Bargaining Markets, Information Asymmetry, and Social Capital

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Abstract

Social capital has been studied by economists at the micro—level in efforts to understand how it contributes to the functioning and growth of markets. In developing countries, where markets frequently have poor information and weak enforcement mechanisms, social capital is considered to play a larger role in facilitating markets to properly function — filling the vaccum of formal institutions and government intervention. This paper tests these theories with a market experiment set in eastern Sierra Leone. We introduce market imperfections with strong information asymmetries and assess how well markets function when traders are known to one another, versus when they are strangers. We use four treatment variations to isolate effects of social-connections and the presence of information asymmetries. We find that socially connected individuals do transact with a higher level of fairness compared to strangers, both when information asymmetries are present and in "perfect" market conditions. Our results lead us to conclude that social capital may help markets to continue to function when otherwise they may fail, but they are not an adequate substitute for formal institutions and government intervention as markets perform significantly below optimal conditions.

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1 Introduction

Neoclassic economic theory predicts that competitive markets will clear, efficiently allocating goods and resources among market traders based on production supply curves and consumer demand curves. Laboratory experiments have largely confirmed theoretical predictions in practice, however some discrepancies arise when experiments are conducted within developing countries. (Bulte et al., 2013) Henrich et al. (2010) argue that regular engagement in impersonal exchange by modern societies is due to the evolution of transactions being underpinned by kinship and reciprocity to being embedded within institutions and norms that sustain fairness. This paper looks at the role social ties and norms of fairness play in facilitating trade when markets are faced with high uncertainty due to information asymmetries through the use of a laboratory style market experiment. We test whether trades between socially connected traders result in more fairly divided transactional profits compared to trades between strangers. We find that socially connected individuals still take advantage of information asymmetries in their favor, at the expense of their trade partner, but to a lesser extent than traders who are unknown to one another. We argue that developing markets face strong imperfections, resulting in social transactions being safer than impersonal transactions. This paper provides empirical evidence of social institutions acting as a mechanism that enables trade to continue despite severely afflicted markets. The experiment provides some evidence as to why personal exchange is predominant within developing countries that are riddled with weak judicial systems —or other contract enforcement mechanisms— and poor access to information.

Neoclassical competitive market theory has strong theoretical predictions of equilibrium price setting within competitive markets. The theory is underpinned by three main assumptions. The first is tht people have rational preferences among outcomes. The second is that individuals maximize utility and firms maximize profit. The third is that people act independently on the basis of full and relevant information. (Weintraub, 2002) These three assumptions are understood to be necessary in order for markets to have stable equilibria, and for resources to be optimally allocated. Smith (1962) used a double auction design with multiple sessions (permitting learning over time) and public outcry of trans-

acted prices and found that experimental markets resulted in prices rapidly converging to theoretically predicted price levels. List (2002) found similarly strong support for neoclassical theory when he used a naturally occurring market, dealing in sports cards, as his experimental laboratory. Gode and Sunder (1993) experimented with testing the necessity of the first assumption of neoclassical theory — rationality. Relaxing the assumption of rationality through the use of zero-rational bid and offers made by imposed reservation value constrained computers, they found that prices still converged to competitive equilibriums. Even absent the assumption of rationality, Adam Smith's proverbial "invisible hand" remains quite powerful. A similar experimental study conducted by Bulte et al. (2013) in rural Sierra Leone replicating small scale trade did not find convergence of market prices, or market efficiency, to competitive equilibrium. The application of a simulated market experiment to one of the most under-developed regions of the world, using small-scale traders as participants, resulted in quite low efficiencies, well below theoretically predicted equilibriums. However they found that varying the interaction mechanism improved efficiency nearly to predicted competitive levels, suggesting that market expansion would solve problems of inefficiency.

This is consistent with theories of developing countries engaging primarily in personal exchange, but switching to anonymous, or market, exchange is necessary in order to reap benefits of trade specialization. (Fafchamps, 2011; Kimbrough et al., 2008) Bulte et al. (2013) hypothesize that hierarchical social structures that are culturally embedded within the region drive these deviations from competitive equilibrium. Social relationships driving inefficient or non-profit maximizing market behavior would seem to not only lack rational thought, but to be irrational. This paper argues that the importance of these social relationships within market behavior is in fact rational. The local markets of rural Sierra Leone are not aligned with competitive theory, but instead are plagued by market failures. It is widely accepted that information asymmetries, or imperfect information, are a major failure within rural markets. Several development projects and interventions even target incomplete information through the introduction of ICT services. (see (Stiglitz, 1989; Jensen, 2007, 2010; Svensson and Yanagizawa, 2009))

A whole field of economics has devoted itself to understanding how information effects

economic outcomes. Stiglitz (2000) points out that even relatively small information imperfections, or associated costs, can have large effects. Akerlof (1970a) looks at uncertainty of quality within markets and attempts to understand the economic costs of dishonesty. His paper ultimately shows with asymmetrical information, bad quality items can drive out better quality items until the market ceases to function (or exist) at all. While Akerlof (1970a) looks at general market functioning, with some practical applications considered, Samuelson (1984) focuses on the case of information asymmetries in a single bilateral bargaining transaction. Samuelson (1984) presents a model in which the seller is informed on both his own and the buyer's monetary valuations of the bargained-over good while the buyer knows neither. [1] The model's equilibrium results highlight that bargaining can sufficiently overcome market failures of information asymmetries. Instead bargaining as a mechanism of exchange is limited by informational constraints, to the extent that mutually acceptable offers may not be reached, despite profitable contract options existing. Despite the grim picture painted by both papers on the effects of information failures within markets, many rural developing markets do continue to function.

It's only been in the past few decades that economists have recognized the extent to which social capital can effect market performance. Previously, social capital was relegated to being a vague mechanism by which individuals could overcome market imperfections, when present. The definition of social capital varies widely with little consensus amongst researchers of it's exact scope or application. [2] For the intents of this paper, we view social capital as those norms or social ties that enable individuals to act collectively. Considerable research has been devoted to understanding the role of social capital within the realm of economics. Studies have looked at resource sharing, or altruistic behavior, between kin (Hamilton, 1963) as well as with friends and acquaintances(Goeree et al., 2009; Leider et al., 2009; Brañas garza et al., 2010). Fehr et al. (1993) found that informal institutions, specifically fairness, have persistent effects on individuals' market behavior. Their experiment, using a delayed-delivery market structure with variable prices and quality of the

[1] The paper's theoretical model uses the example of information asymmetries in favor of the seller, but the model is applicable in any one-sided information asymmetry within a bargaining transaction.

[2] For a full review of the social capital literature, see National Statistics (2001); Woolcock and Narayan (2000)

experimental good, found that prices above market clearing prices were met with higher quality goods. Similarly, Leibbrandt (2012) found that pro-social sellers out-performed selfish sellers within their experiment, and Barr (2009) found that pro-social individuals are more productive than less-social individuals as they can interact better with colleagues and integrate more smoothly into work place social networks. It is evident that social capital can effect market outcomes, in this paper we explore whether social capital is capable of improving market performance in the face of severe market failings. Using a very similar experimental design as Bulte et al. (2013) in the same rural region of Sierra Leone, we introduce strong information asymmetries within the market and vary whether individuals are trading with other traders from their same village, or unknown traders from a distant village. What we find is that while markets remain well below competitive equilibrium (expectedly given such strong information asymmetries), those groups that are able to trade with fellow village members share profits significantly more fairly.

The remainder of the paper is structured as follows. Section 2 will describe the local context of the project, providing background on the region's economic and social characteristics that make the introduction of information asymmetries within an experimental market justified. It will also provide a detailed overview of the experimental design, including descriptions of the five treatment variations implemented. Section 3 discusses the results of the experiment. First we look at session-level outcomes before turning to the specifics of individual transactions, such as characteristics of traders, profit sharing, and basic dyadic relationship characteristics of traders.

2 Context and Research Design

2.1 Experimental Context

Sierra Leone is one of the least developed countries in the world (UNDP, 2014), and suffers from many characteristics of under-development, including poor infrastructure, low education, and the majority of individuals living at subsistence levels. Market activity is limited in rural areas by poor road conditions and high transportation costs. Outside of major urban areas, markets are periodic (Riddell, 1974) — generally weekly — with

small-scale traders roaming the countryside on motorbikes to buy up major crops to then be sold in larger markets. Producers tend to be quite isolated from markets, and with prices fluctuating based on road conditions, fuel availability, and weather — incomplete information is inevitable. These conditions are not unique to Sierra Leone, but are true for many LDC's, making the introduction of information asymmetries to our experimental design quite logical.

2.2 Treatment Variations

The treatments were designed in order to measure the impact of social connections in mitigating potential losses in profits and efficiency in the face of information asymmetries within a market.In order to do so, the effects of social connections and the presence of information asymmetries had to be isolated independently. The four treatments are constructed by varying the presence of information asymmetries within the market, simultaneously controlling for whether buyers and sellers are known to each other. Table 1 below provides a summary of the four treatments.

Table 1: Summary of Treatment Variations

Treatment	Abbrev.	Trading Partners	Information
1. Control — Within Village	C-W	Same Village	Complete Information
2. Control — Across Village	C-A	Stranger Village	Complete Information
3. IA — Within Village	U-W	Same Village	Information Asymmetries
4. IA — Across Village	U-A	Stranger Village	Information Asymmetries

A detailed description of each state of the two interacting binary treatments (social connections and information asymmetries) is as follows:

- Control Treatments (abbrev: "C): Control treatments refer to the absence of any information asymmetries within the simulated market. Buyers and sellers are bargaining based on a randomly selected reservation values.

- Information Asymmetry Treatments (abbrev: IA): Information asymmetry treatments refer to the presence of information asymmetries within the simulated market through the creation of two states of the world (SOW) a high SOW (HSOW) and a low SOW (LSOW). Buyers and sellers have two reservation, each associated with one

state of the world. The high SOW is a uniform 3,000 Le. upward shift from the low SOW reservation values. Only buyers are informed at the beginning of the round on which state of the world is in effect, and are constrained to entering trade agreements based on their respective reservation value. Sellers are not informed of the state of the world during any rounds, and are permitted to agree to any trade with a price higher than their LSOW reservation value. This results in the possibility of sellers earning negative profits during HSOW rounds.

- Within-Village Treatments (abbrev: W): Within-village treatments are limited to transactions between buyers and sellers from the same village, with traders having no option of trading with agents from outside their own village.

- Across-village Treatments (abbrev: A): Across-village treatments are limited to transactions between buyers and sellers from different villages, with traders having no option of trading with agents from within their own village.

2.3 Experimental Design

The experiment was designed to replicate local market conditions of two-way bargaining with outside options. The experiment consisted of ten rounds, each of 5 minutes length, with each participant permitted to transact once per round. A total of 16 individuals participated in each session, with participants divided evenly into the roles of buyers and sellers each round. For C-W and IA-W treatments, this division was a randomized assignment by participant ID number. For C-A and IA-A treatments, this assignment was randomly assigned each round based on village of origin to ensure within-village transactions were not possible. Participants were selected from villages within 1 hours walking distance of the site town where activities were hosted. The highest 8 individuals present within the village administrative hierarchy were invited to join. The remaining 8 participants were randomly selected from those individuals not holding a position of political authority within the village. Individuals within the political hierarchy of the village were randomly assigned ID numbers between 1-8, while individuals with no political position were randomly assigned

ID numbers 9-16. [3] For treatments C-W and IA-W all 16 participants from the same village conducted the market experiment together in the same session. For treatments C-A and IA-A, even numbered participants and odd numbered participants were separated and even numbered participants exchanged with another village. This created sessions in which all odd numbered participants were from village A while all even numbered participants were from village B, but distribution of political position holders vs. non-political position holders remained the same as control treatments. Each sellers received a uniform block of wood which represented the item to be sold and a randomly selected card with a reservation value(s) drawn from a constructed neo-classical supply curve. Buyers received a yellow sash to be worn during the round in order for roles to be visibly distinguishable and a card containing induced value(s) drawn from a constructed neo-classical demand curve. In the IA treatments both seller and buyer cards contained two reservation values: one for the LSOW and one for the HSOW (described in detail below). Each round commences and traders have five minutes to agree to trades at prices that are in accordance with received reservation values. Induced values were kept as private information in order to facilitate optimal bargaining strategy. Once a price was agreed on by both parties the transaction is registered with the trademaster research assistant, who records the ID numbers, reservation values of each trader, and contracted price. Once a trade is registered both parties are removed from the market area until the round finishes; this limits traders to being able to engage in only one transaction per round. Traders who do not enter into a trade agreement before the round finishes have their IDs and reservation values recorded after the 5 minutes is completed. Once the round finishes all materials are collected, trader roles re-assigned, and appropriate materials re-distributed in order for the subsequent round to commence. [4]

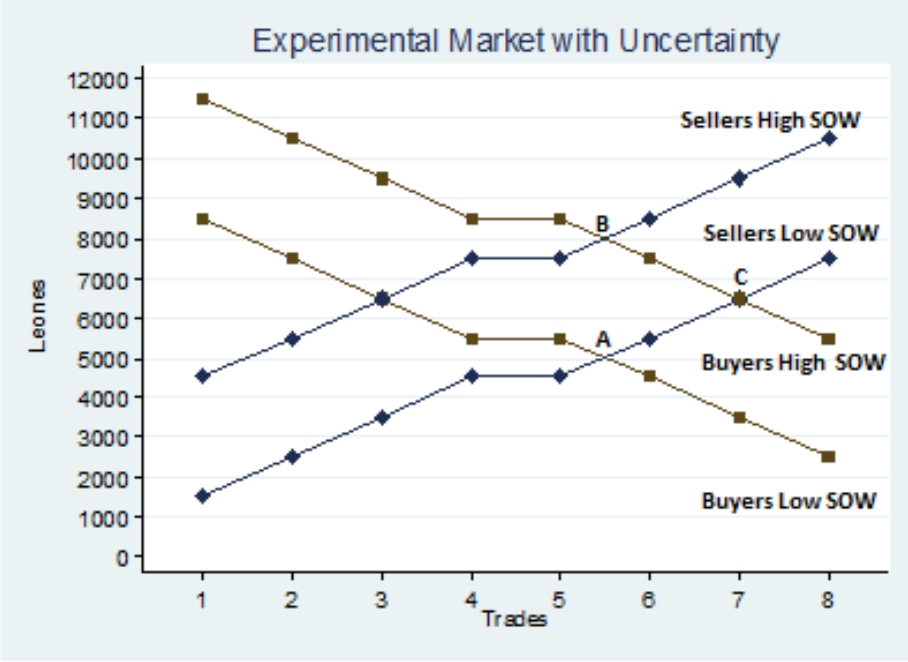
Figure 1 is the constructed supply and demand curves of the experimental market The figure has two demand and supply schedules, one for control treatments and LSOW rounds of IA treatments, and one for HSOW rounds of IA treatments. The HSOW schedules are

[3] This selection and ID-assignment procedure was required by a partner study that utilized two of the same treatments as this study and was maintained for uniformity

[4] Each session conducted a practice round before any data was recorded in order to confirm that all participants clearly understoodnd the rules of the experiment.

uniform 3000 SLL shifts of the LSOW schedules. For the control treatments, participants received reservations values from the Buyers and Sellers LSOW lines, while in the information asymmetry treatments the participants' cards have two values. One from the LSOW curves and one from the HSOW curves. The market would have a competitive equilibrium at 5000 SLL with 5 units traded for control treatments and LSOW rounds in IA treatments. HSOW rounds have a competitive equilibrium at 8000 SLL with 5 units traded. By construction, six traders are "left out" of the market, in that their is no surplus to be gained, only lost, from trade. As induced values for buyers and sellers are randomized (in addition to trader roles) each round, there is little concern of anchoring effects within the experimental market.

Figure 1: Experimental Market



3 Results

The results are discussed in two sections. The first section, section3.1, discusses experimental results at the group level. All analysis is run looking only at the aggregated results from each session conducted within each treatment variation. We look primarily at sum-

mary statistics of each session, price levels, efficiency levels, and for learning over rounds. Subsequently, we move to the analysis at the individual level in section 3.2. Here we will analyze profit capture based on dyadic relationship characteristics and effects of repeated exchange between traders.

3.1 Group Level Effects

Table 2 gives a break down of the summary statistics of price, trades per round, and trades made in price core per round. We define "price core" as those trades that are agreed to with prices within 500 SLL of the theoretical equilibrium price. In Table 2 we separate out IA treatment statistics based on whether the round is of type LSOW or HSOW. What we see is that for control treatments and LSOW information asymmetry treatments, mean prices are closely clustered around the competitive equilibrium price. However, when we look at HSOW rounds, prices are well outside the price core. Comparing across treatments, C-W prices are higher, as well as closer to the equilibrium value of 5000 SLL compared to C-A rounds, and IA-W mean prices are also higher, with IA-W a little above the equilibrium value compared to IA-A being just marginally below. In the IA HSOW rounds, we see that IA-W are also higher compared to IA-A rounds, although both are well short of the compeitive equilibrium price of 8000 SLL. Trades made per round compared across control and IA-LSOW treatments are relatively indistinguishable, all hovering around 5.5 trades. [5] Surprisingly, IA-HSOW rounds have significantly higher trades made per round, with both IA-W and IA-A having above 7 trades per round on average. Given the uncertainty in the market and the potential to earn negative profits as a seller, it would be expected that fewer trades occur in IA treatments across all rounds when compared to control treatments. What is even more interesting, albeit expected when armed with the mean price and mean trades per round data, is that trades made in the price core per round is lowest in IA-HSOW rounds. This tells us that buyers are wielding their informational advantage over sellers at cost to seller profits, capturing more of the profits for themselves by driving prices down to LSOW/control price levels.

[5] With 16 market participants evenly divided, the maximum number of possible trades is 8, however 8 trades occurring would decrease efficiency as negative surpluses would be accrued within the market

Table 2: Summary Statistics by Treatment and Round SOW-type

Variable	C-W no SOW	C-A No SOW	IA-W Low SOW	IA-W High SOW	IA-A Low SOW	IA-A High SOW
Mean Price	4858.14	4762.345	5056.805	6601.993	4927.79	6225.942
(S.E.)	-24.285	-25.447	-38.808	-57.051	-31.122	-79.971
Min Value	4083.33	3625	4000	5125	4200	5428.571
Max Value	5750	5700	6125	8250	5583.333	7500
Mean Trades per Round	5.63	5.592	5.569	7.108	5.75	7.444
(S.E.)	-0.05	-0.055	-0.086	-0.078	-0.149	-0.116
Min Value	2	3	2	4	4	6
Max Value	7	8	8	8	7	8
Mn. Trade Core per Round*	2.6	2.710084	2.715596	1.702703	2.90625	1.777778
(S.E.)	0.074	-0.067	-0.106	-0.116	-0.182	-0.144
Min Value	0	0	0	0	1	0
Max Value	6	6	5	5	5	3
Observations	230	238	109	111	32	36

*Trade Core = trades made within the equilibrium core (4500 price 5500 for Control and LSOW ; 7500 price 8500 for HSOW)

Next, we run t-tests between treatments. We run six tests all together, labeled T1 to T6 in Table 3 below. Each test is between comparable treatments to isolate effects of social ties and market presence of information asymmetries. By construction, price tests for T2 and T3 will be significantly different as IA treatments have a HSOW price rounds where equilibrium is 8000 SLL rather than 5,000 SLL, driving all prices upwards. However, T1 is insignificant, telling us that absent information imperfections, social ties between traders do not result in significantly different price setting than between strangers. However, T4 is significant for price tests, so when information asymmetries are present, individuals who are acquainted have transactions with higher prices compared to trades between strangers. In the efficiency tests, the overall efficiency is still weakly significant (at the 10% level). However the two-sided test shows us that IA-A rounds are more efficient compared to IA-W, this is driven due to buyer's maximum surplus requiring sellers to earn negative profits, so in IA treatments a more efficient market requires less equal distribution of profits. We can confirm this by looking at the trader specific efficiency test results for T4, and find that sellers in IA-W treatments have significantly higher efficiency compared to IA-A while buyers have lower efficiency, confirming that buyers who know their seller utilize their informational advantage to the detriment of the seller less than buyers who do not know the seller they are trading with.

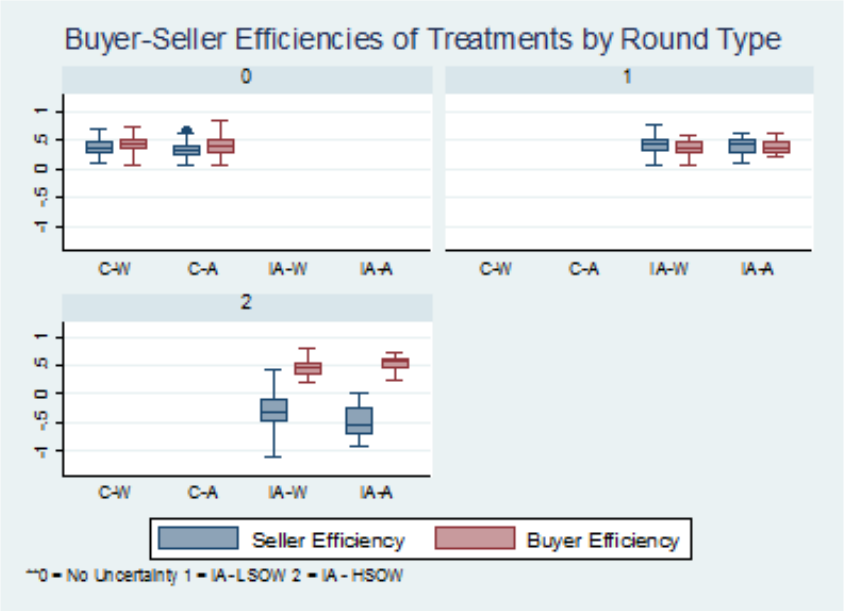
Table 3: T-Tests Reults Comparing Treatments

	T-test	D.o.F.	Price	Trades Per Round	Trades in Core	D.o.F.	Efficiency	Buyer Eff.	Seller Eff.
T1	C-W vs C-A	2624	1.606	0.317	-1.171	466	3.683***	0.774	3.776***
T2	C-W vs IA-W	2689	-18.902***	-6.202***	6.083***	448	12.636***	1.656*	10.3***
T3	C-A vs IA-A	1781	-12.09***	-6.141***	5.102***	304	11.077***	-1.995**	11.597***
T4	IA-W vs IA-A	1846	2.665***	-1.93*	0.003	286	1.755*	-2.845***	2.297**

Two Sided Test ***p < 0.01 **p< 0.05 *p < 0.1

Another interesting result from Table 3 is that while profits, trades per round, and price core trades per round are all insignificantly different in T1, we do see that efficiency and seller efficiency are significant. Figure 2 gives a visual of trader efficiencies by round type. We see that in almost every situation (except LSOW in IA treatments), buyer's have higher efficiency than sellers — telling us that they capture more of their potential surplus compared to sellers. However in control treatments, the difference in efficiency between buyers and sellers is lower when traders are known to one another then when they are strangers. So norms of fairness are still affecting market outcomes even when the market is competitive. [6]

Figure 2: Buyer and Seller Efficiencies by Round Type



[6]Interestingly, when asked in the follow up survey which trader position was better off in the experiment, for control treatments the response was overwhelmingly that sellers had the price-setting advantage. The results seem to refute this, so it's unclear why buyers continually out-perform sellers in profit capture when information is perfect

Table 4 gives an overview of the variables used within the various group level regressions. All variables are aggregated for each round played, with individual characteristics averaged for the group of participating traders per round. The subsequent table, Table 5 gives the results for regressions run using total efficiency (efficiencyt) as the dependent variable. [7] We see that in regressions (1) and (2), treatments C-W has a significantly positive effect on efficiency, contrasting this with treatment IA-A which has a statistically significant strong downard pressure on efficiency (decreasing efficiency 19.3% in (1) to it's upper estimate of 46% in (3)). In regressions (4) and (5) treatment dummies were dropped and replaced with dummies for within-village rounds and information asymmetry rounds. Unsurprisingly, IA rounds have significant and strong negative effects on efficiency. Within village rounds have a positive and moderate (roughly 9% of average efficiency) effect on efficiency, however this effect dissipates when a social-IA interaction term is included in regression (5). Of trader characteristics, literacy and proportion of traders within the group have consistently significant effects on group efficiency levels. Average age, gender demographics, and average wealth scores have no significant effects.

Table 4: Group Level Regressions Summary Statistics

Variable Name	Variable Description	N	mean	sd	min	max
avg_price	Average Price	911	5,279	836.8	3,625	8,250
avg_trade	No. of Trades	911	5.969	1.057	2	8
score_pca	Average Wealth Index Score	911	2.146	0.475	0	4.648
avg_age	Average Trader Age	911	42.28	5.558	27.9	61.5
avg_gender	Average Trader Gender	911	0.684	0.171	0.167	1
avg_literate	Average Trader Literacy	911	0.264	0.146	0	0.833
avtraders	Average No. of Traders	911	0.406	0.152	0.188	0.8
efficiencyb	Buyers Efficiency	911	0.426	0.14	0.0294	0.844
efficiencys	Sellers Efficiency	911	0.209	0.356	-1.118	0.794
efficiencyt	All Traders Efficiency	911	0.635	0.317	-0.324	1
treat1	C-W Treatment Dummy	911	0.252	0.435	0	1
treat2	C-A Treatment Dummy	911	0.261	0.44	0	1
treat3	IA-W Treatment Dummy	911	0.241	0.428	0	1
treat4	IA-A Treatment Dummy	911	0.0746	0.263	0	1
price_core	Avg. Price in Price Core Dummy	911	0.64	0.48	0	1
trade_eq	No. of Trades = Equilibrium	911	0.247	0.431	0	1
trade_out	No. of Trades ¿ Equilibrium	911	0.692	0.462	0	1
trade_in	No. of Trades ¡ Equilibrium	911	0.0615	0.24	0	1
social	Within-Village Treatment Dummy	756	0.595	0.491	0	1
IA	IA Treatment Dummy	756	0.381	0.486	0	1
social_IA	Within-village IA interaction term	756	0.291	0.455	0	1

Table 6 separates out buyer and seller efficiencies to see how specific trader role performance is driven. We see that treatment dummies are more significant than in the general

[7] All regressions are run clustering on sessions for robus standard errors

Table 5: Group Level Regressions: All Traders

VARIABLES	(1) efficiencyt	(2) efficiencyt	(3) efficiencyt	(4) efficiencyt	(5) efficiencyt
treat1	0.069**	0.071**	—		
		-0.031	-0.03		
treat2	—	—	-0.044		
			-0.03		
treat3	-0.046	-0.039	-0.199***		
	-0.034	-0.036	-0.028		
treat4	-0.123***	-0.137***	-0.292***		
	-0.037	-0.039	-0.04		
round_id	0.006***	0.006***	0.000	0.000 0.000	
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
price_core			0.264***	0.264***	0.264***
			-0.033	-0.033	-0.033
trade_eq			0.055*	0.053	0.055*
			-0.032	-0.032	-0.032
trade_out			-0.135***	-0.137***	-0.135***
			-0.035	-0.036	-0.035
avg_age		0	-0.001	-0.001	-0.001
		-0.002	-0.002	-0.002	-0.002
avg_gender		0.062	0.092	0.089	0.092
		-0.083	-0.074	-0.073	-0.074
score_pca		-0.036*	-0.017	-0.016	-0.017
		-0.021	-0.019	-0.019	-0.019
avg_literate		-0.179**	-0.190***	-0.190***	-0.190***
		-0.079	-0.065	-0.066	-0.065
avtraders		0.153**	0.149**	0.139**	0.149**
		-0.068	-0.069	-0.07	-0.069
avg_price	-0.000***	-0.000***			
	0	0			
avg_trade	-0.130***	-0.129***			
	-0.017	-0.017			
social				0.058**	0.044
				-0.025	-0.03
IA				-0.214***	-0.248***
				-0.024	-0.041
social_IA					0.049
					-0.047
Constant	2.048***	2.085***	0.668***	0.617***	0.625***
	-0.106	-0.154	-0.092	-0.096	-0.097
Observations	756	756	756	756	756
R-squared	0.572	0.586	0.509	0.508	0.509

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

efficiency regressions, and more so for sellers than buyers. IA-W has a positive effect in regression (1) but a nearly equal and opposite effect in regression (2), while IA-A is positive and significan in (1) but that significant disappears in (2) when more explanatory variables are included. For sellers however, the effects seem stronger and more consistent. IA- W and IA-A are both negative and significant on seller efficiences, which is to be expected given that seller's are disadvantaged by the information asymmetry, however IA-W is smaller in magnitude compared to IA-A (a drop on average of 18% in IA-W versus a drop of 40% in

IA-A from regression (4) and (5) estimates).

Looking instead at within-village round dummies and information asymmetry round dummies, social connections seem to have no significant effect on buyers, but a positive and significant effect on seller efficiencies. Information asymmetries have a positive effect on buyers (as expected, given their advantage) and a negative effect for sellers. [8]

Table 6: Group Level Regressions: Buyers vs. Sellers

VARIABLES	(1) efficiencyb	(2) efficiencyb	(3) efficiencyb	(4) efficiencys	(5) efficiencys	(6) efficiencys
treat1	0.012			0.060**		
	-0.028			-0.024		
treat2	–	-0.01		–	-0.033*	
		-0.028			-0.018	
treat3	0.046*	-0.048**		-0.085**	-0.151***	
	-0.027	-0.021		-0.037	-0.03	
treat4	0.072**	0.003		-0.209***	-0.295***	
	-0.032	-0.029		-0.039	-0.038	
round_id	-0.000	0.000	-0.001	0.006**	0.000	0.006**
	(0.001)	(0.002)	(0.001)	(0.003)	(0.003)	(0.003)
price_core		-0.086***			0.350***	
		-0.016			-0.037	
trade_eq		0.031			0.024	
		-0.024			-0.034	
trade_out		0.014			-0.149***	
		-0.025			-0.037	
avg_age	-0.001	0	-0.001	0.001	-0.001	0.001
	-0.001	-0.002	-0.001	-0.002	-0.002	-0.002
avg_gender	0.07	0.052	0.073	-0.008	0.04	-0.013
	-0.053	-0.053	-0.053	-0.062	-0.056	-0.062
score_pca	0.029**	0.029*	0.028**	-0.065***	-0.046**	-0.062***
	-0.014	-0.015	-0.014	-0.022	-0.02	-0.022
avg_literate	-0.037	-0.007	-0.037	-0.142*	-0.183***	-0.141
	-0.054	-0.059	-0.054	-0.085	-0.066	-0.085
avtraders	0.069	0.055	0.077	0.084	0.095	0.07
	-0.066	-0.071	-0.065	-0.078	-0.076	-0.08
avg_price	-0.000***		-0.000***	-0.000***		-0.000**
	0		0	0		0
avg_trade	0.029***		0.030***	-0.158***		-0.160***
	-0.007		-0.007	-0.02		-0.02
social			0.001			0.079***
			-0.021			-0.021
IA			0.047**			-0.166***
			-0.02			-0.03
Constant	0.548***	0.378***	0.556***	1.537***	0.291***	1.523***
	-0.104	-0.077	-0.1	-0.182	-0.103	-0.178
Observations	756	756	756	756	756	756
R-squared	0.142	0.111	0.139	0.483	0.513	0.481

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

At the group level, social connections seem to have a small impact on improving ef-

[8] an interaction term was included in regressions for both buyers and sellers, but due to insignificance in both it was dropped and not displayed in the results table.

ficiency within markets within the control treatments. However once market failings are introduced through information asymmetry, social connections weakly improve fairness, which in turns lowers efficiency as buyers maximizing profits necessitates negative profits for sellers. Lower buyer efficiency levels thus demonstrate more equitable sharing of profits and thus higher seller efficiency when comparing IA-W with IA-A treatment rounds.

3.2 Individual Level Effects

At the individual level, transactions are analysed. The two variables of key interest are division of potential suprluses between traders, with each individual's surplus share measured as

$$Surplus\ Share_i = \frac{|RV_i - Price|}{RV_b - RV_s} \quad where\ i\ = [b, s] \tag{1}$$

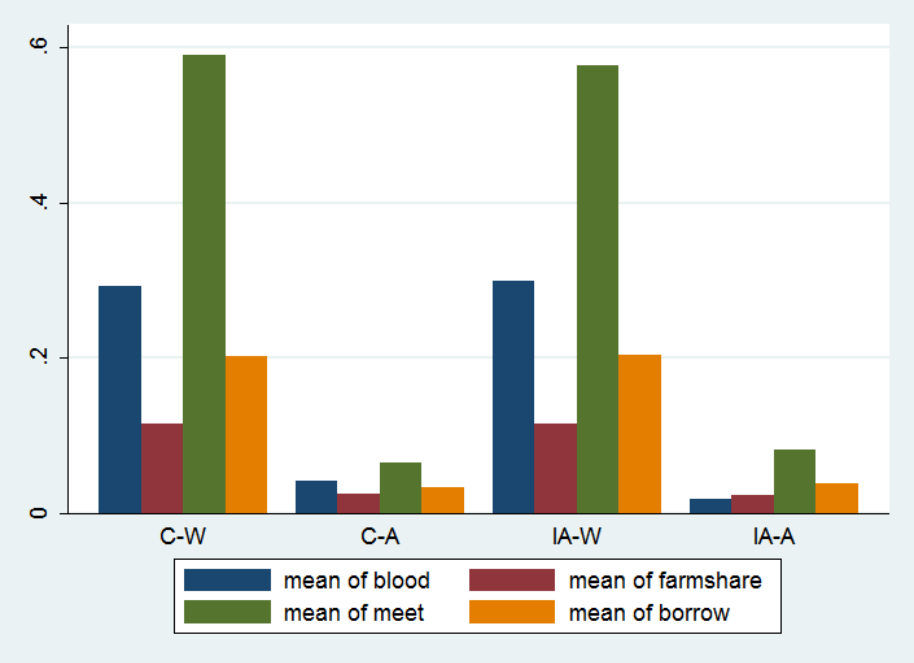
. In IA treatments, sellers can have negative surplus capture as negative profits can be earned, in this situation buyers would have surplus capture greater than 1. The second area of interest for individual transactions, are who individuals decide to trade with, including what relationships exist outside the simulated market. We also look at whether repeated trade partners effect surplus capture over time. In the post-experimental market survey we included a module on dyadic relationships for each trader about all 15 of the other market participants. The interaction between these two variables of interest, or the profit share captured by individuals based on their pre-existing relationships, is the third variable of interest analysed at the individual level.

As relationships are a complex variable to measure and quantify, we focused on four relationship classifications within this study. The first is whether two traders are blood-relatives of one another (i.e. not family through marriage). The notion of family within Sierra Leone is broad and poorly defined. Specifying a blood connection is an attempt to narrow this definition to a more select sub-group. The second relationship is friendship, which we proxy as those individuals who meet up socially at least twice weekly. While this is quite a crude representation, it provides a snapshot of frequent interaction on a social basis. Third, we ask about who traders work with on their farms, and which individuals they have laboured alongside for production. Finally, we ask about traders who have borrowed or

lent money to one another. Table 7 provides summary statistics on the frequency of these relationships within recorded transactions for each treatment, while Figure 3 provides the same data graphically for ease of comparison across treatments.[9]

At a glance, in both Figure 3 and Table 7, no significant changes occurs in relationship frequencies with the introduction of information asymmetries, with patterns holding between C-W and IA-W and only a small change in C-A to IA-A of blood relations decreasing relative to co-production and credit relationships. There is no indication that one relationship type becomes dramatically more(or less) important in the face of information asymmetries.

Figure 3: Individual Level: relationships between contracting traders



Moving to profit shares by treatment, Figure 4 shows surplus capture for totals (blue), buyers (maroon), and sellers (green) for each treatment. We see that buyers consistently capture more profit, even within the control treatments. Although sellers appear to capture relatively more of the surplus in within-treatment villagges compared to respective across-

[9]Note that despite best efforts in designing the experiment, across-village treatments still have a low number of pre-existing relationships within the market. This speaks to the highly inter-connected nature of Sierra Leoneon villages. We run the later regressions dropping those transactions in the IA-A and C-A treatments where individuals are known to one another to accurately assess strangers vs. acquainted trader behaviours at the individual level. The full sample regression results are included in Appendix A.

Table 7: Summary Table: Transactional Relationships

		Treatments				
		C-W	C-A	U-W	U-A	Total
Trade with kin						
No	Freq	70.73%	95.79%	70.06%	98.07%	80.31%
	Obs.	1,820	2,550	2,452	1,067	7,889
Yes	Freq	29.27%	4.21%	29.94%	1.93%	19.69%
	Obs.	753	112	1,048	21	1,934
Trade with co-producer						
No	Freq	88.46%	97.37%	88.40%	97.61%	91.87%
	Obs.	2,276	2,592	3,094	1,062	9,024
Yes	Freq	11.54%	2.63%	11.60%	2.39%	8.13%
	Obs.	297	70	406	26	799
Trade with friend						
No	Freq	41.04%	93.50%	42.40%	91.73%	61.36%
	Obs.	1,056	2,489	1,484	998	6,027
Yes	Freq	58.96%	6.50%	57.60%	8.27%	38.64%
	Obs.	1,517	173	2,016	90	3,796
Trade with financial relation						
No	Freq	79.71%	96.66%	79.60%	96.14%	86.08%
	Obs.	2,051	2,573	2,786	1,046	8,456
Yes	Freq	20.29%	3.34%	20.40%	3.86%	13.92%
	Obs.	522	89	714	42	1,367

village treatments (when comparing C-W to C-A and IA-W to IA-A). When T-tests are run to test for significance between means, every test comes up significant at the 5% level.

Figure 4: Surplus Capture for Trades by Treatment

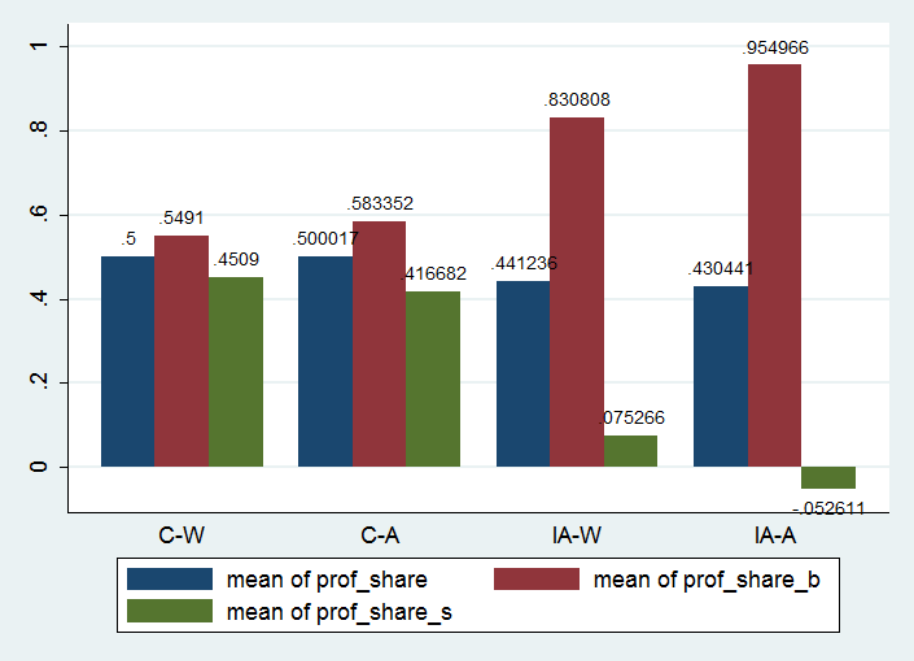


Table 9 lists the number of traders engaging in repeated trades within each treatment.

Table 8: T-Tests of Surplus Capture between Treatments

		Mean 1	Mean 2	T-Test	D.o.F.
Buyer Surplus Capture					
TB1	C-W vs. C-A	0.5491906	0.5837218	-3.4051***	2405
TB2	IA-W vs IA-A	0.8308083	0.9549663	-2.9647***	1650
TB3	C-W vs. IA-W	0.5490996	0.8308083	-12.7246***	2440
TB4	C-A vs. IA-A	0.5837218	0.9549663	-15.2136***	1615
Seller Surplus Capture					
TS1	C-W vs. C-A	0.4509004	0.4166823	3.3996***	2405
TS2	IA-W vs IA-A	0.0752662	-0.0526107	4.0686***	1765
TS3	C-W vs. IA-W	0.4509004	0.0752662	21.0437***	2521
TS4	C-A vs. IA-A	0.4166823	-0.0526107	23.5049***	1649

Two Sided Test ***p< 0.01 **p<0.05 *p<0.1

Table 9: Repeated Trade Occurences within Treatments

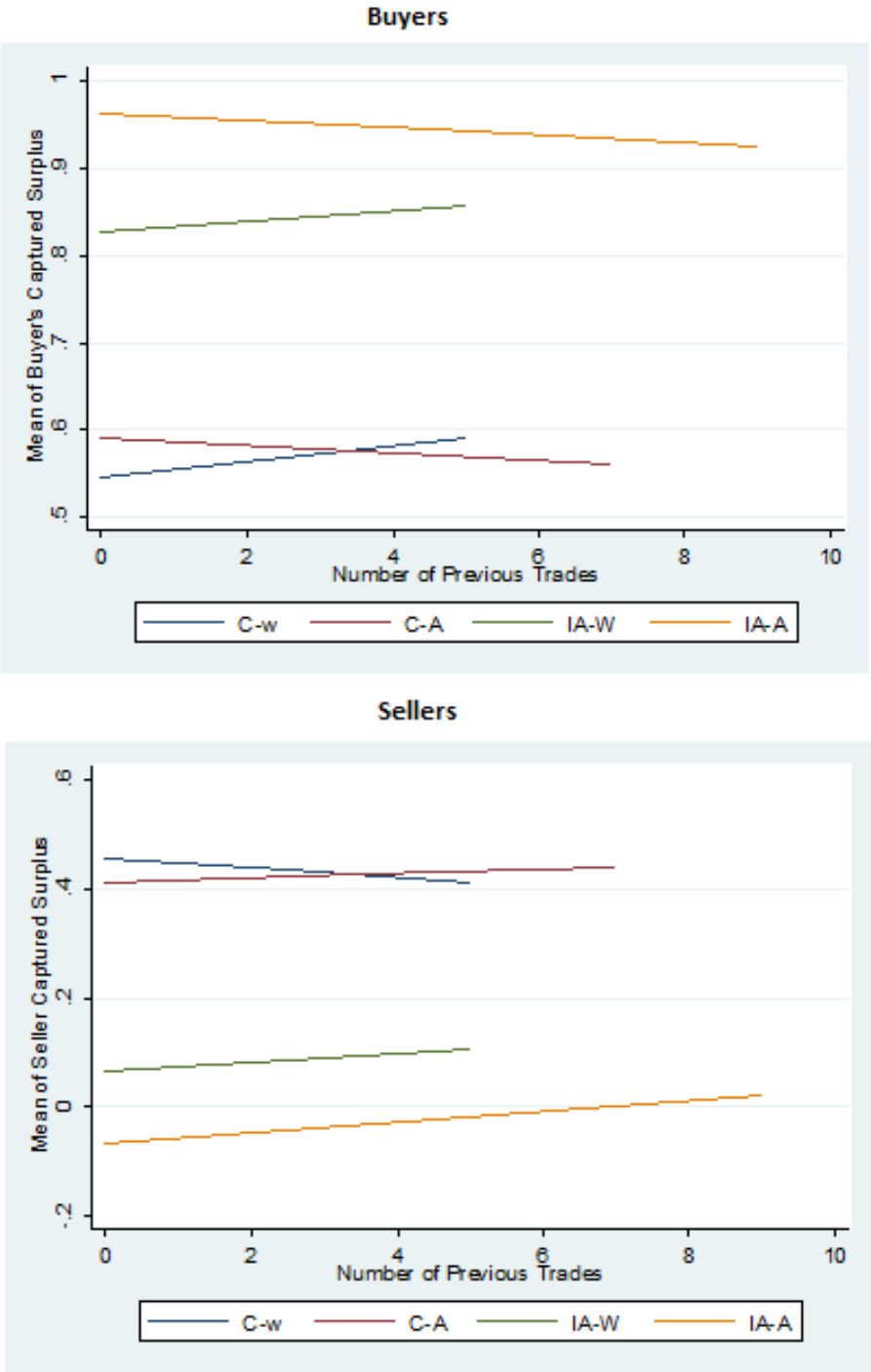
	Treatments				
No. of Prior Trades	C-W	C-A	IA-W	IA-A	Total
0	1,510	938	1,722	302	4,472
1	788	860	1,140	328	3,116
2	234	354	486	170	1,244
3	16	288	120	136	560
4	30	120	40	62	252
5	12	72	12	46	142
6	0	14	0	12	26
7	0	16	0	16	32
9	0	0	0	16	16
Total	2,590	2,662	3,520	1,088	9,860

**Note: This table reports the number of traders engaged,
for the number of trades that occurred you would have to divide each cell in half.

When we look at surplus capture in relation to repeated trades throughout rounds in Figure 5, we see some interesting results. In control treatments, opposite effects occur in C-W and C-A treatments. C-W treatments, buyers capture greater portions of available surplus with repeated trade at the expense of sellers. In the C-A treatment, buyers sacrifice portions of their surplus to the advantage of sellers with repeated trades. Unsurprisingly, there was a maximum of 5 repeated trades between two traders in C-W, but a maximum of 7 in C-A. In IA treatments, sellers do better off with more repeated trades on average in both IA-A and IA-W, while it's at the buyer's expense in IA-A but mutually beneficial in IA-W. In IA-A there was a maximum repeated trade of 9, while IA-W had a maximum of only 5. However, the sample size at the higher levels of repeated trades are quite low, so our fitted trend lines could change significantly with an increase in occurences.

When we regress our variables of interest on suprlus captured by traders, we do it for buyers and sellers seperately. For buyers, Table 10 shows the results of four regressions undertaken, varying slightly the independent variables included. All treatment dum-

Figure 5: Repeated Trade Relationships and Surplus Capture Share



mies are significant, with buyers capturing greatest shares in treatment IA-A (labeled as treat4). Buyers appear to improve their surplus capture throughout each round, indicating learning effects may be at play. The dummy variable indicating an external relationship (rels_dummy, is positive and significant, but once specific dummies are included for the four types of relationships, only the friends proxy (meet)has a significant result — and only at the 5% level. When we drop the treatment dummies and instead include a dummy for within-village treatments, IA-treatments, and an interaction between the two (capturing IA-W seperately), all three terms are significant. Within-village treatments have a negative effect on buyer surplus capture — potentially indicating higher fairness — while information asymmetries (to the advantage of the buyer) unsurprisingly improve buyer's share of a trade's surplus, both remain true even when summing together with the interaction term coefficient (social$_I A$).

For sellers we see similar results to buyers, but with an opposite directional force. For the relationship dummies, again only the variable measuring friendship has a significant result, but unlike for buyers, seller trades with friends have lower surplus capture. Perhaps friends aren't the fairest of trade partners and will seek personal gain even at their seller-friend's expense. Interestingly, in all regressions for both buyers and sellers prior trade history has not significant effect on surplus capture. This could be attributable to the relatively low occurence of repeated trades.

4 Conclusion

Overall, we see that social recognition with your trading partner does effect fairness within the market, indicating that social institutions may help failing markets to function when formal institions and government intervention are unavailable. However the extent to which these social relationships correct for market failings is relatively low. However, on average sellers within the IA-W market had positive surplus capture, while sellers in IA-A had averages of negative surplus capture. Taking these results to an extreme, one could make the point that assuming an exit option from the market, the IA-A market would fail as sellers earn no profit from engaging and withdraw from the market — as Akerlof

Table 10: Individual Level Regressions: Surplus Capture of Buyers

VARIABLES	(1) Buyer Surplus Share	(2) Buyer Surplus Share	(3) Buyer Surplus Share	(4) Buyer Surplus Share
treat1	-0.285***	omitted	omitted	
	(0.0538)			
treat2	-0.242***	0.0812***	0.0870***	
	(0.0539)	(0.0253)	(0.0252)	
treat3	-0.155**	0.132***	0.129***	
	(0.0603)	(0.0286)	(0.0286)	
treat4	omitted	0.324***	0.329***	
		(0.0554)	(0.0552)	
round_id	0.00730**	0.00724**	0.00715**	0.00715**
	(0.0034)	(0.0034)	(0.0034)	(0.0034)
trade_id	0.0248***	0.0249***	0.0250***	0.0250***
	(0.0059)	(0.0060)	(0.0059)	(0.0059)
cv	0.000100***	0.000100***	0.000100***	0.000100***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
prior_trade	0.0002	-0.0003	0.0000	0.0000
	(0.0069)	(0.0069)	(0.0069)	(0.0069)
blood			0.0454	0.0454
			(0.0341)	(0.0341)
meet			0.0549**	0.0549**
			(0.0235)	(0.0235)
farmshare			0.0342	0.0342
			(0.0449)	(0.0449)
borrow			-0.0231	-0.0231
			(0.0327)	(0.0327)
rels_dummy		0.0577***		
		(0.0212)		
social				-0.0870***
				(0.0252)
IA				0.242***
				(0.0539)
social_IA				-0.114*
				(0.0628)
Constant	0.0723	-0.251***	-0.257***	-0.170**
	(0.0916)	(0.0808)	(0.0816)	(0.0746)
Observations	3907.0000	3907.0000	3894.0000	3894.0000
R-squared	0.2020	0.2040	0.2050	0.2050

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

(1970b) predicts. In the IA-W market, sellers still manage to earn low profits and the market may struggle on over time despite the strong information asymmetries present. This paper can contribute to the growing literature on pro—social behaviour and fairness, as results are quite strongly indicative of socially-connected traders engaging in more fair division of trade surpluses when compared to non—social trades. This norm of fairness is strengthened when informational asymmetries are introduced, but are present even in the "perfect" market of the control treatment. Social capital, in the form of fairness, does facilitate markets operating even under extremely poor conditions, but markets perform poorly with extremely low efficiencly levels and high inequality in profit division, so social

Table 11: Individual Level Regressions: Surplus Capture of Sellers

VARIABLES	(1) Seller Surplus Share	(2) Seller Surplus Share	(3) Seller Surplus Share	(4) Seller Surplus Share
treat1	0.440***	0.474***	omitted	
	(0.0361)	(0.0380)		
treat2	0.414***	0.415***	-0.0555***	
	(0.0353)	(0.0353)	(0.0199)	
treat3	0.111***	0.144***	-0.329***	
	(0.0412)	(0.0430)	(0.0252)	
treat4	omitted	omitted	-0.470***	
			(0.0374)	
round_id	-0.00438*	-0.00460**	-0.00505**	-0.00505**
	(0.0023)	(0.0023)	(0.0023)	(0.0023)
trade_id	-0.0288***	-0.0288***	-0.0285***	-0.0285***
	(0.0055)	(0.0055)	(0.0055)	(0.0055)
cv	-9.18e-05***	-9.17e-05***	-9.15e-05***	-9.15e-05***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
prior_trade	-0.0029	-0.0026	-0.0024	-0.0024
	(0.0055)	(0.0055)	(0.0055)	(0.0055)
blood			-0.0224	-0.0224
			(0.0206)	(0.0206)
meet			-0.0353*	-0.0353*
			(0.0183)	(0.0183)
farmshare			-0.0327	-0.0327
			(0.0244)	(0.0244)
borrow			0.0103	0.0103
			(0.0241)	(0.0241)
rels_dummy		-0.0506***		
		(0.0189)		
social				0.0555***
				(0.0199)
IA				-0.415***
				(0.0353)
social_IA				0.0857**
				(0.0428)
Constant	0.463***	0.463***	0.934***	0.878***
	(0.0643)	(0.0643)	(0.0536)	(0.0494)
Observations	4013.0000	4013.0000	3995.0000	3995.0000
R-squared	0.3160	0.3180	0.3190	0.3190

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

capital cannot be considered a subsitute to formal institutions or government intervention.

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5 Appendix A

Table 12: Individual Level Regressions: Surplus Capture of Buyers - Full Sample

VARIABLES	(1) $\text{prof}_s hare_b$	(2) $\text{prof}_s hare_b$	(3) $\text{prof}_s hare_b$	(4) $\text{prof}_s hare_b$
treat1	-0.260***	-0.295***	-0.309***	
	(0.0546)	(0.0520)	(0.0511)	
treat2	-0.222***	-0.236***	-0.237***	
	(0.0541)	(0.0504)	(0.0499)	
treat3	-0.129**	-0.165***	-0.182***	
	(0.0613)	(0.0592)	(0.0585)	
treat4	omitted	omitted	omitted	
$\text{round}_i d$	0.00726**	0.00762**	0.00760**	0.00760**
	(0.0033)	(0.0033)	(0.0033)	(0.0033)
$\text{trade}_i d$	0.0240***	0.0278***	0.0281***	0.0281***
	(0.0058)	(0.0064)	(0.0064)	(0.0064)
cv	9.99e-05***	9.95e-05***	9.95e-05***	9.95e-05***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
$\text{prior}_t rade$	-0.000221	-0.00101	-0.000653	-0.000653
	(0.0067)	(0.0081)	(0.0078)	(0.0078)
age		-0.000772	-0.000751	-0.000751
		(0.0007)	(0.0007)	(0.0007)
gender		0.0121	0.00983	0.00983
		(0.0215)	(0.0213)	(0.0213)
literate		0.0453*	0.0467*	0.0467*
		(0.0237)	(0.0238)	(0.0238)
$\text{indiv}_t rader$		-0.00912	-0.00989	-0.00989
		(0.0217)	(0.0219)	(0.0219)
$\text{born}_v ill$		0.00652	0.00375	0.00375
		(0.0246)	(0.0245)	(0.0245)
$\text{score}_p ca$		0.0194**	0.0172**	0.0172**
		(0.0077)	(0.0076)	(0.0076)
blood			0.0796**	0.0796**
			(0.0386)	(0.0386)
meet			0.0179	0.0179
			(0.0238)	(0.0238)
farmshare			0.0208	0.0208
			(0.0436)	(0.0436)
borrow			-0.0438	-0.0438
			(0.0297)	(0.0297)
$\text{rels}_d ummy$		0.0176		
		(0.0221)		
social				-0.0717***
				(0.0253)
IA				0.237***
				(0.0499)
$\text{social}_I A$				-0.110*
				(0.0614)
Constant	0.0534	0.0189	0.0257	-0.212**
	(0.0904)	(0.0988)	(0.0966)	(0.0882)
Observations	4059	3282	3271	3271
R-squared	0.2	0.207	0.21	0.21

Robust standard errors in parentheses
*** p< 0.01, $**p$¡0.05, * p< 0.1

Table 13: Individual Level Regressions: Surplus Capture of Buyers - Full Sample

VARIABLES	(1.0000) Seller Surplus Share	(2.0000) Seller Surplus Share	(3.0000) Seller Surplus Share	(4.0000) Seller Surplus Share
treat1	omitted	omitted	0.463***	
			(0.0400)	
treat2	-0.0274	-0.0568***	0.412***	
	(0.0170)	(0.0206)	(0.0387)	
treat3	-0.329***	-0.324***	0.141***	
	(0.0267)	(0.0303)	(0.0456)	
treat4	-0.442***	-0.468***	omitted	
	(0.0342)	(0.0406)		
round_id	-0.00401*	-0.00516**	-0.00574**	-0.00574**
	(0.0023)	(0.0024)	(0.0024)	(0.0024)
trade_id	-0.0283***	-0.0272***	-0.0270***	-0.0270***
	(0.0055)	(0.0058)	(0.0058)	(0.0058)
cv	-9.10e-05***	-9.13e-05***	-9.11e-05***	-9.11e-05***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
prior_trade	-0.0049	-0.0022	-0.0020	-0.0020
	(0.0056)	(0.0058)	(0.0058)	(0.0058)
age		-0.00202***	-0.00206***	-0.00206***
		(0.0006)	(0.0006)	(0.0006)
gender		0.0274	0.0297*	0.0297*
		(0.0167)	(0.0167)	(0.0167)
literate		0.0136	0.0112	0.0112
		(0.0173)	(0.0176)	(0.0176)
indiv_trader		-0.0075	-0.0084	-0.0084
		(0.0152)	(0.0148)	(0.0148)
born_vill		-0.0264	-0.0247	-0.0247
		(0.0207)	(0.0214)	(0.0214)
score_pca		-0.0074	-0.0068	-0.0068
		(0.0067)	(0.0069)	(0.0069)
blood			-0.0190	-0.0190
			(0.0208)	(0.0208)
meet			-0.0210	-0.0210
			(0.0178)	(0.0178)
farmshare			-0.0498*	-0.0498*
			(0.0294)	(0.0294)
borrow			0.0038	0.0038
			(0.0213)	(0.0213)
rels_dummy		-0.0443**		
		(0.0177)		
social				0.0515**
				(0.0196)
IA				-0.412***
				(0.0387)
social_IA				0.0894*
				(0.0477)
Constant	0.897***	1.037***	0.567***	0.979***
	(0.0491)	(0.0617)	(0.0702)	(0.0587)
Observations	4174.0000	3376.0000	3358.0000	3358.0000
R-squared	0.3150	0.3230	0.3250	0.3250

Robust standard errors in parentheses
*** p< 0.01, ∗ ∗ p¡0.05, * p< 0.1