(0.00)			(0.00)			(0.00)		
Wildman RD		0.001*			0.001*			0.001*			0.001*	
		(0.05)			(0.07)			(0.07)			(0.09)	
rank			0.003*			0.002			0.003			0.003
			(0.10)			(0.35)			(0.23)			(0.26)
Observations	618	618	618	618	618	618	618	618	618	618	618	618

1. p values in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%
2. Definitions for the centrality measures can are on page 20.
3. Administrative village and year fixed effects, shocks (family member death, natural disaster, livestock death and big disease), natural village mean income, household head characteristics (education, gender, marriage status, age, cadre and party membership), household characteristics (household size, share of the elderly, and travel time to the local blood bank), and wage blood price ratio are included but not reported here.

Table 10 Effect of Network-based Social Interactions and Relative Income on Share of Family Members Donating Blood (2004-2009)

	I	II	III	IV	V
	Sub-sample		Full Sample		
Centrality Measure 7	0.000**	0.000**			
	(0.04)	(0.05)			
Mean number of family Members donating blood			1.647***	1.747***	1.805***
			(0.00)	(0.00)	(0.00)
Per capita income	0.012***	0.015***	-0.024	0.016	0.017
	(0.00)	(0.00)	(0.22)	(0.60)	(0.51)
Squared Per capita income	-0.000**	-0.000***	0.001	0.000	0.000
	(0.04)	(0.01)	(0.43)	(0.74)	(0.86)
Gini*rank	0.000		0.000		
	(0.15)		(0.82)		
Gini	-0.221**		0.738*		
	(0.03)		(0.06)		
Deaton RD		0.046*		0.295*	
		(0.08)		(0.07)	
Wildman RD					0.000**
					(0.05)
wage Blood compensation Ratio	0.021	0.018	-0.145	-0.205	-0.223
	(0.49)	(0.56)	(0.42)	(0.24)	(0.20)
Observations	618	618	2448	2448	2448

1. p values in parentheses
2. * significant at 10%; ** significant at 5%; *** significant at 1%
3. Blood donation compensation is excluded from measures of income, inequality, and relative deprivation. In column III, IV and V mean number of blood donors in the reference group is endogenous and instrumented by travel time to the local hospital.
4. Definitions for the centrality measures can are on page 20.
5. Administrative village and year fixed effects, shocks (family member death, natural disaster, livestock death, and big disease), household head characteristics (education, gender, marriage status, age, cadre and party membership), household characteristics (share of the elderly and travel time to the local blood bank) are included but not reported here.

Appendix I: Data Descriptions (2004-2006)

I Village and Household Summary Statistics

Table 1 and Table 2 present summary statistics for the three administrative villages. In Table 1, the longer distance to county seat renders administrative village 1 significantly fewer marketing opportunities. The proportion of households with migrants rose from 31% to 50%. In contrast, migration fell sharply in village 2 as new on-farm opportunities developed with the new road. Village 3 had a smaller share of households with migrants, because of its easy access to off-farm work in the nearby county seat and much more flat land good for farming.[21] Meanwhile, the share of minority households in village 1 was overwhelmingly higher than in the other two. Family members in village 1 also reported significantly fewer average school years.

Table 2 provides the FGT measures which show that head-count index, poverty gap, and squared poverty gap under both the high poverty line and the low poverty line were uniformly larger for village 1 and village 2. Compared to village 1 and 2, village 3 had much higher per capita income and income growth, higher percentage of flat land, higher land rental rate, higher values of home appliances, and easier access to drinking water.

Income and expenditure inequality in village 2 were the highest. Inequality decomposition tells us that farming and local non-farm jobs (part-time job and wage job) were the largest income inequality contributors, while food and medical care were the largest expenditure inequality contributors. However, farming and food contribute much less to inequality than to their income shares. Remittance was a large contributor to income inequality compared to its income share. Blood donation was poverty reducing as well as inequality alleviating. Gift income was relatively inequality reducing, but gift and festival spending is inequality increasing.

II Pervasive Blood Donation

Table 3 shows that in 2004 41%, 29%, and 20% of households in three administrative villages donated blood respectively, which accounted for 9% of annual

[21] Over 60% of the households in village 3 had members employed off-farm, whereas less than half of the households in the other villages did. Meanwhile, 40%, 20%, and 80% of the land in village 1, 2, and 3 are flat respectively.

income to the mean households.[22] Annual per capita blood donation volume was 1000cc. Among the three villages, village 2 ranked the first in per capita blood donation, while village 1 and village 3 ranked the second and the third respectively.[23] In general, in all three villages poorer households correspond to higher income ratio of blood donation (Figure 4).

Poverty simulation excluding blood donation income shows large percentage increases in FGT measures. The percentage changes are higher for village 1 and village 3 (Table 4). Figure 1 illustrates poverty situation in the three villages before and after deducting blood donation compensation. Besides, excluding the compensation, the Gini coefficient is higher for the three villages in both years, which indicates that blood donation mitigates unequal distribution. Inequality decomposition verifies that blood donation reduces income inequality, since it accounts for 10.9% of total income but contributes only 1.8% to total inequality.

Blood donation reflects households' decisions, meaning that if any of the family members is able to donate blood, the household might turn out to be a blood provider. It is consistent with the fact that in the local blood bank households with people seriously disabled donate blood (CHAIN, 2006). T-test shows that if all family members are seriously disabled, the household is less likely to donate blood. Most of these families live on government poverty subsidies.

Cash shortage is almost always an important reason behind blood donation, especially when peasants are in their sowing season or faced with shocks. Meanwhile, in some rural areas that are endowed with less land, local residents rely on donating blood to survive winters when food is scarce. T-test shows that the relationships between per capita farmland and blood donation and its value are negative, and the latter link is stronger.

Further, given that off-farm work opportunities are limited and people do not realize the long term impact of blood donation towards health outcomes, their initial decision

[22] Our natural village level survey (Table 4) shows that in 2004 23% of the households had blood donation experience, smaller than 28% in the household survey. However, village level survey shows that in 11% of the households sold blood in 2006, while in the household survey it corresponds to 7%. On average, in 2004 12 households in each natural village treated blood donation as a stable income source, which reduced to 6.4 in 2006.

[23] In 2006, village 1 had the highest mean per capita blood donation.

may end up with lacking of energy to do farm work and relying on blood donation in the long run. T-test shows that blood donation corresponds to low farm income.

An interesting question would be whether a minority-headed household systematically differs from a Han family in blood donation. Brown et al. (2008) find that minority people are significantly less likely to participate in social status competition, and it is interesting to test whether being a minority is less likely to donate blood.

Another thought provoking question is whether cadres and party members are less likely to donate blood, since their special political and social power should avoid them from this behavior. However, T-test shows that they are significantly more likely to donate blood at larger value. The trend reversed in 2006 when blood contamination occurred. Overall, it may suggest that there exists pride effect and they can rationalize their behavior.

III Inflating Social Spending

Between 2004 and 2006, gift income as a share of total income rose by 41% in village 1, and rose by an amazing 127% in village 3. In the three villages, the share of gift expenditure and festival spending increased nearly 80% from 7% to 12%. Gift spending had higher growth than income growth between 2004 and 2006. Village 3 had the largest share of per capita gift expenditure and median per capita gift expenditure.

Table 3 provides information on gift expenditures in different social occasions, but it excludes other non-gift expenditures, such as holding weddings, funerals, child births ceremonies, college entrance ceremonies, big diseases, natural disasters, and livestock deaths. Non-gift social expenditures mainly occur in weddings and funerals (Table 5 and Table 6). From 2004 to 2006, the gift giving participation rate on average increased by 50%, while median per capita gift expenditure increased by nearly 4 times on average. Median gift per occasion given to direct relatives is much more than given to friends and neighbors, with a roughly equal increasing rate of 50%. On average, in 2006 people sent out gift twice. Comparing median gift for husbands' and wives' family between 2001 and 2006, the male/female ratio of median gift expenditure per occasion converged, while in absolute value median gift per occasion for male side is still much higher than median gift for female side.

In the 2007 survey, we collected household book record for social spending in the last ten years.[24] Gift expenditure and income in different social occasions were also collected. From gift receivers' records, we list in Table 5 gift income from marriages in grooms' family and marriages in brides' family. We also provide gift value in funerals of family member death during that period. Although weddings and funerals are not frequent in the three villages, it is clear that gift expenditure per occasion during major social events has soared lately.

Research solely based on gift-giving might underestimate the negative positional externality, as other social spending also takes major effects. In China, gift expenditure accounts for a small part of total social spending, compared to holding social occasions such as wedding and funeral, which call for much larger amount of cash expenditure.

The groom's family is responsible for paying a bride price, which is often accompanied by gifts to the bride and huge expenditure holding the wedding ceremony. Meanwhile, the bride's parents usually send out dowry with the bride to gain more equal status in the new family. Table 6 illustrates that median wedding expenditure in the last ten years has had a year-on-year increase of 17% in the three villages, far exceeding the growth rate and absolute value of per capita income. The bride's family has endured less prominent but significant increase.

Funerals usually provide another opportunity for status competition both for the decedent's family and its relatives and friends. Funerals typically last several days, which involve all kinds of things from simple meals to fancy banquets. Table 6 shows a steadily large amount of spending and rapidly increasing trend.

If we further consider the massive house building campaign before marriage, the burden of social spending is even more overloaded. Traditionally, the groom's family is responsible for building a house ("*Xi Fang*") for the new couple, which renders an expense far exceeding even the total cost of wedding ceremony. In the three villages, it is easily seen that a lot of *Xi Fang* are empty because the new couples migrate out to work. Nonetheless, the house is built to show social status of parents from both sides.

[24] For social spending, most of rural households keep detailed record of involved names, expenditures, and gift sent out or received to keep track of network around them. Thus, the recall error rate is very low, even over a long period.

Appendix II Measures of Centrality

To begin exploring how social interactions, embodied in social structure and social power, influence blood donation decision, a series of comprehensive measures of structure and power are summarize below. The centrality of a node in a network captures the idea of power and prominence in a certain social structure (Freeman, 1979). Three measures are most frequently used, degree centrality, closeness centrality and Bonacich centrality.

The normalized degree centrality of a node i in network g is defined as the degree of the node divided by the maximum possible degree, i.e. $C_d(i;g) = \frac{\eta_i(g)}{n-1}$. Higher degree centrality corresponds to more ties, more dominance of the resources in the network, and hence lower dependence on other individuals. Degree centrality for the entire network g is defined relative to the maximum attainable centrality,

$$C_d(g) = \frac{\sum_{i=1}^{n}[C_d(i^*;g) - C_d(i;g)]}{\max_{g' \in G}[\sum_{i=1}^{n}[C_d(i^*;g') - C_d(i;g')]]} = \frac{\sum_{i=1}^{n}[C_d(i^*;g) - C_d(i;g)]}{n-2}$$

where i^* is the node that achieves the highest degree centrality in network g.

Closeness centrality is calculated based on proximity. The normalized closeness centrality for node i is defined as $C_c(i;g) = \frac{n-1}{\sum_{j \neq i} d(i,j;g)}$, where $\sum_{j \neq i} d(i,j;g)$ denotes the total distance from node i to all other nodes in network g. The higher the total distance, the lower closeness centrality it would be. It is further multiplied by the minimum possible total distance $(n-1)$. Closeness centrality for the entire network g is defined relative to the maximum attainable differences between closeness centrality for node i^* and the others.

$$C_c(g) = \frac{\sum_{i=1}^{n}[C_c(i^*;g) - C_c(i;g)]}{\max_{g' \in G}[\sum_{i=1}^{n}[C_c(i^*;g') - C_c(i;g')]]} = \frac{\sum_{i=1}^{n}[C_c(i^*;g) - C_c(i;g)]}{(n-1)(n-2)/(2n-3)}$$

where i^* is the node that achieves the highest closeness centrality in network g.

The degree centrality and closeness centrality are equal for two extreme cases, star network and cycle network, while they are valued differently in this range. The major shortcoming for the two centrality measures is that it excludes the case when actions of a person influence actions of their neighbors which in turn feedback on the initiator. The degree centrality only takes into account the immediate ties each node has. One node might be centrally tied to a large number of others, but those others might be disconnected from the network as a whole. The closeness centrality solely depends on the length of the shortest paths between nodes in network, while it is possible that ties are not perfectly reliable and other paths of different lengths may take effects. Fortunately, both the direct and indirect influences in a network are captured by Bonacich centrality.

Bonacich centrality is mainly based on the adjacency matrix G of network g, in which an entry in a square corresponding to a pair {i, j} denotes whether there exists a link from i to j. In adjacency matrix G, entries in the main diagonal is set to be 0. G^k denotes the k-th power of the matrix, where $G^0 = I$. In G^k, an entry g_{ij}^k measures the amount of walks of length k that exist between players i and j in network g.

A matrix $M(g,\alpha\sigma)$ is well-defined when $\alpha\sigma$ is sufficiently small. Its entry $m_{ij}(g,\alpha\sigma) = \sum_{k=0}^{\infty}(\alpha\sigma)^k g_{ij}^k$ measures the total amount of walks in g from i to j where walks of length k are weighted by $(\alpha\sigma)^k$.

$$M(g,\alpha\sigma) = [1-\alpha\sigma G]^{-1} = \sum_{k=0}^{\infty}(\alpha\sigma)^k G^k$$

Given parameter $\alpha\sigma$ [25], Bonacich centrality vector is defined as $C_b(g,\alpha\sigma) = [1-\alpha\sigma G]^{-1} J$, where Bonacich centrality of node i $C_b(i;g,\alpha\sigma) = \sum_{j=1}^{n} m_{ij}(g,\alpha\sigma)$. It is straightforward to observe that Bonacich centrality is no smaller than 1.

$$C_b(i;g,\alpha\sigma) = m_{ii}(g,\alpha\sigma) + \sum_{j\neq i}^{n} m_{ij}(g,\alpha\sigma) = \begin{cases} >1 \ \ if \ \ \alpha\sigma > 0 \\ =1 \ \ if \ \ \alpha\sigma = 0 \end{cases}$$

[25] In our empirical study, Bonacich centrality with positive attenuation factors generated by the UCINET software are adopted, as we accept the idea that being connected to neighbors with more connections makes one powerful. However, in some sociology literature negative attenuation factors are used since they argue that neighbors without many connections to others make ego more powerful. The two results differ, especially for households whose ties are mostly with households of high degree.

Appendix III-1 Effect of Social Interactions and Relative Income on Values of Blood Donation (Full Sample, 2004-2009)

	I tobit	II tobit	III tobit	IV tobit	V IV+tobit	VI IV+tobit
Median per capita blood donation	0.774***	0.644**	0.650**	0.745***	2.887***	3.084***
	(0.00)	(0.02)	(0.01)	(0.01)	(0.00)	(0.00)
Per capita income	1.098	4.608	-2.887	2.180	-105.939***	-106.029***
	(0.82)	(0.46)	(0.69)	(0.68)	(0.00)	(0.00)
squared per capita income	-0.005	-0.100	0 .067	-0.048	1.931*	1.933*
	(0.97)	(0.54)	(0.68)	(0.74)	(0.06)	(0.06)
minority	-78.975***	-84.414***	-84.160***	-87.385***	-259.631*	-238.270*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.06)	(0.08)
Share of the elderly	-89.273***	-95.101***	-92.924***	-94.038***	-535.801***	-535.086***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Wage/blood compensation	63.679	18.676	21.982	25.196	9.131	-15.644
	(0.14)	(0.69)	(0.63)	(0.58)	(0.98)	(0.96)
Gini	-403.766***				1,377.256**	1,614.494**
	(0.00)				(0.04)	(0.02)
Gini*rank	0.344**				0.775	0.783
	(0.04)				(0.40)	(0.39)
Deaton RD		65.846**				
		(0.05)				
Wildman RD			0.011			
			(0.48)			
rank				0.150**		
				(0.03)		
Year=2006	-119.424***	-104.227***	-106.238***	-106.425***	-550.880**	-521.001**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.02)	(0.03)
Year=2009	-23.914	-12.174	-12.619	-12.828	-673.422***	-658.355***
	(0.21)	(0.67)	(0.66)	(0.65)	(0.00)	(0.00)
Observations	2448	2448	2448	2448	2448	2448

1. p values in parentheses
2. * significant at 10%; ** significant at 5%; *** significant at 1%
3. Blood donation compensation is excluded from measures of income, inequality, and relative deprivation. In column V and VI median value of blood donation in the reference group is suspected to be endogenous and instrumented by travel time to the local hospital and average income for the prior period in the reference group.
4. Administrative village fixed effects, shocks (family member death, natural disaster, livestock death and big disease), household head characteristics (education, gender, marriage status, age, cadre and party membership), household characteristics (household size and travel time to the local blood bank) are included but not reported here.

Appendix III-2 Effect of Network-based Social Interactions and Relative Income on Values of Blood Donation (Sub-sample, 2004-2009)

	I	II	III	IV	V	VI
Centrality Measure 2	1.950***	1.838***				
	(0.00)	(0.00)				
Centrality Measure 4			0.003***	0.003***		
			(0.00)	(0.00)		
Centrality Measure 5					0.003***	0.003***
					(0.00)	(0.00)
Per capita income	12.028	20.323	7.381	22.592*	11.971	23.813*
	(0.22)	(0.13)	(0.45)	(0.10)	(0.21)	(0.07)
squared per capita income	-0.229	-0.441	-0.184	-0.519	-0.257	0.534
	(0.46)	(0.25)	(0.55)	(0.18)	(0.39)	(0.15)
Gini	-526.202*		-415.156		-177.987	
	(0.08)		(0.19)		(0.57)	
Gini*rank	0 .130		-0.199		0.084	
	(0.73)		(0.61)		(0.82)	
Deaton RD		67.038		79.23		97.385
		(0.44)		(0.36)		(0.25)
Wage/blood compensation	135.759	70.779	88.151	-4.152	82.883	51.189
	(0.16)	(0.49)	(0.37)	(0.97)	(0.38)	(0.61)
Share of The elderly	-174.229***	-171.615***	-174.624***	-171.357***	-179.065***	-179.141***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
year=2006	-165.631**	-124.293*	-106.754	-48.386	-156.428**	-135.757**
	(0.01)	(0.07)	(0.11)	(0.49)	(0.01)	(0.04)
year=2009	-6.596	71.169	23.431	134.757**	-47.753	-5.665
	(0.84)	(0.22)	(0.46)	(0.02)	(0.14)	(0.92)
Observations	618	618	618	618	618	618

1. p values in parentheses
2. * significant at 10%; ** significant at 5%; *** significant at 1%
3. Blood donation compensation is excluded from measures of income, inequality, and relative deprivation.
4. Definitions for the centrality measures can are on page 20.
5. Administrative village fixed effects, shocks (family member death, natural disaster, livestock death and big disease), household head characteristics (education, gender, marriage status, age, cadre and party membership), household characteristics (household size and travel time to the local blood bank), and wage blood price ratio are included but not reported here.