Development Cooperation
Ministry of Foreign Affairs

Does Market Experience Shape Behaviour?

Experimental Evidence From Rural Ethiopia

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June 2010

VC4PD

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The Netherlands' Directorate-General for International Cooperation and Wageningen UR are implementing the Partnership Programme 'Globalisation and Sustainable Rural Development'. In the context of conflicting local, national and global interests and drivers of change processes, the programme aims, among other things, to generate options for the sustainable use of natural resources, pro-poor agro-supply chains and agro-biodiversity. Capacity strengthening and institutional development form cross-cutting issues in of the Partnership programme. The programme's activities contribute to improved rural livelihoods, poverty alleviation and economic development in countries in the south. Farmers and other small-scale entrepreneurs in the agricultural sector form the primary target group. The program has a strong -but not exclusive- focus on countries in Sub-Sahara Africa.

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1 Introduction

People make choices to satisfy their needs given a finite set of resources. Scarcity requires choice, and "rationality is a tool for defining the best choice" (Barnes and Sheppard, 1992). Economists use rational choice theory to predict "correct" or "optimal" behaviour of agents, or infer underlying preferences by analyzing actual behaviour of people. The first theorem of welfare economics then stipulates that market equilibria based on self-interested utility maximization are efficient. It is routinely assumed that respondents maximize a continuous, concave and monotonic utility function, which requires completeness, reflexivity and transitivity of preferences. The Generalized Axiom of Revealed Preference (GARP) is a necessary and sufficient condition to meet these requirements (Varian, 1982). A GARP violation occurs when a bundle x is chosen when a bundle y is available, where bundle y has at least as much of all goods and strictly more of at least one good than a third bundle z, and z has been directly or indirectly revealed to be preferred to x. Economics may lose its power as a predictive discipline if actual behaviour is characterized by irrational choices, and the efficiency of market equilibria is no longer guaranteed.

Rational choice theory has been a powerful basis for the development of theories, policies and ideologies. Until fifteen years ago, consistency of choices of real agents was assumed, rather than measured. However, the assumption of rationality proved untenable. Experiments showed that between 10 and 75 percent of subjects violated the GARP predictions (e.g. Sippel, 1997; Harbaugh et al., 2001; Andreoni and Miller, 2002), acting more or less irrationally according to the neoclassical paradigm. Such studies were typically carried out in controlled environments with a non-random sample of respondents (e.g., students), with very limited effort to test the external validity of the findings.

Henrich et al. (2004) suggest that exposure to markets influences preferences, including social preferences and the propensity to trust others. Following up on that argument, it may be hypothesized that rationality violations are also dependent on the nature of the context and market experience. Specifically, evidence suggests rationality violations are less prevalent in an environment that more closely resembles the market-type of setting that is the basis of neoclassical models (List and Millimet 2008, but see also the discussion below). Professional stock brokers, for example, may reveal more consistent choices in the above-mentioned experiments than a person who has rarely engaged in competitive markets and has exchanged goods according to other mechanisms. If so, rationality is not a hard-wired characteristic of humans. Rather, it is a trait that will be acquired through learning and exposure to markets. Markets, then, are not simply mechanisms to allocate goods and services. They are also forces shaping the underlying nature of preferences (Henrich et al. 2004) as well as the processes with which preferences are translated into behaviour: buying and selling.

We use a field experiment in Ethiopia to explore whether trading experience affects rationality, and analyze which factors affect the "learning process" associated with reducing rationality violations. A field experiment was developed in Humera, Ethiopia, that involved local farmers and traders and that was designed so as to be closely related to the core of their livelihoods strategies (selling and buying sesame). Initially, both farmers and traders rarely satisfied the GARP requirements; rationality violations were common. However, after a randomly selected subsample of our respondents was exposed to a treatment that involved participation in a competitive real sesame market, we observed that treated farmers showed significant reductions in the number of GARP violations. We also document that farmers and traders responded differently to the treatment.

The paper is organized as follows. In section 2 we discuss the existing literature on market experience and rationality. In section 3 we present the context and background to the field experiment. Section 4 outlines the experimental design and presents the data, whilst section 5 contains all the results. Finally the discussion and conclusions are presented.

2 Rationality and market experience

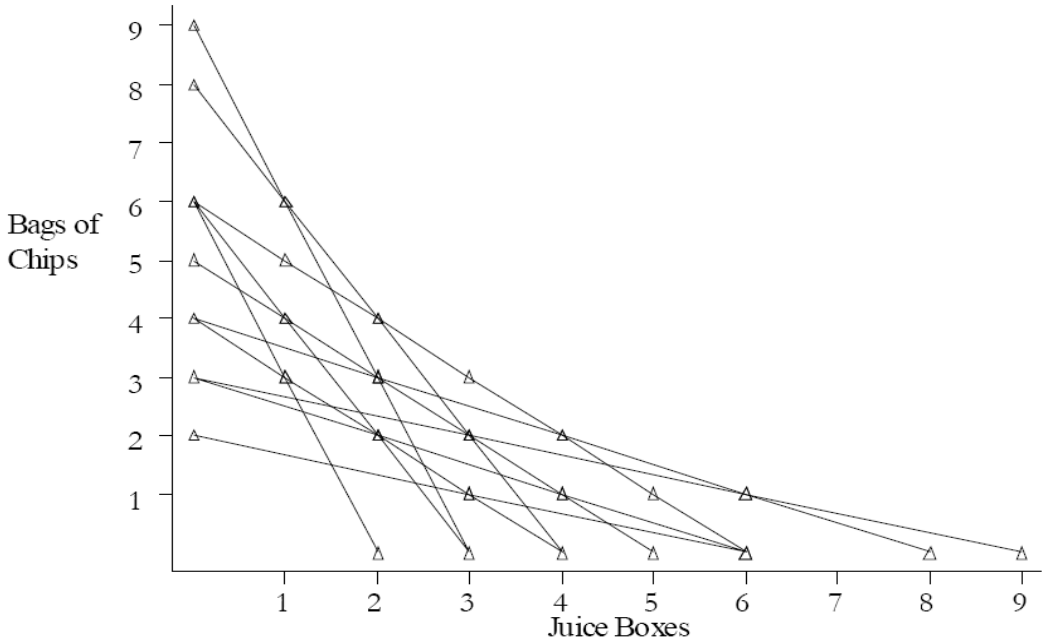
Since Becker (1962), authors have tried to capture apparently "irrational behaviour" into economic theory to account for behavioural patterns that were seemingly at odds with prescriptions for Homo Economicus. For example, Simon (1982) explored relaxing certain assumptions (i.e. perfect information) in his models of bounded rationality, and Bowles (1998) argued that preferences are not hard-wired but malleable and endogenous to markets and institutions. Bussemeyer et al. (2006) believe that violations of the bounds of rationality might "reflect subtle, yet reasonable, dependencies on the environment", suggesting that different market environments may lead to different rationalities.

Several lab experiments (e.g. Smith, 1962) show that, when placed in the "right environment", agents tend to behave according to neoclassical theory. List (2003) provides empirical evidence that certain market anomalies tend to vanish as market experience increases, confirming a hypothesis dating back to Koopmans (1964). Inspired by a famous experiment by Knetsch et al. (1989), List investigated the strength of the endowment effect (i.e. the tendency of subjects to keep a randomly allocated gift, rather than swapping it for an equally valuable alternative good). He shows that this tendency is strongest among inexperienced non-traders, and that, as market experience intensifies, behaviour converges to the neoclassical predictions (no endowment effect). While suggestive, such studies cannot address an important concern regarding self selection: people who behave more rationality are perhaps more likely to self-select into occupations that involve trading. If so, the correlation between market experience and rationality does not necessarily imply a causal effect of market exposure on rationality and coherence of choice.

This challenge is addressed in an important and prize winning follow-up study. List and Millimet (2008) designed a field experiment where randomly selected respondents are exposed to a market setting, and analyze how market experience influences the consistency of choices. This is a true test of endogenous rationality.

List and Millimet sample young sportcards traders and young subjects shopping at a mall, and first test the pre-existing levels of rationality violations among these subjects. For this, they use a GARP test developed by Harbaugh et al. (2001), which involves gift bundles of juice boxes and chips. Subjects were offered three to seven different gift bundles from which to select their preferred gift. The composition of the gift bundles depended on the relative price of the two goods in the proposed choice sets (Figure 1) and on the budget. Once the choice sets had been evaluated and their preferred gift chosen, the experimenters randomly selected one of the gift bundles and offered it to the subject.

Figure 1: Gift Bundles and possible choice sets (Harbaugh et Al., 2001)



List and Millimet found that only a minority of the subjects made choices consistent with profit maximization. Overall, some 70% of the subjects exhibited at least one GARP violation. Consistent with the evidence above, they also found that self-selected traders are significantly more rational than their counterparts. But again, due to self selection into the trading business, this is not necessarily indicative of a causal effect.

Next, they induced a random subsample of the young shoppers to participate in the sportcards' market[1]. Randomization at this stage allows the analysts to "circumvent" the potential bias due to self selection. Upon comparing the learning rates of "non-treated" shoppers to the treated ones, List and Millimet again find that market experience and rational choice directly related. The key result is that treated shoppers have significantly fewer GARP violations than the control group[2]. Thus, List and Millimet present robust empirical proof of endogenous rationality induced by participating in a real market, rather than a tailored lab experiment. They clarify that the external evidence of their experimental evidence is an important issue.

While Akerlof and Yellen (1985) find that small amounts of non-maximizing behaviour have little impact on economic equilibria, and Gode and Shyam (1993) demonstrate that even zero-intelligence softwares reach allocative efficiency at market level, the results with respect to endogenous rationality potentially have important implications for (economic) policy. For example,

[1] To induce the selected subsample to participate to the sportcards' market, List and Millimet offered them a "parting gift" worth approximately $25 of sportscards and memorabilia. Then they informed the subjects about the approximate value of the gifts and stated the dealers at the show were interested in the goods. Finally, the experimenters stressed that the gifts could be sold, swapped, or taken home

[2] As a significant number of subjects did not return to the experiment, List and Millimet possibly faced a bias due to non-random attrition, i.e. the possibility that the subjects that had self-selected out of the experiment had different characteristics from the participating subjects. The Heckman Selection model however yielded no statistically meaningful evidence of non-random attrition, whilst the significance of the market experience term remains robust.

Goodhue et al. (1998) argue that liberalization policies in transition countries should take market "learning costs" into consideration when setting the target level of privatization. In addition, notwithstanding limited efficiency losses at the "macro level", the distributional impacts of market experience and irrational choice can be a concern for policy makers, as it brings up problems of competitiveness, rent allocation, equality, and regional growth.

3 Context and background

To test rationality effects from market experience amongst "real agents", an experiment involving sesame smallholders and traders in the Ethiopian town of Humera was organized (Figure 2).

Figure 2: Location of Humera, Ethiopia

At the border with Eritrea and Sudan, in the Ethiopian hot lowlands, Humera has experienced a period of stable economic growth since sesame was introduced as a cash crop in the late 1990s. Smallholders, however, have benefited little from this innovation, locked up by credit constraints and ineffective trade practices. The farmers used for this study were selected from the village of Baeker, separated from the main town by 57 km of dirt road, and living in a rather isolated environment. They may deliver their produce to the village cooperative, which then sells it on their behalf, or directly sell the sesame to local traders. These traders often work in interlinked markets, serving also as moneylenders. Smallholders are therefore restricted in their selling choices, and tend to trade with the same trader over time.

When quantities traded are sufficiently large, the exchange happens through the mediation of a so-called "broker". Brokers assist the flow of various tons of sesame per year, and therefore are considered more experienced in trading than smallholders. Farmers, however, do not work in a conventional competitive market environment. To outperform their colleagues, long-standing relations, trust, and reputation are important. They spend time and money to "court" sellers and buyers: sticking banknotes into pockets, offering beers and motor rides, going to weddings and so on. Besides, they sometimes engage in money-lending activities. Bargaining over prices is therefore relatively less important for this end of the sesame value chain.

All the traders that participated in the experiment belong to this category of brokers. Normally they receive a fixed commission of 2 Birr (0,16 US$) per quintal from each trading partner. Contrary to traders that base their profits on the purchase and sale margins, which could be called "merchants" for distinction, brokers often have peasant origins and limited formal

education. The use of brokers in our experiment therefore limits the potential role of other influences (such as life experiences, education, family environment, ethnical group, urban/rural origins, etc.) on rationality levels. In what follows we use the terms “broker” and “trader” interchangeably.

Sesame trading in Ethiopia will soon be in a state of flux. A major institutional innovation, the Ethiopian Commodity Exchange (ECX), has been introduced by the central government. Brokers, and others, might see their position change in the value chain during the next years. The philosophy behind the ECX is that a central and transparent market for key export crops will lower transaction costs in the value chain, and will address issues about asymmetric information. The idea is to link farmers directly to international markets, and the mechanism chosen is an open outcry double auction trade floor, in the capital city Addis Ababa. The impact of the ECX on farmers' livelihood has still to be assessed. This study looks at the possible effects that a change in market “environment” could have on the behaviour of key agents. We introduce elements of the ECX – a competitive market environment characterized by public bidding – at the village level, allowing farmers and brokers to engage in competitive selling and buying of a crop that is the basis of their livelihood strategy.

4 Experimental design and data

The experiment builds on List and Millimet (2008), and aims at testing the external validity of their findings with respect to endogenous rationality. Rather than teenagers, we focus on adults (18 to 74 years old) with considerable experience in life (including market transactions, but predominantly in a non-competitive context). In fact, while local farmers mainly produce sesame, a cash crop, their "competitive market experience" may be limited as local trade practices are often related to personal relations and interlinked transactions (e.g. linked to the provision of credit). Traders might have more market experience and face some sort of self-selection bias, and are therefore useful to compare rationality levels and learning rates.

Our design also differs from List and Millimet because our subjects are not drawn to a market (sportcards) that might be extraneous or irrelevant for them, but are instead asked to engage in transactions that involve their main source of income, sesame, and that involve an institutional innovation that is and will be salient to them. Other differences have to do with the different culture, the income level (our respondents are poor, with an average income level of 1-2 US$ a day for the farmers and 6-7 US$ for the traders), and with the fact that the treatment and its implied opportunities were very significant to the participants, as it was ensured that the premium resulting from participation to the treatment would exceed the opportunity cost of one day of work at that time of the year. These differences broaden the scope of the research beyond merely assessing the external validity of List and Millimet's results, upgrading it to a distinctive field experiment with unique features and wide-ranging policy implications.

A pilot survey showed that both smallholders and traders had limited experience in competitive trading, and a pilot experiment demonstrated that GARP violations were common when subjects had to choose a preferred bundle of goods for a range of different relative prices. After this test, 68 smallholders from a remote village – which had already agreed to sell sesame collectively to one trader at a given price through their cooperative – were randomly selected to participate in the field experiment.

After filling out a brief survey, including age, level of formal education attained, hectares of land owned, amount of money borrowed from informal moneylenders, and a self-evaluation parameter expressing their "market experience", the farmers where kindly asked to select their preferred gift which is the standard approach to measuring GARP violations. They were shown 8 separate sheets of paper on which 6 to 10 distinct gift possibilities were depicted (see annex). Gifts included raw coffee beans (in unitary bags of 100 g), sugar (in unitary bags of 500 g) and mango juice (in bottles of 300 ml), all familiar, similar in price, and commonly consumed by the farmers. By showing drawings of possible gifts, rather than giving a budget and relative prices, it was made certain that the subjects did not need to "do the math to stay within a budget constraint" (Harbaugh et al., 2001). To ensure comprehension, several trial runs were done. Moreover, it was clearly stated that each agent would receive only one of the eight selected gifts. A transparent lottery process was used to determine which choice would be selected. Table 1 shows the relative prices that determined the composition of the gift bundles in each choice set. In choice set 2 for example, with a budget of 4 "$" the subjects could receive: (1). two bags of coffee (200g); (2). one bag of coffee (100g) and two of sugar (1000g); (3). one bag of coffee (100g) and one bottle of mango juice (300ml); (4). four bags of sugar (2000g); (5). two bags of sugar (1000g) and one bottle of mango juice (300ml); or (6). two bottles of mango juice (600ml). A copy

of the paper sheets shown to the agents can be found in the Appendix[3]. A group of 22 traders, all members of the only brokers' cooperative in the area, went through an identical procedure.

Table 1: Choice sets, budgets and relative prices

Choice Set	Budget $	Coffee $	Sugar $	Mango Juice $	Possible Choices
1	4	2	2	2	6
2	4	2	1	2	6
3	3	1	1	2	6
4	4	1	2	2	6
5	3	1	2	1	6
6	3	2	1	1	6
7	4	2	2	1	6
8	3	1	1	1	10

Following the GARP experiment, traders and farmers were randomly divided into four groups: two treatment groups (one for farmers and one for traders), and two controls groups. The "treatment" groups were kindly asked to participate in a trading session mimicking the new auction process at the ECX, the following Sunday. The "control" groups, instead, were invited to simply re-do the same GARP game after 6-7 days. The randomness of the partition is confirmed by the descriptive statistics of Table 2 and Table 3.

Table 2: Group statistics, Traders

Variable	Group (subjects)	Mean	Std. Dev.	Min.	Max.
Age	Control (10)	35.3	5.42	29	48
	Treat (12)	35.1	8.81	28	59
Education (grade)	Control (10)	5.6	3.84	0	10
	Treat (12)	5.8	2.48	2	10
Experience (1-5)	Control (10)	4.5	0.70	3	5
	Treat (12)	4.0	0.90	2	5
GARP violations	Control (10)	12.2	7.54	0	24
	Treat (12)	11.8	10.07	0	28

Table 3: Group statistics, Farmers

Variable	Group (subjects)	Mean	Std. Dev.	Min.	Max.
Age	Control (21)	39.4	14.42	18	74
	Treat (26)	46.6	14.16	20	68
	Non-Complying (21)	41.4	13.99	18	70
Education (grade)	Control (21)	3.5	3.09	0	9
	Treat (26)	3.9	3.46	0	10
	Non-Complying (21)	3.6	3.09	0	10
Experience (1-5)	Control (21)	3.7	1.35	1	5
	Treat (26)	3.8	0.98	2	5
	Non-Complying (21)	3.6	1.16	1	5
Land farmed (ha)	Control (21)	5.6	5.24	1	20
	Treat (26)	5.7	4.77	1	20
	Non-Complying (21)	7.1	7.27	1	30
Pre-harvest selling (*shel*)	Control (21)	0.9	1.28	0	3
	Treat (26)	1.0	2.10	0	10

[3] GARP violations were counted with the GARP software hosted on the EconPort digital library (Cox and Swarthout, 2006).

(quintals)	Non-Complying (21)	0.9	1.11	0	3
Credit from Moneylender (Birr)	Control (21)	1404.8	2483.04	0	10000
	Treat (26)	1346.2	1758.01	0	6000
	Non-Complying (21)	931.4	1768.26	0	5500
GARP violations	Control (21)	11.1	5.94	0	20
	Treat (26)	12.8	5.27	1	21
	Non-Complying (21)	11.7	6.37	1	22

As is evident from Table 2 and Table 3, the average number of GARP violations did not vary significantly across subgroups; neither did any other variable reflecting "personal characteristics". GARP violation levels did not vary significantly also across "types" (p=0.964). On the other hand, between traders and farmers education, age and experience are all significantly different (at a 5% level). Traders tend to have attained a slightly higher average education level (+2.05 years) and self-declare higher trading experience (+0.55). Farmers instead are on average older than traders (7.61 years), and present a much wider age range.

The market treatment was inspired by Smith (1976), and consisted of an open outcry double auction similar to the trading floor of the ECX. Farmers and traders were told that a given quantity of sesame sold previously by their coop had to be re-bargained that day, and that market participants could make extra-profits in accordance with the selling/buying prices that eventuated in the auction. The cost associated with the auction were thus modest (we only paid for the difference between the 'market prices' and the formerly agreed price). The sesame had been sold collectively by the coop (circa 500 members), not by the farmers themselves. Farmers and traders faced normal incentives to bargain, as their payoff depended on deviations (trading margins) from threshold values. The trading margin for farmers was simply the bargained price minus 1.540 Birr (which was the price struck earlier by the coop). The 26 (out of 32) farmers that showed up were only allowed to sell 1 quintal per round, and were paid at the end of the experiment only the sum of the margins over the 6 rounds. The rest, as promised, would be paid through their coop. The 12 traders were told to buy 2 quintals per round, at the lowest price possible. For each round they would receive the difference between the buying price, and the threshold value of 1.565 Birr. Participating traders were also offered a 300 Birr award, to cut opportunity costs, and had their bus trip fully organized and paid, to reduce transaction costs. None of the 22 traders withdrew from the experiment, so bias due to non-compliance was not an issue.

During this "fictitious real market" 132 quintals of sesame were sold, adding a modest cost of 203.991 Birr (US$ 16.319) to the experiment's finances. The average selling price was 1.545,39 Birr per quintal (US$ 123,63). Farmers sold on average 5,1 bags of 1 quintal of sesame, averaging therefore 7.845 Birr (US$ 627). Of these, only 27,35 Birr (US$ 2,19) each were paid by the experimenters. Treated traders earned instead 316 Birr (US$ 25,26) on average. After the treatment, the traders and the treated as well as "control" farmers were asked to re-perform the GARP experiment, and again were handed the selected gift.

This ended the data collection process. In total there were 21 non-complying farmers—who either failed to show up for the auction treatment or for the endline GARP assessment. We tested for bias due to non-random self selection, see section 5.

5 Experimental results

We used a three-goods GARP violations test to determine the consistency of choices. Compared to two-good tests, this approach invites more frequent GARP violations. Indeed, compared to List and Millimet (2008) we find that a greater share of the farmers and traders revealed at least one GARP violation during the first round.

RESULT 1: 98,5% of the farmers and 81,8% of the traders revealed at least one GARP violation in the first round of the experiment.

When computing sample means and standard deviations we find that the difference in GARP violations between farmers and traders disappears (Table 4).

Table 4: GARP violations at time zero, per type and group

Type	Group (subjects)	Mean	Std. Dev.	Min.	Max.
Farmers	Control (21)	11.10	5.94	0	20
	Treat (26)	12.81	5.27	1	21
	Non-Complying (21)	11.67	6.37	1	22
Traders	Control (10)	12.20	7.54	0	24
	Treat (12)	11.83	10.07	0	28

RESULT 2: farmers and traders did not show significant differences in the number of GARP violation levels in the first round of the experiment (t=-0.05; p=0.964).

We find no evidence that non-complying farmers are systematically different from complying farmers (recall that non-compliance cannot bias our results for traders as there was full compliance in that sample). Table 5 presents the results of a probit model that predicts compliance with respect to the farmer's GARP violation levels in the first round.

Table 5: Probit of compliance and initial level of GARP violations for farmers

Independent Variable	Coefficient	Std. Error	Z	P>|z|
GARP violations	-0.02	0.02	-0.87	0.385
Constant term	1.12	0.29	3.93	0.000

Table 5 shows that the initial number of GARP violations levels is not significantly correlated with compliance when regressed alone. The same result was obtained for a multivariate probit that included a vector with "personal characteristics" (no variable was significant at a 5% level). Therefore we reject the hypothesis of non-random self-selection.[4]

On average subjects exhibited 11.9 GARP violations during the first round. This number fell in the second round. For the control group, this implies that there is some learning. For the treated group, we pick up both learning and the treatment effect. During the second round the pooled

[4] To further test for non-random selection of the 21 non-compliers, we also estimated a Heckman selection model, using age, education and experience as instruments. While the results support the earlier results (specifically, the Treatment variable is significant at 1%), the instruments are weak in terms of relevance. Details available from the author on request

average decreased to 10.4 for the non-treated and 6.8 for the treated subjects (Table 6). The difference between the reduction in GARP violations is statistically significant, implying that our pooled data pick up a treatment effect. Subjects who have been exposed to the auction make significantly less rationality violations than their peers in the control group.

Table 6: GARP violations through time, per treatment and type

Treat	Group (subjects)	Time 0	Time 1	Change
Non-treated	Farmers (21)	11.10	9.95	-1.15
	Traders (10)	12.20	11.20	-1.00
	Non-Complying (21)	11.67	-	-
Treated	Farmers (26)	12.81	7.69	-5.12
	Traders (12)	11.83	4.42	-7.41

Next, we estimated a panel model, and regressed the number of GARP violations on the treatment dummy and a series of controls. The results for the pooled dataset again support the view that the market treatment significantly reduced the number of GARP violations (Table 7). This is true for the regular panel model and the model that allows for serially correlated error terms (GLS with random effects).

RESULT 3: market experience and rational choice behaviour are directly related: engaging in a competitive market reduced pooled GARP violations by 4.91 (OLS), or ¾ of a Standard Deviation (6,60).

Table 7 summarizes the results of the pooled OLS and the pooled GLS with random effects regressions, based on the equation:

$$GARP_{it} = X_{it}\beta + Treat_{it}\delta + \eta_{it} \quad \text{with } i = 1,\ldots,N \text{ and } t = 0,1 \qquad (1)$$

Where $GARP_{it}$ represents the number of GARP violations for subject i in round t, X_{it} is a vector of personal characteristics including type (farmer or trader), age, education and self-assessed market experience level. $Treat_{it}$ is a dummy representing whether or not a subject participated to the market experiment and $\eta_{it} = \varepsilon_{it} + \mu_i$ is the error term composed by the idiosyncratic shock and the individual-specific terms. The model translates into an OLS if σ^2_μ – or the variance of the random effects in the GLS – is equaled to zero: $\sigma^2_\mu = 0 \rightarrow$ OLS (Table 4.4); else $\sigma^2_\mu \neq 0 \rightarrow$ GLS-re.

Table 7: Pooled (panel data) OLS and GLS-re regressions

Model	Variable	Coefficient	Std. Error	t	P>|t|
GLS-re	Treat	-5.30	1.08	-4.89	0.000
	Type	0.48	1.42	0.34	0.737
	Age	0.03	0.54	0.50	0.618
	Edu.	-0.03	0.21	-0.14	0.892
	Exp.	0.26	0.60	0.47	0.636
	Const.	9.29	3.63	2.56	0.011
OLS	Treat	-4.91	1.22	-4.01	0.000
	Type	0.60	1.24	0.48	0.630
	Age	0.02	0.05	0.50	0.617
	Edu.	-0.18	0.19	-0.09	0.926
	Exp.	0.36	0.49	0.73	0.469
	Const.	8.82	3.22	2.74	0.007

Both models indicate that the treatment variable has a negative sign and is significant at the 1% level. Interestingly, personal characteristics do not significantly affect the number of GARP violations. We proceed by considering farmers and traders separately. Results are summarized in Table 8.

Table 8: Determinants of GARP violations: Pooled, Farmers and Traders

Group	Model	type	Age	Edu	exp	treat
Pooled (69)	OLS	0.60	0.02	-0.02	0.36	-4.91*
	GLS-re	0.48	0.03	-0.03	0.26	-5.30*
Farmers (47)	OLS	-	0.05	0.32	-0.24	-4.05*
	GLS-re	-	0.05	0.29	-0.30	-4.10*
Traders (22)	OLS	-	0.05	-0.63	2.15	-6.68*
	GLS-re	-	0.05	-0.63	2.12	-7.08*

Note: the sign "*" indicates a significance at a p<0.01 level;

RESULT 4: Both farmers and traders separately reveal a significant (at p<0,01) reduction in GARP violations after market participation ("treat"). Moreover, the number of subjects revealing at least one GARP violation (inconsistent choices) dropped to 73,1% and 58,3%, respectively, after treatment.

The treatment coefficient is greater for traders than for farmers. Does this imply that traders learned more from participating in the experiment than the farmers? To further assess whether there is a difference in "learning rates" between farmers and traders, an additional OLS regression is run for the treated (Table 9) and non-treated subjects separately, controlling for age, education and experience . We find a difference in learning rates for treated subjects. Hence, we find evidence that traders behave more rationally after they have been introduced to a market environment. This might reflect a selection effect; the quicker learners self-select into trade rather than farming. Yet, it is interesting to observe that the lack of exposure to competitive markets in the conventional sesame value chain implies that this enhanced ability to learn did not translate into fewer ex-ante rationality violations.

Table 9: Determinants of GARP violations for treated and control groups

Model	Variable	Coefficient	Std. Error	t	P>ltl
Control	Type	-0.51	1.45	-0.35	0.725
	Age	0.03	0.05	0.57	0.567
	Edu.	-0.09	0.22	-0.41	0.680
	Exp.	0.28	0.56	0.50	0.615
	Const.	9.93	3.73	0.67	0.009
Treated	Type	4.02	2.38	1.69	0.100
	Age	-0.02	2.37	-0.22	0.826
	Edu.	0.17	0.40	0.44	0.665
	Exp.	0.57	1.08	0.52	0.605
	Const.	1.86	6.81	0.27	0.786

RESULT 5: The learning rate of treated traders (i.e. with market experience) is significantly higher, at a p<0.05 level, than the learning rate of treated farmers.

6 Discussion and conclusions

In this report we explore whether market experience affects the "rationality" of choices made by a sample of sesame farmers and traders. Following earlier work by List and Millimet (2008) we provide new evidence of this endogenous relationship. Markets are not only neutral institutions to efficiently allocate resources among participants. They also improve the coherence of the decision-making process of participants. This introduces the possibility of dynamic efficiency gains associated with market expansion in developing countries, but requires also revisiting their pace and progress.

Compared to the earlier study by List and Millimet, our study was carried out in a radically different context (a different country and continent, different culture and institutions), with very different subjects (adult smallholders and traders) and with a treatment that was much more salient to the participants (involving sesame trading, which is at the core of their livelihood strategy). The fact that the results are quite consistent across studies provides support for the external validity of the notion of "endogenous rationality."

Our subjects did a series of rationality tests and a random subsample engaged in a treatment that involved competitive trading of sesame, exchanging it for a total value of US$ 16.319. Our first result is that behaviour of the vast majority of the subjects in the baseline study (prior to the treatment) is not consistent with assumptions regarding the straw-man *Homo Economicus*. The main result is that our subjects respond to a single day trading session, where they were engaged in competitive market behaviour, by reducing the number of GARP violations by ¾ of a standard deviation.

Interestingly we observe differences in the behaviour of farmers and traders. Somewhat surprisingly, given the difference in trading experiences across these groups, farmers and traders performed equally good (or bad) on the baseline choice consistency test. We conjecture that traders seemingly do not outperform farmers—as observed in the domain of sportcards trading, for example—by the fact that sesame trading in the Ethiopian countryside does not place in a setting resembling a competitive market. Personal relations may matter more than responding quickly to price margins. However, we also find that farmers and traders display different learning rates. That is, traders are better equipped to learn from the "market lesson," reducing rationality violations to a greater extent after being treated. This suggests a subtle form of self-selection—while rationality is not rewarded in the current sesame trading system, people self select to become a trader because of some talent, and this talent is correlated with the ability to learn about rationality. Future research should explore this issue further.

In an era of rapid market liberalizations, an expanding role of the market in the life of people might lead to efficiency gains, reducing dead weight losses due to non-competitive exchanges. At the macro level this may be relatively unimportant. Akerlof and Yellen (1985), among others, found that deviations from rational behaviour may have little impact on general economic equilibria. However, there may be significant effects at the micro level. Different rationality effects through a market-led leaning process may influence the allocation of rents across groups in society, affecting the distribution of wealth. This phenomenon could have an impact also at a micro as well as macro-regional level, affecting regional growth rates. For example, while the ECX was initiated

to improve the performance of the commodity value chain, an unexpected side effect may be a shift in the distribution of rents from one group of actors to another in response to differential ability to respond to incentives and margins.

Differentiated endogenous rationality poses thus new challenges to policymakers in terms of economic policy and reforms, requiring more attention to the dynamic effects of partial equilibria and rent distribution. More in general, if the (trading) context determines the rationality of choice, affecting the behaviour of agents, then the dynamic effects of policies aimed at accelerating or decelerating market expansion are very difficult to assess, *ex ante*. If so, the welfare effects of many policies aimed at stimulating development may be difficult to gauge.

To ensure a broader scope of generalizability, the experiment could be reproduced in a different culture, e. g. in Asia. Moreover the rigorous study of endogenous rationality might require a larger sample size. Involving active agents in such an experiment, however, is not an easy exercise, unless the conditions for natural shifts in economic environment pre-exist. In fact, unless substantial levels of trust are created beforehand, asking large groups of population to change their usual trading habits happens to be a difficult job even for official authorities.

Using GARP violation measurements to test for rationality is an accepted convention. Nevertheless, to "complete the picture", it could be suggested to combine it with different complementary tools, such as the study of the endowment effects (List, 2003) and risk preferences (Haigh and List, 2005) which pertain to the field of behavioural economics. It is also fundamental to understand "what" is maximized by actors in the ex-ante environment. A simple conclusion of "non-rationality" cannot be considered as a sufficient answer. More needs to be done on the topic of the "talents" that agents such as traders posses and develop, and the impact of these "talents" on their utility in the present market environment.

Finally, a more extensive study with longitudinal data would allow investigating further the convergence to the rational choice theory and its different learning curves, improving the understanding of the "costs of learning" for different actors in a changing economic context.

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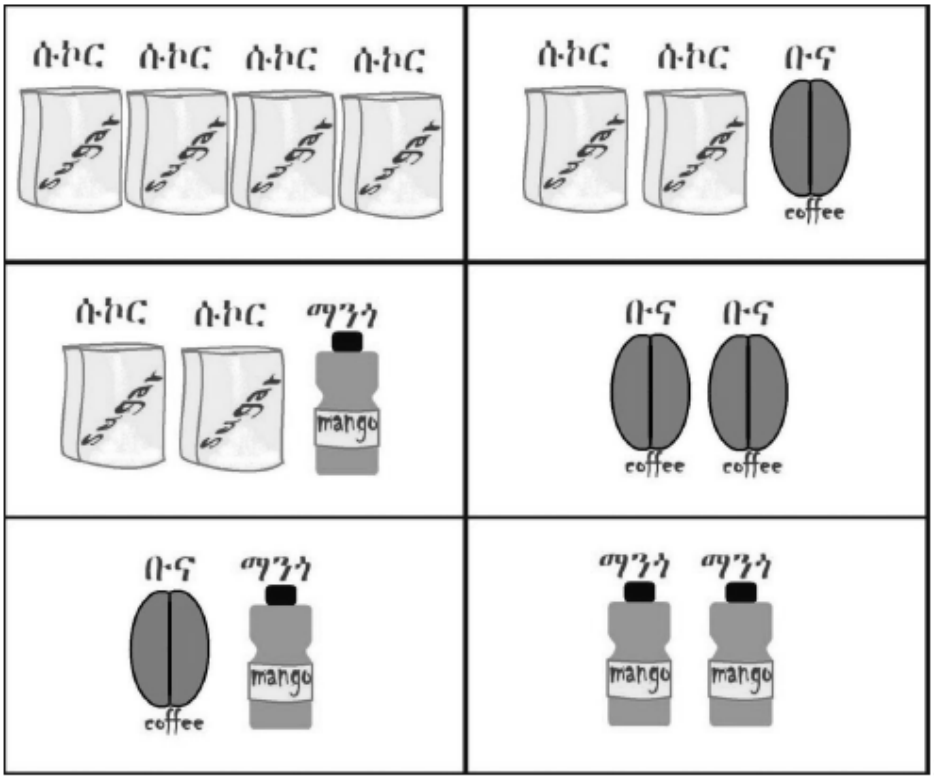
8 Annex

1. Choice set sheet example



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