Cheating in Markets: A Methodological Exploration ⋆

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Summary. In the 1970s, experimental economics split from social psychology by embracing rational choice and equilibrium methods. Behavioral economics has recently narrowed the divide, to the dismay of some. The present paper argues that evolutionary dynamics provides a framework which unifies the best features of social psychology with equilibrium and rational choice.

Ongoing research in cheating in markets illustrates the main points. A new equilibrium model provides distinctive testable predictions under three regimes: autarky, frictionless free trade, and anonymous foreign trade with opportunities to cheat. The predictions organize quite well the data collected so far. Later phases of the project will allow trader networks to evolve, altering the market institution and perhaps affecting preferences. Thus the major forces recognized by social psychologists can be combined with a rationality and equilibrium to study how markets respond to the risk of cheating.

1 Introduction

The entire economics discipline has thrived on rational choice and equilibrium methods since the 1950s (e.g., Samuelson [30]). The subdiscipline of experimental economics took shape in the 1970s as pioneers showed how the same methods could guide laboratory experiments (e.g., Vernon Smith [32]; Charles Plott [28]). The researcher obtains clear and striking predictions from theoretical models that assume rational choice and equilibrium. Then the researcher recruits human subjects, induces appropriate preferences, information and economic institutions using clear and honest instructions, abstract

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framing, and salient payments. Stationary repetition gives subjects the opportunity to adapt to the laboratory task, and outcomes observed after behavior settles down are compared to the theoretical predictions. Deviations suggest refinements of equilibrium theory, and the refinements in turn suggest further laboratory experiments. Thus one obtains a progressive research program organized by rational choice and equilibrium methods. (e.g., Davis and Holt [11]; Friedman and Cassar [13]).

Behavioral economics in recent years has followed a different script. The goal is to document departures from standard rational choice, especially irrationalities or other-regarding behavior, and to break the shackles of rational choice and equilibrium. Evidence comes mainly from laboratory experiments that often include salient pay and clear instructions, but that usually lack stationary repetition and that focus on the home-grown preferences of inexperienced subjects. Such experiments are as much in the style of social psychology as in the classic style of experimental economics.

The trend is quite dramatic. Many of the contributed papers in the present book are more in the new behavioral style than in the classical experimental economics style. The proportion of behavioral papers was considerably higher at the 2004 International Meeting of the Economic Science Association in Amsterdam, and was not much lower even at the 2004 North American regional ESA workshop.

Some experimental economists (young as well as old) think the pendulum has swung too far. It is all very well to broaden one's horizons, but something crucial is lost in abandoning traditional first principles. Experimental economics would be impoverished if it became a branch of experimental social psychology. At the same time, retreating to the classic approach of the 1970s does not seem the best way to advance experimental economics in the 21st century.

My suggestion is to use evolutionary dynamics as a framework that incorporates the best aspects of the classic experimental economics style as well as useful aspects of social psychology.

The next section summarizes the existing styles of economics and psychology and then sketches an evolutionary dynamics approach. To make the ideas concrete, the following sections introduce ongoing research regarding cheating and trust (central issues for social psychology) in markets (the home base of economic analysis). Section 3 poses the problem and summarizes new theoretical results in the classical style. Section 4 presents an experiment, again in the classical style, and the results obtained so far. Section 5 points to behavioral elements and offers an embracing framework in evolutionary dynamics. The concluding section offers some conjectures on other applications where the evolutionary dynamics approach might prove fruitful.

2 Three Methodologies

The classical economics methodology (e.g., Smith [32], who draws on Hurwicz [21] among many others) takes as given the characteristics of individual economic agents-e.g., preferences and endowments of resources, technology and information-and the economic institutions within which they interact, e.g., competitive markets. The researcher assumes that individual behavior is rational and has somehow achieved mutual consistency, e.g, competitive equilibrium (CE). The researcher then is able to deduce what the social outcomes (e.g., CE prices, quantities and gains from trade) must be, and to compare the observable components of the deduced outcomes to actual data obtained in the field or laboratory. Panel A of Figure 1 summarizes the classical economics methodology.

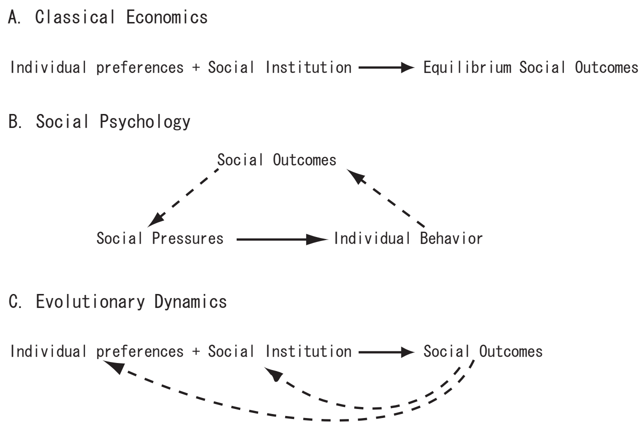

Fig. 1. Three Methodologies

The tradition in social psychology (e.g., Aronson [4]) is quite different. It is not so deductive, but the chain of reasoning starts with ideas about the pressures society exerts on individuals. These pressures shape individual preferences and behaviors, and reinforce social outcomes. The social outcomes are central, as shown in Panel B of Figure 1. As indicated by the dotted lines, social outcomes are the source of social pressures which typically shape individual behavior so as to perpetuate the social outcomes. Sometimes the pressures undermine themselves and lead to a changed society. Experiments are conducted mainly to clarify how social pressures affect individual behavior.

An example will illustrate the contrast between these two methodologies. Consider financial bubbles and crashes such as Tulipmania in 16th century Holland and England's South Sea Bubble a few years later, or Japan's stock market and real estate bubbles of the 1980s and California's dot.com bubble of the late 1990s. Historical accounts of these episodes often center on irrational "mob psychology." Indeed, Mackay [26], the classic treatment of the subject, is entitled Extraordinary Popular Delusions and the Madness of Crowds, and even the most popular treatment by an economist, Kindleberger [23], has a title that features psychological aberrations: Manias, Panics, and Crashes. These and many other books suggest that social pressures occasionally cause many people to do irrational things, and the irrationality can become contagious. Bubbles and crashes are individual irrationality writ large.

On the other hand, several authors in the last decade or so have explained some aspects of financial bubbles and crashes using the traditional economic methods of rational choice and equilibrium. Bikhchandani, Hirshleifer and Welch [6], and Banerjee [5] for example, show how equilibrium with fully rational agents can look something like a self-feeding irrational bubble. These and other authors demonstrate conditions under which it is rational for you to "follow the herd," even when your personal information suggests otherwise and you know that the herd sometimes thunders off in the wrong direction. A separate strand literature starting with Diamond and Dybvig [12] shows how "bank panics" can be explained without reference to social or clinical psychology. Under some well specified conditions, in equilibrium all depositors will try to withdraw their funds and the bank collapses. Morris and Shin [27] and a several later authors find conditions under which speculators can successfully attack a currency that is (in a reasonable sense of the word) fundamentally sound. Even the original Tulipmania (or much of the surviving evidence about it) can be rationalized using traditional economic methodology (Garber [16]).

The traditional economics approach has some impressive advantages. It starts from well-defined first principles, and employs flexible auxiliary assumptions (e.g., regarding the relevant economic institutions and information conditions) that often produce testable predictions. It is internally consistent, clear, and insightful. It can even provide economic insight into psychologically freighted words such as reputation, prestige, commitment and norms. There would be no reason for economists to consider other approaches if the predictions (or refinements of the predictions using sensible variations on the auxiliary assumptions) always enjoyed empirical success.

Unfortunately the world is not as tidy as one might wish, and empirical success is sometimes elusive. Garber's article illustrates the point that the combination of weak field evidence and flexible auxiliary assumptions makes it impossible to completely refute the traditional economics methodology. But laboratory studies can sharpen the empirical tests, and sometimes they undermine facile defenses of the traditional methodology. For example, consider the Ultimatum game introduced by Guth et al. [18]. After hundreds of theoretical and laboratory studies, it seems safe to say that the usual (subgame perfect Nash) equilibrium fails to predict outcomes very well, and that an explanation is needed for the fact that responders often reject small but positive offers.

How should economists proceed in the face of empirical failure? Do we have to give up our cherished traditional methods? Should we become merely specialized social psychologists?

I would urge economists not to follow psychologists in neglecting theoretical first principles. My reading (admittedly limited) of literature in cognitive and social psychology persuades me that it is difficult to maintain a coherent and broad based research program purely on the basis of empirical findings. A theoretical backbone helps keep researchers from wandering in circles (Lakatos [25]). But we need to take another look at the content of our first principles.

My first recommendation is to pay attention to the equilibration process. Traditional economics neglects the process by assuming that it automatically reaches completion (or nearly so) before outcomes are observed. Psychologists also neglect it by focusing on adjustments but seldom asking where they might settle down. We should ask ourselves what economic forces are pushing towards equilibrium and when (and whether) they might reach completion.

In general, I would say that economic adjustment processes operate on three distinct time scales. Individual learning is the most rapid. Given facilitating market and other social institutions, learning will rapidly and reliably produce outcomes close to equilibrium. Thus utility maximization and equilibrium should be thought of as the end result of a learning dynamic shaped by efficient social institutions. Unfortunately, social institutions evolve on a slower time scale and not always towards the efficient institutions. Our basic human nature as social creatures shapes the evolution of our institutions, and it in turn is subject to the slow force of genetic evolution. Thus the traditional economics approach will not always offer a reasonable approximation to actual outcomes.

To illustrate, consider again the Ultimatum game. Binmore [7] argues that for various reasons Responders learn much more slowly than Proposers, so the equilibration process converges not to the subgame perfect Nash equilibrium but rather to some particular imperfect Nash equilibrium in which Proposers usually make (and Responders usually accept) a substantial positive offer. An alternative explanation that I and several other economists favor involves non-standard preferences. Proposers often prefer the (0, 0) refusal outcome to an "unfair" proposed outcome like (8, 2); see Cox and Friedman [10] for a fully articulated model.

There is a real danger in departing from the standard view of preferences as exogenously fixed and selfish. All predictive power disappears when arbitrary behavior is rationalized by assuming arbitrary preferences for such behavior. To justify even the standard view of preferences, theorists traditionally have used evolutionary arguments, as exemplified in Alchian [1] and Friedman [15]. My point is that any other preference model requires the same justification. The model must account for the empirical data but also must pass the following theoretical test: people with the hypothesized preferences receive at least as much material payoff (or evolutionary fitness) as people with alternative preferences [1]. Otherwise, the hypothesized preferences would disappear over time, or would never appear in the first place. Papers such as Friedman and Singh [14] show how preferences for negative reciprocity (as in the previous paragraph) meet the theoretical test.

Panel C of Figure 1 summarizes the third social science methodology that I call evolutionary dynamics. Its first principle is evolution: preferences and institutions are not exogenous and arbitrary but rather are the products of well defined processes. At any moment of time, of course, preferences and social institutions are predetermined, as in the traditional economics methodology. They produce social outcomes, which are the traditional equilibrium outcomes when the institutions promote rapid learning that converges to those outcomes. For example, the Continuous Double Auction market institution promotes rapid convergence to Competitive Equilibrium in a variety of settings (e.g., Smith [32]; Cason and Friedman [9]).

The dotted lines in Panel C indicate slower feedback effects recognized by many psychologists but neglected in traditional economics. Individuals' emotional states (hence preferences over outcomes) respond quickly to their circumstances (e.g., to unfair treatment). Indirect evolution drives underlying emotional capacities and tendencies in the very long run. In the medium term (months to decades), cultural evolution shapes the economic institutions in which we interact. Thus traditional approach becomes a good short-to-medium term approximation when economic institutions promote rapid learning of the relevant equilibrium. When the traditional approach fails empirically, the methods of evolutionary dynamics can point to reasons for the discrepancy and offer a principled guide to better models.

The preceding discussion is rather abstract. Of course, the real test of a methodology is not how it sounds on first presentation, but rather how well it works in practice. The next several sections take work in progress to illustrate all three methodologies and to develop the abstract points just presented.

3 Cheating in Markets

Perhaps the most important theoretical result in traditional economics is that frictionless markets perform at 100% efficiency. Laboratory experiments since Smith [31] have given strong empirical support. Actual markets, however, face moderate to severe trading frictions. In particular, some buyers or sellers may cheat. The seller might ship an item of lower quality, and the buyer might not pay in full or on time. How do such markets perform?

The possibility of cheating seems to be a small friction in well-run modern markets, but it looms large in major markets of the ancient and medieval world

[1] This test is sometimes referred to as indirect evolution (Guth and Yaari [19]) because evolution operates on preference parameters that determine behavior rather than operating directly on behavior.

(e.g., Greif [17] and in some important contemporary markets. For example, according to some observers, eBay's main competitive advantage in Internet auctions is that its reputation rankings reduce such frictions (e.g., Anderson et al. [3]). Many observers believe that Russia's economic woes in the last decade are due largely to uncompetitive markets, in particular to weak enforcement of contracts (e.g., Klebnikov [24]). The observed volume of international trade is far smaller overall than predicted by traditional models, even when formal trade barriers are taken into account (Trefler [33]; Helliwell [20]). A leading suspect is the lack of trust in the enforcement of contracts in international markets (e.g., Rauch [29]; Anderson and Marcouiller [2]).

Cassar, Friedman and Schneider [8] develop a model in the classic economic tradition to study cheating in markets, as follows. Assume two distinct markets (called Red and Blue) with domestic supply and demand as in Figure 2. The textbook theory of Competitive Equilibrium (CE) predicts Autarky prices, transactions and surpluses as shown by the intersections of supply and demand in the first two Panels (Blue and Red). The same theory predicts the CE indicated in the third panel for frictionless free trade.

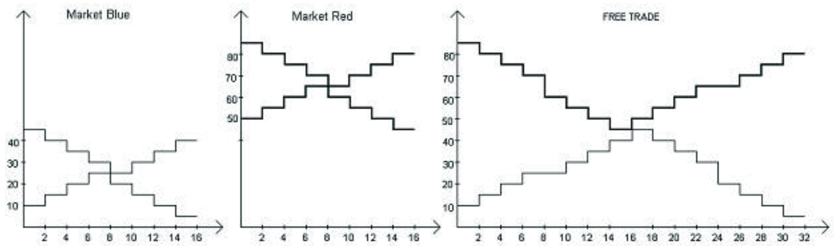

Fig. 2. Demand and Supply Schedules

The model of frictional trade gives the buyer in international transactions the option to pay only a given fraction π of the agreed price, and gives the seller the option to deliver only π of the value. Contracts are fully enforced in domestic transactions. Thus buyers and sellers must trade off better opportunities in international markets against the friction of imperfect contract enforcement.

It takes a little work, but the model can be solved explicitly to characterize CE with cheating for any value of π in [0,1]. At $\pi = 1$, of course, we have frictionless free trade, and at $\pi = 0$ the model predicts a reversion to Autarky. In between, the model yields novel testable predictions on price, volume and surplus. For example, agents with highest value and lowest cost are predicted to trade exclusively in their domestic market, while agents closer to the margin trade only in the cross market and always cheat; the overall volume is higher (!) than in frictionless free trade; and as π decreases from 1 to 0, domestic prices move non-linearly from autarky levels to the frictionless free trade level. Specific predictions are shown in Table 1.

Table 1. Testable Predictions

	Red market			Blue market			Cross-market					
							No Cheating			Cheating		
Autarky	65	8	160	25	8	160	-	-	-	-	-	-
Free Trade	-	0	0	-	0	0	45	16	640	-	-	-
Cheat Friction	60-65	6	150	30-35	6	150	-	-	-	40-45	10	125

4 An Experiment in the Classical Style

The traditional model just sketched provides the competitive equilibrium (CE) predictions. The next step in the classical tradition of experimental economics is to create a laboratory environment to test the predictions. The experiment reported in Cassar, Friedman and Schneider (2004) uses the well-known continuous double auction (CDA) market format for the reason mentioned earlier: it is known to promote rapid learning, at least in the Autarky treatment. At any instant during a CDA trading period, each buyer can post a public bid (offer to buy a unit at a given price or better) and each seller can post a public ask (offer to sell a unit at a given price or better). Each trader also at any instant can accept another trader's offer and immediately transact at the posted price p. A buyer with unit value v earns profit or surplus $v - p$ on the transaction, and a seller with cost c on the unit earns $p - c$, so the overall gains on the transaction are $v - c$.

The computerized CDA used in the experiment has several distinctive features, illustrated in Figure 3. Two markets, called Red and Blue, run simultaneously. Depending on the treatment, a trader may be able to trade only in her home market, or in both markets. Each trader can transact up to 4 units each period, and different units can have different cost or value. Each trader has an ID code that in some treatments can be used to identify her to potential transaction partners. The Figure shows the Marketplace window, active during the trading period. Between trading periods traders can view the History window by clicking the tab shown in Figure 1 above the upper edge of the open window. The History window shows all transactions from the period just completed, as well as a summary of trading profits from all previous periods.

Sixteen human subjects participate in each laboratory session. Four subjects are randomly assigned for the entire session to each of the four roles, buyer or seller in the Red or Blue home market. Each session with inexperienced subjects begins by going through the Autarky portion of the instructions, followed by a practice period and 3 to 4 Autarky trading periods.

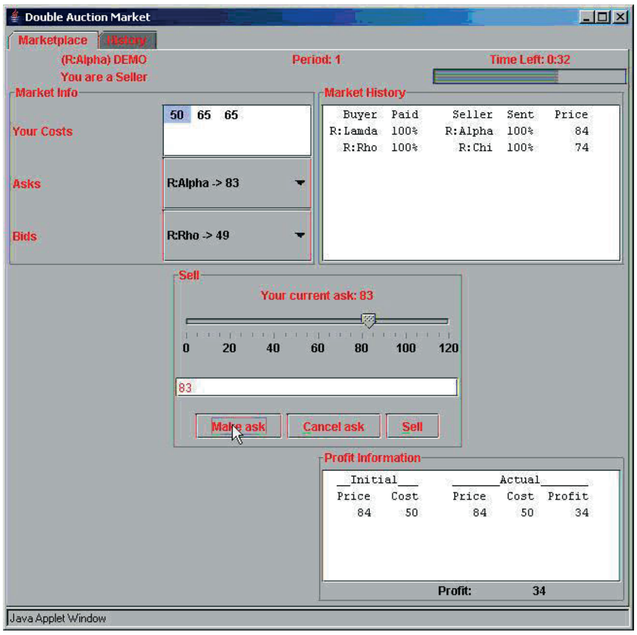

Fig. 3. User interface

`Autarky trading screen` is shown for a seller (ID code R:Alpha) in the Red market. In the center box she typed in an offer to sell a unit ('an ask') at price 83.
The upper left box labeled Market Info shows Alpha's costs for the current unit (highlighted, here 50) and remaining units (here 65 and 65). The next line shows the lowest ask (83, which here happens to be held by herself); clicking the small triangle pulls down a menu with other current asks. Bids (here the highest is 49 by R:Rho) similarly appear in the next line.
The Market History box (upper right) shows the current period transactions in the Red Market. Here, under autarky, all prices and trader ID's are shown.

Instructions, a practice period, and trading periods then follow for Frictionless Free Trade, and then for Cheating with $\pi = 0.5$. Sessions with experienced subjects skip Autarky and Frictionless Free periods, and reshuffle buyer values and seller costs once about half-way through the two-hour session. Each trading period lasts 240 seconds with a 20 second break between periods. After the last period, subjects are paid a \$5 show-up fee plus earnings for all periods; most subjects earn between \$15 and \$35.

Cheating is never allowed in domestic trades, e.g., in the Blue market between two Blue traders. The choices are sequential. First the trader accepting an offer chooses whether to cheat. That choice is observed by the trader who posted the offer, who then decides whether to cheat. Sellers cheat by delivering a good that costs πc instead of c and that provides value πv instead of v. Buyers cheat by paying only πp instead of p. Of course, the instructions avoid the word "cheat," and just talk about the choice of paying 50% (for π =0.5) or 100%, etc. It should be emphasized that in this treatment, cross market transactions are anonymous. Traders' ID codes are shown in all home market transactions, but are replaced by "??" when they post or accept bids and asks in the foreign market. The idea is to prevent traders from building reputations and to prevent discrimination among cross-market trading partners.

The results so far are very supportive of the competitive equilibrium model. Figure 4 summarizes the Autarky results. With inexperienced traders, actual prices converge towards CE from above in the low price Blue market, and converge from below in the high price Red market. In both markets, the standard deviation of prices declines and by the third period is less than 3.0, while the average price is within 2.0 of the CE predictions. Over all periods and in both markets, average price is within half a standard deviation of the CE prediction. Thus price convergence is quite sharp in both high and low price markets.

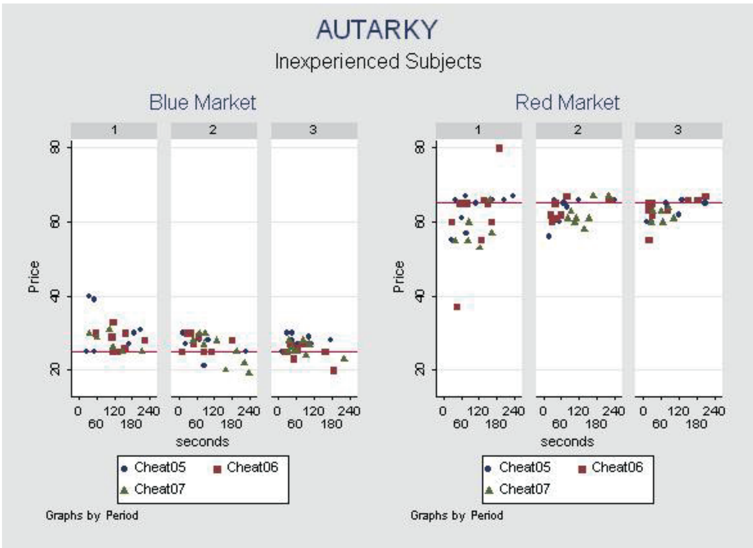

Fig. 4. AUTARKY (Inexperienced Subjects)

Average trading volume is within 1.0 unit of the CE prediction in every period in both markets, and the overall average volume of 8.1 is amazingly close to the 8.0 prediction. Average gains from trade are 259.4, about 81% of the CE prediction 320.0.

Figures 5 and 6 show behavior in frictionless free trade. As predicted, domestic trade volume shrivels, averaging 1 unit or less in both Red and

Blue. Average volume in the cross market reaches 15.7 in the third period and averages 15.0 overall, quite close to the CE prediction of 16.0. Average price in the cross market (and overall) are within 1 (or 2) of the CE prediction 45. However, the standard deviation of prices declines only slowly, to 7.2 in the third period versus 8.5 over all periods. CE surplus doubles to 640, and realized surplus also rises sharply to over 600. Indeed, overall efficiency is $604.4/640 \approx 94\%$.

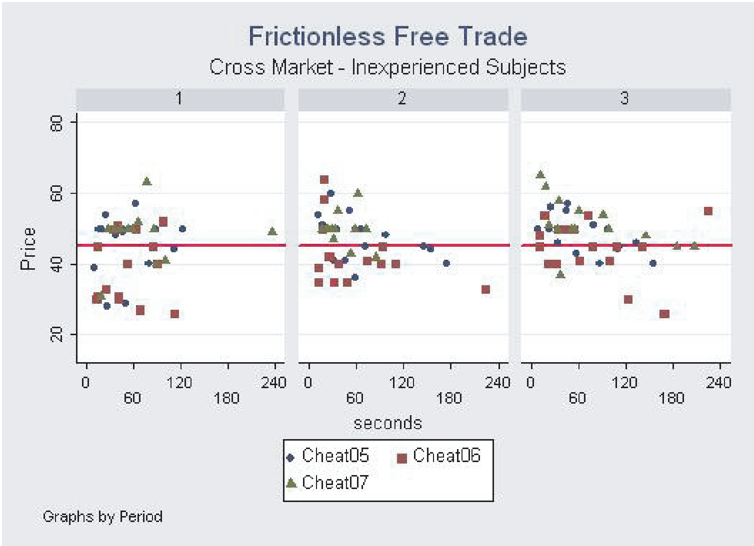

Fig. 5. Frictionless Free Trade (Cross Market – Inexperienced Subjects)

We conclude that actual behavior tracks the extreme CE predictions quite well in the first two treatments, but what happens with cheating frictions? Figures 7-10 and Table 2 show the results. With inexperienced subjects who have just finished the frictionless free trade treatment, the actual average number of cross-market trades with no cheating falls from 15.0 to 2.8, compared to the CE predicted fall from 16.0 to 0. Meanwhile, the average number of cross-market trades with cheating rises to 12.5, beyond the CE forecast of 10.0. With experienced traders, the average number of cross-market trades with no cheating falls to 1.5, and the average number with cheating falls to 11.0. Thus cheating is indeed rampant in cross-market trade (82% of trades for inexperienced and 88% for experienced traders), and deviations from the CE quantity predictions diminish with time and experience.

The predicted price range is 40-45 for cross market trades, and average prices are 46.9 for inexperienced and 48.3 experienced traders. The standard deviation of price declines over time, and averages about 7 for inexperienced

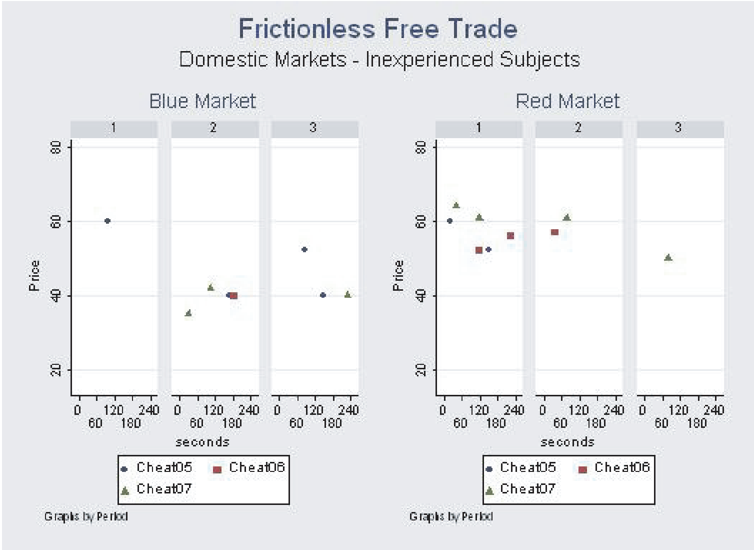

Fig. 6. Frictonless Free Trade (Domestic Markets – Inexperienced Subjects)

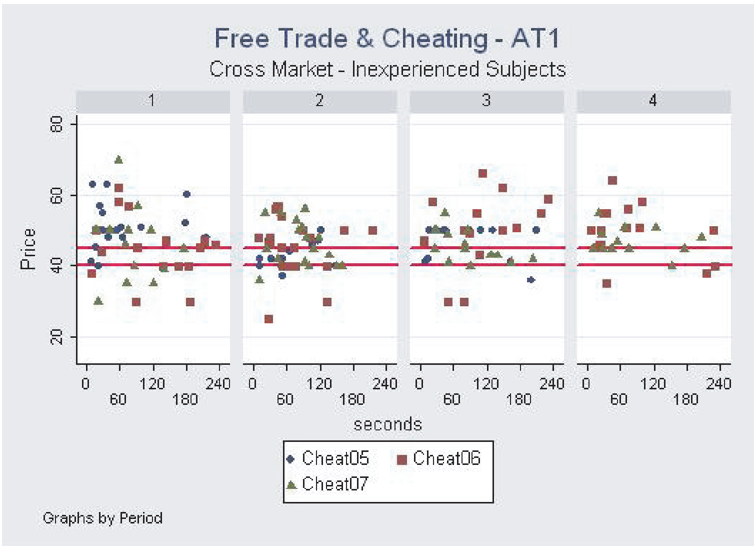

Fig. 7. Free Trade & Cheating - AT1 (Cross Market – Inexperienced Subjects)

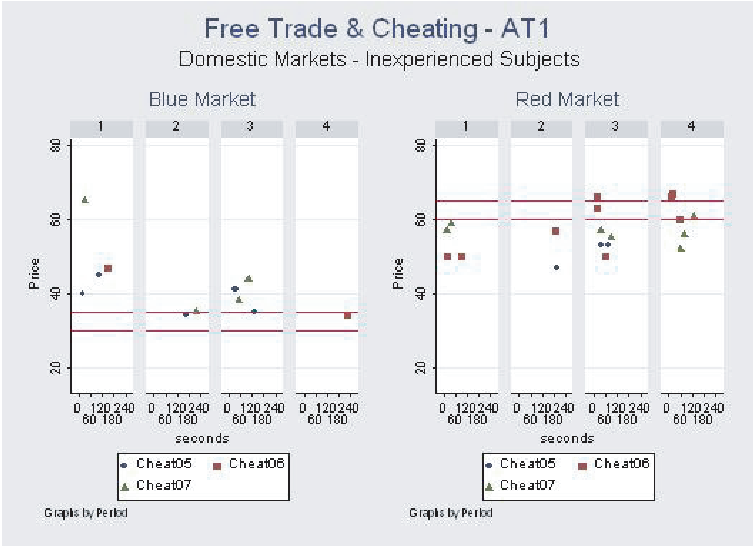

Fig. 8. Free Trade & Cheating - AT1 (Domestic Markets – Inexperienced Subjects)

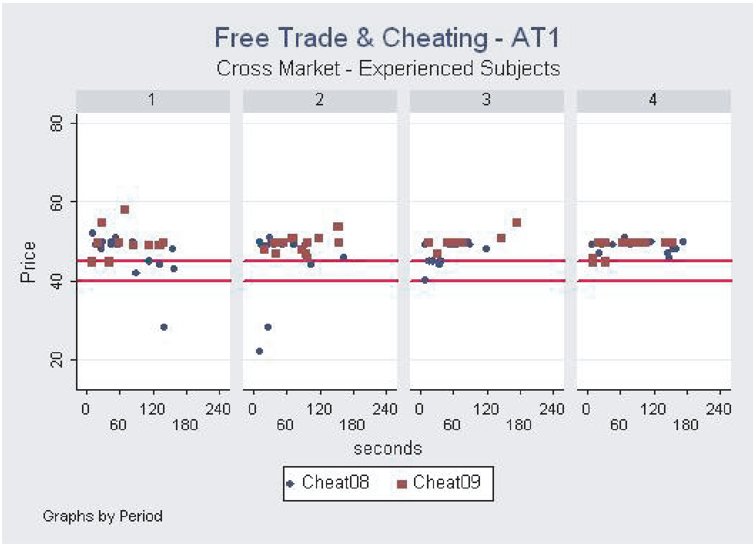

Fig. 9. Free Trade & Cheating - AT1 (Cross Market – Experienced Subjects)

Table 2. Mean Outcomes in Trade with Cheat Frictions (Inexperienced subjects). In parentheses: standard deviation and number of observations.

	Red Market			Blue Market		
	pR	qR	SR	pB	qB	SB
Predicted	60-65	6	150	30-35	6	150
Period 1	54.0 (4.7, 4)	1.3 (1.15, 3)	30.0 (30, 3)	49.3 (10.9, 4)	1.3 (0.6, 3)	15.0 (17.3, 3)
Period 2	52.0 (7.1, 2)	0.7 (0.6, 3)	16.7 (14.4, 3)	34.5 (0.7, 2)	0.7 (0.6, 3)	11.7 (12.6, 3)
Period 3	56.7 (5.8, 7)	2.3 (0.6, 3)	61.7 (20.2)	39.8 (3.4, 5)	1.7 (1.5, 3)	20.0 (18.0, 3)
Period 4	60.3 (5.7, 6)	3.0 (0, 2)	70.0 (21.2, 2)	34.0 (0, 1)	0.5 (0.7, 2)	2.5(3.5, 2)
Total 1-4	56.8 (6.0, 1.9)	1.7 (1.1, 11)	42.3 (29.3, 11)	41.6 (8.6, 12)	1.1 (0.9, 11)	13.2 (14.0, 11)
	Cross-market					
	NoCheating			Cheating		
	pNC	qNC	SNC	pc	qc	SC
Predicted	-	0	0	40-45	10	125
Period 1	46.0 (7.0, 15)	5.0 (2.6, 3)	238.3 (127.0, 3)	48.4 (9.7, 32)	10.7 (2.1, 3)	131 (21.9, 3)
Period 2	49.4 (5.0, 7)	2.3 (1.5, 3)	78.3 (53.5, 3)	44.6 (6.5, 44)	14.7 (2.1, 3)	261 (53.4, 3)
Period 3	50.0 (9.0, 3)	1.0 (1.0, 3)	53.5 (57.9, 3)	47.4 (7.3, 39)	13.0 (1, 3)	211 (40.3, 3)
Period 4	50.2 (7.4, 6)	3.0 (0, 2)	125.0 (21.2, 2)	48.4 (6.2, 22)	11.0 (2.8, 2)	151 (79.2, 2)
Total 1-4	48.0 (6.8, 31)	2.8 (2.13, 11)	123.6 (102.8, 11)	46.9 (7.6, 137)	12.5 (2.4, 11)	191.9 (67.9, 11)

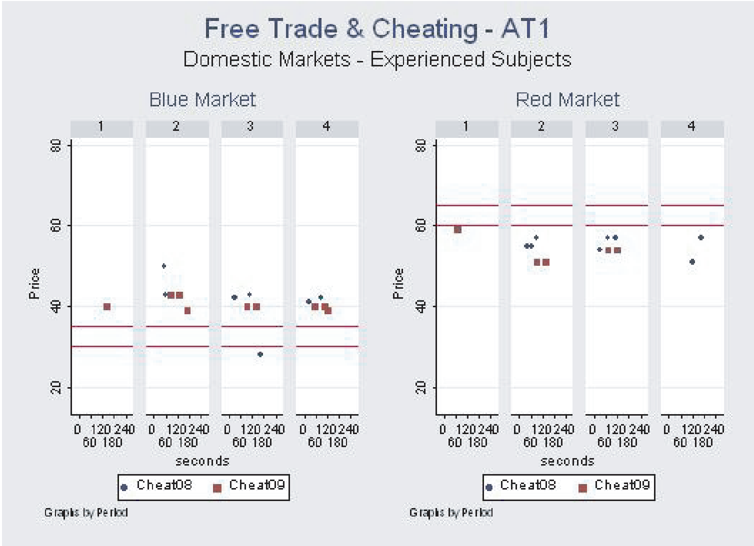

Fig. 10. Fred Trade & Cheating - AT1 (Domestic Markets – Experienced Subjects)

and less than 5 for experienced traders. Thus there is approximate price convergence to CE, a bit tighter than in the frictionless free trade treatment.

The CE model overpredicts trade volume in the two domestic markets. Actual volume in both markets under both treatments is less than half the predicted 6.0. Domestic price predictions are not bad: with inexperienced traders average actual prices fall within the predicted band by the last period, while with experienced traders the prices remain about 5 outside the predicted bands of 60-65 for Red and 30-35 for Blue.

Total surplus is quite variable in this treatment: 371 $\pm$ 71 with inexperienced traders and 403 $\pm$ 68 with experienced, versus the CE prediction of 425. The no-cheat cross-market trades increase surplus beyond the CE prediction, but the other departures from CE more than offset.

The CE predictions for this treatment again are rather extreme, and again behavior moves strongly in the predicted direction. We have less than complete convergence, however, and in particular the domestic trade volume does not recover to the predicted level.

5 Behavioral Explanations and Evolutionary Dynamics

Overall the traditional CE methods have led to surprisingly accurate predictions of behavior under the treatments examined so far: Autarky, Frictionless Free Trade, and Anonymous cheating. There clearly is a learning process at work. Many inexperienced traders at first do not cheat in cross-market transactions, but cheating seems contagious and becomes more prevalent in later periods. Or, to put it in less psychological terms, traders more frequently exercise their own cheat option after being cheated by another trader. This may be a dispassionate learning process, or may be done in anger, as part of negative reciprocity. Our current design does not distinguish between these two behavioral explanations. Either way, the data do indicate that the adaptation process proceeds rapidly, towards the competitive equilibrium in which cheating is universal in cross market transactions.

The next step in the research program involves institutional evolution. Traders will be able to break the anonymity constraint in cross market trading by becoming part of an interpersonal network. Long a staple of social psychology and sociology, personal networks are a crucial social institution that economists have only recently begun to study (e.g., Jackson and Watts [22]). After observing baseline efficiency and cheating in exogenously specified networks, my coauthors and I will run new treatments that allow traders to form their own personal networks. Thus there will be a feedback loop from social outcomes (prices, quantities and profits) to the institution, and we shall see what kinds of interpersonal networks emerge over time. We also expect to be able to see in more detail how individuals respond to cheating and to honest dealing both inside and outside their personal networks. Thus all links in the evolutionary dynamics scheme in Figure 1C will be operational.

I should try not to get too far ahead of the laboratory results here. Traditional equilibrium theory exists for pieces of the network trading environment. Perhaps these can be stitched together to obtain equilibrium predictions for which personal networks will form, and for individual behavior (and social outcomes) within those networks. Existing literature contains equilibrium models whose structure more or less resembles the trading networks we shall investigate. Some of the models feature inefficient equilibria, while others predict that efficient networks will emerge. We shall see what emerges in the lab.

6 Concluding Remarks

The evolutionary dynamics methodology outlined here might prove useful other ongoing research programs.

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