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A Multi-Level Choice Theory

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Abstract

The Great Recession has called into question many tenets of Neo-classical Microeconomics. Neo-classical theory allows each agent only one fixed type, homo economicus, while not denying other possible types as in adverse selection. We propose that economic agents not only choose their market basket but also their types. Agents are members of groups and each group has social norms to which the agent more or less conforms. His/her market behavior trades off private well being which responds to prices but also social well being which responds to norms. We show how deviation from norms are determined. We also discuss other anomalies in the light of this model.

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"Understanding human behavior requires more knowledge about the utility function – to understand why we care about things we care about - along with knowledge about prices, incomes and how we make choices. In other words, the time is ripe for combining biology and economics." Donald Cox (2002) donald.cox@bc.edu

"No human societies exist without social norm, that is, without normative standards of behavior that are enforced by social sanctions…Thus, it is impossible to understand human societies without an adequate understanding of social norms." Fehr and Fischbacher (2004)

I. Introduction

The Boundaries of Neo-Classical Consumer theory: Neo-Classical consumer choice theory starts with the assumption that all agents have a particular type called *homo economicus*; that is, agents are both "strictly rational" and "self-interested". In practice, these get embodied in well-behaved preference orderings representable by a specific utility function. An economic agent displays rationality by maximizing this utility function with respect to goods. The neo-classical consumer choice model considers preferences as given and ignores how the agent's preference ordering arises thereby effectively shutting out "society" from the discourse. This has the advantage of freeing the discipline of the seemingly insoluble intricacies of the human psyche that doomed J Bentham's (1871) seemingly quixotic search for the proverbial hedonimeter. From the utility calculus and the seemingly harmless assumption that agents are "atomistic" (i.e., numberless and thus "powerless"), the discipline derives neat mathematical hypotheses on the behavior of market prices that are for the most part consistent with observed short-run market reality. That this model also allows the derivation of the vaunted welfare theorems that formalize the "Invisible Hand" in Adam Smith's *The Wealth of Nations (1776)* making the paradigm more compelling.

It was in the beginning imperative to narrow the compass of consumer theory to price determination in the supply and demand space in order to achieve clarity and testability. The resulting "sharp predictions" and their non-falsification were then no doubt a source of its strength. Note that consumer theory does not deny the role of other dimensions in the determination of equilibrium price; it only "curls" these dimensions into constants and corner points or intercepts. These constants are said to be determined somewhere else in the social and biological universe and economic agents have no choice about them. In the categories proposed by the eminent ethnobiologist Ernst Mayr (1976), Neo-classical consumer theory is an *open behavioral program* in respect to market baskets but is a *closed behavioral program* in respect to type.

If pressed, an economist may resort to two arguments in favor of fixed preference: one is to say that preferences, if they change, do so very slowly as to be irrelevant to market outcomes. Another is to say that the changes of taste in a population tend to be random around the mean of the normal distribution and so effectively cancel out in large populations. Yet another is to say that with taste change, economics can explain everything and thus nothing. While probably valid in the past, these are now subject to reasonable challenges.

Increasingly and perhaps inevitably, this overly narrow focus is being revisited and challenged. There is now a growing body of evidence that the homo economicus assumption does not stand more detailed empirical scrutiny. Pressure comes first from the fact that Economics as a social science is now increasingly called upon to deal with issues outside the narrow confines of well-developed markets. The phenomena of "market failure" and "missing markets" arise either in small numbers games where agents exercise market power or where agents are beset by information asymmetry. The issue of global warming exemplifies this genre of problems. But even in well-developed markets, phenomena like economic bubbles and crashes, eloquently articulated by the 2008 global financial crisis, do not to sit comfortably with the orthodox Economics. The "cancel out" and the "too slow" arguments for fixed preference" struggle vainly against the headwind of new evidence of herding behavior. The contention in this paper is that changes in taste under certain circumstances can be very rapid and can be highly correlated. As Richerson et al (2003) put it: "Throughout most of human history, institutional change was so slow as to be almost imperceptible by individuals. Today, change is rapid enough to be perceptible."

The latter may relate to another boundary problem: the degree of ignorance and uncertainty. The Neo-Classical paradigm allows its actors to operate only under Knightian risk, viz., up to a known probability distribution. This governing probability distribution is assumed fixed. By contrast, in the Knightian or Keynesian radical uncertainty (when neither the set of outcomes nor the probability distribution over this set is known) no economic or behavioral theory can be built since theory is the accounting of patterns and complete randomness has no pattern. It is like building a computer program to account for the completely random decimals of an irrational number. The program would be infinitely long.

However, theorists are now beginning to explore how these probability distributions are arrived at. In other words, we have begun the next logical step: to model the emergence of probability distributions which govern behavior. Not only is there imperfect information as to goods; there is imperfect information as to the probability distributions over those goods. In effect our retort to the view that allowing taste to change will tautologize Economics is: yes if taste change is without any structure; no if it is structured so that one can control for it.

Somehow, questions that may be rooted upon two boundary issues, viz., (i) how "preferences" or "behavioral tendencies" are formed and (ii) how people attempt to whittle down uncertainties keep rearing their heads. The Adam Smith of *Theory of Moral Sentiment(1771)* who struggled with the question of why we value people other than ourselves just won't go away. It appears that the time is ripe for the boundaries of Neo-Classical Economics to again shift.

[This temptation, nay imperative, to transcend, endogenize or even discard erstwhile "givens" in the face of mounting anomalies forms an integral part of every scientific discipline (Kuhn, 1962). Johannes Kepler's "ellipse" replaced the perfect circular orbit of Ptolemy on the basis of Tycho Brahe's detailed astronomical data. The dropping of Newton's "absolute space" assumption allowed Einstein to account for the negative result of the Michelson-Morley experiments. Increasingly, the previously sacred constants of Physics (Planck's constant, Einstein's speed of light and constant of universal gravitation) are subjected to questions of why and how (Kane, 2000, *Supersymmetry*).]

In this paper, we will first present some of the anomalies that have emerged over the years and which we deem relevant to this enquiry (Section II). In Section III, we propose and discuss a possible alternative, Multi-Level Choice Consumer Theory, where agents are viewed as open behavioral programs (Mayr, 1976) both as to type as to market baskets. That is they choose their type before they choose their market basket. The choice of type is associated with "norms" set by the actor's reference group. Change here is expected to be sporadic but dramatic. These norms, how they change and the sanctions associated with them are imperfectly known to the agent and imitation and mimicking are some of the ways to avoid sanction.   In Section IV, we formalize this alternative model and in Section V we discuss how it accounts for the anomalies identified.

II. Anomalies

The anomalies confronting Neo-Classical consumer theory are myriads. We concentrate only on two categories, viz., cooperative solutions in social dilemma games and the phenomena of bubbles and herding most prominent in Financial Economics.

1. Cooperative Outcomes in Social Dilemma Games

This enquiry deals with economic agents belonging to and interacting with other members of a group of finite size. It is a largely non-formal market environment where economic agents exercise some "market power" and can and do influence the outcomes of social games. The most interesting subset of social games is the set of "social dilemma games" where the pursuit of individual self-interest tend to produce inferior social outcomes. The unequivocal prediction is that strict rationality among participants in “social dilemma games” (also known as “collective action games”) will invariably fail to cooperate and thus forego “the cooperators’ dividend” implied in a higher social outcome (Lichbach, 1996). To this genotype of games belong the following well-known phenotypes: the “Prisoner’s Dilemma Game”, the “Tragedy of the Commons Game”, the “Public Goods Game” and the “Ultimatum Game” etc.. The implications of strict rationality in these games readily lend themselves to laboratory testing. Let us consider “Public Goods Games” for the moment.

Collective Action Failure in Public Goods Game: In a Public Goods Game, N >2 participants are given 100 units (say, pesos) and are asked to contribute c units voluntarily to a kitty. The total kitty is then multiplied by r > 1 by the researcher and the proceeds divided equally among the participants (contributor or not). Let n be he number of contributor and m the number of non-contributors with n + m = N. The total kitty is (ncr) and everyone’s share of the kitty is (ncr/N). A non-contributor then also gets (ncr/N). A contributor gets [(ncr/N) – c]. Contributors get less than a non-contributors. *Free riders* prosper! If an agent is strictly rational and knows others to be the same, each will contribute c = 0. Each member then gets only his initial endowment 100 or no extra payoff. This result does not change even if the game is repeated a finite number of times due to backward induction. This is called the “zero contribution thesis.” If, however, each contributes c = 100, the total kitty is Ncr and each member’s share is 100r> 100r. The group of rational egoists will fail to attain a higher payoff for each, a collective action failure! Example: Let N = 2, r = 1.5, c=100. The gross and net payoff from the kitty for this Public Goods Game are (Note C = Contribute, D = Don’t Contribute are strategies):

Table 1: Gross Payoff (Kitty)

	C	D
C	300/2, 300/2	150/2, 150/2
D	150/2, 150/2	0, 0

Table 2: Gross Payoff

	C	D
C	150, 150	75, 75
D	75, 75	0, 0

Table 3: Net Payoff (Total)

	C	D
C	150, 150	-25, 175
D	175, -25	100, 100

Observe that the strategy combination (C,C) is not a Nash equilibrium since either A or B can do better by playing D. By contrast combination (D,D) is a Nash equilibrium since neither A nor B can profit by deviating. The Nash equilibrium coincides with "zero contribution" (see e.g., Olson, 1965, for a discussion of "free riding"). But clearly note that both A and B are better off had they both chose C with total payoff 150 versus 100! There is therefore a collective action failure! This outcome remains even in finitely repeated versions of the game. This feature of the Public Goods Games is shared by all social dilemma games.

In the context of common property resource game, this hypothesis emerges as "over-exploitation" which produces the "tragedy of the commons" (Hardin 1968, 1981). "Global warming" is an example of a tragedy of the commons. The contortions in and the ultimately half-full compromise out of the recently concluded COP 15 in Copenhagen (December, 2009) is a testament to the tenacity of national self-interest as hurdle to global cooperation.

Laboratory Experiments: The Neo-classical prediction of the game outcome in collective action games has been tested many times under various permutations in the laboratory and been found falsified every time (see Offerman 1997 for a review; also Ostrom, 2000; 2008; 2009; Richerson, Boyd and Paciotti, 2001). Voluntary contribution to the kitty is never zero even in repeated versions. The results here are confirmed by extensive experiments with "Ultimatum Games" and "Prisoner's Dilemma Games" (Heinrich et al., 2004). Ostrom contemplating the evidence concludes that agents behave as if they were "conditional cooperators" rather than "rational egoists." Punishment for deviants appear to contribute heavily to sustaining cooperation. (Rasmussen and Hirshleifer, 1989; Boyd and Richerson, 1992; MacAdams, 1998; Fehr and Fischbacher, 2004). But punishment meted by members is another problem for the rationality hypothesis: the cost of punishing is private but its benefit is public which suggests tendencies other than selfish.

Field Research on CPRs: The laboratory results have now been amply reinforced by extensive field studies under the leadership of 2009 Economics Nobel Memorial Prize awardee Elinor Ostrom. Although the context differ in that field research games tend to be repeated and face-to-face whereas in many laboratory researches, games tend to be one-shot and anonymous. Note however that finitely repeated collective action games tend to have the same sub-game perfect equilibrium as single stage versions. They have found again and again that groups under certain circumstances (which we will refer to as the "Ostrom conditions") find ways to overcome the "tragedy of the commons" in common property resource (CPR) management (Ostrom, 1990; 2001; 2009). Ostrom (1990) has listed some of the requirements for the social environment to attain superior social outcomes; in particular, the game must be repeated; the game allows face-to-face communication (small number interaction) and the members are allowed to invest in monitoring and punishment of free riders; entry and exit is not easy; members are fairly homogeneous; the successful outcome of the game must be important enough. The importance of punishment, as observed above, is especially notable because punishers invest private resources that benefit even non-punishers. Thus, there is an element of abnegation and a violation of sub-game perfection.

One can view this body of evidence as partly realizing the theoretical results due to Kreps et al (1982) which predict episodes of cooperation arising in finitely repeated games if some agents are self-abnegating (use "tit-for-tat" sometimes referred to as "insanity") is upheld. Likewise the attainment of cooperation in infinitely repeated games require the adoption of contingent strategies such as the "grim strategy" of Fudenberg and Maskin (1986) and Abreu (1987). Contingent strategies such as tit-for-tat where agents open themselves up to opportunism form a fertile soil for the emergence of cooperation (see, e.g., Axelrod, 1984). They also are a marked departure from the assumption strict rationality. As Richerson, Boyd and Paciotti (2001) summarizes it: "Evidence from the commons literature suggests that people are neither individualist nor prosocial rational actors by nature." They are instead one or the other depending on what the situation warrants, a trait which we call "situational rationality".

2. Bubbles, Crashes, Herding and Fat Tails

We now turn our attention to another set of anomalies, this time, from the world of finance and macro-economics. The anomalies here were made especially salient by the 2008 global meltdown and the previous booms and crashes of a frequency not warranted by current mainstream models.

In 1965, Paul Samuelson (1965) taking off from Bachelier (1900) proved the proposition that fully anticipated prices are martingales, that is, prices of this genre are un-forcastable. Fama (1970) taking a cue from Roberts' "weak form efficiency" (1967) and his own dissertation (1965) coined the moniker "efficient market hypothesis" (EMH) to describe the state where market prices reflect all available information and no trading strategy can consistently make money. The 1970's saw added theoretical impetus given by the results that price changes weighted by the aggregate marginal utilities of risk-averse agents is unpredictable (Le Roy, 1973; Rubinstein, 1976). Lucas (1978) showed that risk-averse agents exhibiting "rational expectations" fully embody all information and only risk-adjusted marginal utility discounted prices qualify to be martingales. Since Lucas' ambition to rewrite the whole of Macroeconomics based on rational expectations (The "Lucas Critique) was coming to fruition, Financial Economics and Neo-Classical Macro-economics came to be woven from the same fabric: rational expectations (RE) and the Efficient Market Hypothesis (EMH).

This powerful orthodoxy bedded down snugly with such well-developed mathematical constructs as "random walk," "markov process" , "brownian motion" and "geometric Brownian motion". The common attractive property of these processes is they generate distributions that all converge to the Gaussian or normal distribution of price movements by the law of large numbers. In this paradigm, bubbles and crashes constitute very rare statistical events with near zero probability of occurrence. They may well be and are conveniently ignored.

But bubbles and crashes (booms, avalanches, cascades) refused to be so lightly dismissed. They occur so much more frequently than orthodoxy would have them. The October 1987 stock market collapse, the 1998 LTCM debacle, the 2001 dot.com bubble and crash, and the 2008 sub-prime bubble and collapse point to fundamental flaws in the orthodoxy.

It turns out that more careful analysis of the process beginning with Mandelbrot's (1963) showed that asset prices do not exhibit the Gaussian distribution. Mandelbrot himself proposed the Levy distribution to account for the frequency of large price changes that would have near-zero probability under the normal distribution. He coined the phrase "fat tails " to describe this leptokurtic property of distributions. Fat-tailed distributions do not tend to the Gaussian distribution in the limit. This is considered the source of excess volatility of stock returns.

In the 90's, the fledgling discipline of "Econophysics" weighed in with evidence similarly compelling. Mantegna and Stanley (1995) showed that for a very large number of observations of Standard and Poor 500 index, the distribution that best fitted was the "truncated Levy distribution" which displays finite variance. They also found that price increments are correlated in time which should not be the case if the process is geometric Brownian and EMH is valid. Likewise, volatility fluctuates with time and is not constant as the EMH would have it. Gopikrishnan et al (2000) and Stanley et al (2000) showed that for an even greater number of S & P index observations, the log-log plot was linear showing a non-Gaussian power law. What these means is that the powerful theorems of financial economics based of geometric Brownian motion such as Black-Scholes option pricing have circumscribed applicability!

Meanwhile many other anomalies began to be noticed. The serial correlation of asset prices and the persistence of arbitrage are examples of a phenomena that shouldn't exist (Cont and Bochaud, 2000). The "Oracle of Omaha" who consistently beat Dow Jones is an anomaly at least according to the strong version of EMH. The first order autocorellation coefficient that should be falling as markets became deeper instead showed a cyclical variation and lower in the 50's than in the 90's (Lo, 2004). The so-called "equity premium conundrum" where over very long periods, stock returns outperform other financial assets is an anomaly if EMH is true. That the Random Walk Hypothesis is rejected for weekly stock returns indexes (Lo and MacKinlay, 1997) is also an anomaly.

The message here is that market participants do not act like they believe the "no arbitrage" condition; they instead act as if they believe that some form of strategic complementarity occurs in the market. In other words, market agents are susceptible to herding behavior.

Economics have began to recognize the existence of herding behavior in the market. Models of how herding and bubbles emerge (Banerjee, 1992; Birchandani, Hishleifer and Welch, 1993) have been proposed and now constitute a robust subdiscipline in Economics. These models do not depend on irrationality to generate herding. They depend rather on imperfect information and the Bayesian updating of that information from watching others' actions.

3. The Billion DollarAdvertising and Endorsement Industry

The existence and vibrance of the advertising and celebrity endorsement industry is an anomaly if consumer or type is fixed and prices do not rise with the ad spend. The billions that Nike, Toyota and the like spend yearly would be irrational unless there is some correlation between ad spending and consumer patronage. If, however, the perception of what is the norm changes towards the brand with adspend, it makes sense.

4. Kuhnian Anomalies?

For some, these conundra now constitute a body of Kuhnian "anomalies" that call for a shift away from the homo economicus assumption. But which of the two features of homo economicus, strict rationality or self-interestedness should be jettisoned? It has been proposed that strict rationality in the sense of Von Neumann-Morgenstern expected utility and rational expectation (Tversky and Kahnemann, 1981) should be replaced by bounded rationality, rationality operating under imperfect information (Simon, 1955, 1957, 1999). In Financial Economics, the "Adaptive Market Hypothesis" based on evolutionary perspective (Lo, 2004) has been proposed by behavioralists (Shiller, 2008) to replace the EMH. The proposed alternatives do not yet constitute a consistent body of beliefs and research programs to adequately replace the prevailing orthodoxy.

III. A Multi-Level Choice Model: Heuristics

Our interpretation of the mounting evidence issuing from laboratory and field experiments and the turbulent world of finance is that to each agent is mapped a non-singleton set of types and he/she chooses the type that he/she thinks will best serve his/her end in particular environment. We will assume that economic agents can choose their type in a calculus similar to the choice of market basket but the choice of type is attended by a lot of uncertainty, is episodic and occurs before the choice of market baskets. In other words, we hold on to agent rationality in the sense of bounded and based on imperfect information about the situation or environment. This we call "situational rationality". The resulting decision landscape we call "multi-level choice theory" (MLCT).

The mapping of each agent against a multiplicity of types is not a novelty in Economics. In the economics of incentives compatible contracts under asymmetric information (adverse selection), an agent 's true type is private information while others know no more than the probability distribution over types. In Mechanism Design, the agent has one true type but has the choice of lying about it. The problem is to devise a way to make the agent tell the truth. If the situation is right, the agent will pass himself off as a different type to attain a higher payoff. Here agent choice is limited to the type he/she reveals but there is no choice over his true type. We intend to go farther than this. We will ague that agent's true type itself is subject to choice.

We first make the fundamental assumption (following Adam Smith's TMS) that every agent belongs to a group. In Sociology, where "Homo sociologicus" is king, the taste or preference of an agent and consequently his behavior is shaped by the norms his/her social group. "Norms" is the most invoked concept in the social sciences (Hechter and Opp, 2001). Where the concept of "deviance" is of serious academic interest, the choice of type is central. The implied concept here is that society has a way of keeping member behavior within tolerable bounds. Parents sanction deviant behavior in children. Parents or societies appear to have an "ideal type" or norms of behavior for each member that serves as the reference point for deviance. Norms is however invoked very sparingly in Economics although to good effect when done (Solow, 1990; Kandori, 1992; Lindbeck, Nyberg and Weibull, 1999).

The choice of type by an agent is a quintessentially social process. Societies have an ideal type (norm) for each behavioral trait which impacts on social outcomes. Where such norms exist, deviations from the ideal are meted some penalty. Societies where most members choose the "ideal type" are called "coherent." The Japanese society is many times mentioned as example of a coherent society. A concept that has attained increasing foothold in Economics to the same end is "social capital" (Putnam, 1993) foremost among which, "trust", is also a source of this coherence (Fukuyama, 1995; Fehr, 2008). While social coherence is usually viewed with envy by competitors in the market, as it can lead to remarkable performance (see, e.g., Knack and Keefer, 1997), it can also lead to tragic results as did the military adventurism by Japan and Germany. How do the ideal types get established in the group?

Groups are concerned with group performance (survival in Biology) and the ideal types associate with the behavior patterns that best advance that performance. This performance becomes more compelling in situations where the group competes with other groups. In other words, the ideal types is viewed by the group, rightly or wrongly, as conferring a competitive advantage upon the group. Such for example is the trait "eusociality" or "altruism" which remains a very live issue in Biology (Wilson DS and EO Wilson, 2007). Why do sterile females in an ant or bee colonies sacrifice their own procreative potential for the group? The solution according to Darwin in his other classic *The Descent of Man* (1871) is that groups with a good proportion of altruists have a distinct advantage over groups of mostly selfish individuals. In Darwin's own words:

"Although a high standard of morality gives but a slight or no advantage to each individual man and his children over the other men of the same tribe... an advancement in the standard of morality will certainly give an immense advantage to one tribe over another."

Thus in this case, ideal types are viewed as giving the group a distinct selective advantage and must shape member actions if need be by sanctions. In lion prides, maturing male offsprings who are likely to challenge for mating rights, defy heirarchical order and weaken the pride, are instinctively driven out by the resident alpha male. Over generations, members of successful groups will display an ingrained or hardwired predilection for group norms.

The old adage "In Rome, do as the Romans do" embodies this viewpoint like no other. The agent concerned, perhaps a visiting Damascene, knows there are norms of proper behavior in Rome. Since "doing as the Romans do" serves valuable public order in Rome, this is supported by sanctions. To that effect, the Roman legal principle "ignorantia legis neminem excusat" is very ancillary. Whoever acts in violation of the norms risks being punished. For most visitors to the capital of the Roman empire, this is a small price to pay for amenities of Rome.

It is, however, one thing to accept the counsel; it is another matter to actually execute it. Rome is a complex web of inter-phasing social environments. Thus there is a lot of uncertainty attached to the simple counsel. You can read travel guides. Or, as is most likely favored, you can just follow the crowd. There is safety in numbers. You don't know the motive for nor the information which motivates their behavior but you can observe the behavior flowing from those. That is called herding. Herding need not be an irrational behavior. If agents have imperfect information, follow the Bayes updating rule and depend on other's actions for additional information, their cumulative decisions will produce herding behavior and thus booms and avalanches. (see e.g., Cont and Bouchaud, 2000 and Birchandani et al., 1993; 1998; Banerjee, 1992; Nerei, 2008). The crucial point here is that value to an agent of a behavioral type depends partly upon the reference group and that value is attended by imperfect information and uncertainty.

An agent's optimal type is therefore contingent on the situation in which he/she finds himself/herself at a particular time. His/her choice of type is rational but situational; thus *situational rationality*. Every agent finds himself operating in two exchanges at the same time: one is the formal "mature market" of the textbook where exchange of goods and services is mediated by posted prices and thus faceless; the other is the social exchange market or "proto-market" where exchange is governed by norms and sanctions.

This is a departure of some moment from Neo-Classical consumer theory where an agent's type, homo economicus, is fixed. In the categories introduced by the great ethnologist Ernst Mayr (1976), Neo-Classical consumer theory is a *closed behavioral program*, one where the behavior of the organism is laid down in very great detail (strict rationality); what we are propose here is, again in Mayr's categories, an open behavioral program, one where certain choices or alternatives are open. Behavior in Neo-Classical theory may be described by the declaration: "These are my principles. If you don't like them, eat out heart out!" The proposed alternative consumer theory allows the more strategic declaration: "These are my principles. If you don't like them and you are bigger than me, I have others."

IV. Multi-Level Choice: The Formal Model

Let $U^*(p, B; z) = V(z)$ be the indirect utility function of agent H where p is the vector of prices of the vector or market goods x, B the budget of H and $z = \{z_j\}$, j = 1,2,3…,m, is the m-vector of non-market goods (to include modes of behavior) that each has a direct utility to H. We normalize each of the z_j to range between 0 and 1. z are not bought and sold in the market (missing formal markets). The use of z by H is not regulated by the market. Among these are those productive of positive or negative externality (e.g., the use of common property resource such as fishing). These are already subject to choice by H in orthodox consumer theory. This vector is a the pillar in the economics of "market failures" (see e.g., Mas Collel et al., 1995, Chapter 11). The second is the vector of parameters or constants reflecting "taste", "preference" or "behavioral tendencies". They do not produce utility directly but only affect the utility of goods. This vector consists of black boxes imported from other disciplines and are not subject to choice in the textbook consumer theory.

Example: In the Cobb-Douglass utility function $U = Ax_1^a x_2^{1-a}$, $0<a<1$. Then Z is empty. If we let "A" be interpreted as a function of a non-market good z (say, $A = z^d$, $-1<d<1$), then Z = (z) which is now subject to choice. (It is also worth noting that in growth theory, "A", which is interpreted as the Hicks neutral technology, has been successfully endogenized as the "total factor productivity". As such it depends on other primitives such as R & D and human capital investment which themselves are subject to choice.) Both "d" and "a" are behavioral markers: d because it signals that y is distasteful (-1) or desirable (1) directly and "a" because it affects the relative desirability of the x's. But neither of these are observable. The parameter "a" forms the boundary between classical consumer economics and other disciplines. It may happen that "a" is not known with certainty by the agent. The value of "a" is instead revealed to the agent by how others react to "a" as manifested by his group's reaction. If x_1 is "baby food" and the agent is a father to a baby, then a higher "a" (a higher expenditure on baby foods) will be applauded by his group but a zero will be viewed as irresponsible. He will not be insensate to such regard.

Assumption 1: Every agent is a member of a reference group operating in external social environment E . $E \varepsilon \mathbf{\Omega}$, the set of all possible external environments. This group assigns an ideal type z* to each member for each environment E in $\mathbf{\Omega}$.

Let z_j be an element of the set, not necessarily a singleton, Z_j . Let Z be the Cartesian product of all the Z_j's, i.e., $Z = \prod Z_j$, the m-dimensional unit space of traits. Let Z be closed, compact and convex. For each member, the group identifies an "ideal type," z*, $z^* \varepsilon Z$. The type z* is a bundle of traits which maps into a behavior pattern that maximizes group welfare such as success in the environment E. Note that z* is different for different elements of $\mathbf{\Omega}$. An example of a trait is "cooperativeness". This can range from "completely cooperative" (0) to "completely uncooperative" (1) with combinations in between. The collection z* is established by group selection on cultural variation (Richerson, Boyd and Heinrich, 2004).

Assumption 2: H chooses a $z \varepsilon Z$ for each E.

To fix ideas, let z_j be the trait "cooperativeness" and let $z_j = 0$ be most cooperative (least selfish in specific instance may also be construed as zero carbon emission or no smoking where more is individually preferred to less). This means that $(\partial V/\partial z_j) > 0$, or a higher z_j raises private well-being at the same time that it reduces social welfare. There is a conflict as is the case in social dilemma games.

Assumption 3: There exists a penalty function $C(\{h_j\})$ where $h_j = (z_j - z_j^*)$, giving the sanction attached to every deviation by H from the ideal level z_j^*. If $h_j = -(z_j - z_j^*)$, we call $C(\{h_j\})$ a reward function. We assume C(.) to be increasing and convex in h_j. The level of the penalty (reward) rises the greater the distance is from ideal.

For convenience of treatment, we let

$$C(\{h_j\}) = \sum c_j(z_j - z_j^*)^2, \text{ where } c_j = c_j(1) + c_j(2)$$

We call the vector [c, z*] the *norm enforcement environment*. The term $c_j(1) > 0$ is the "conscience cost" parameter of deviation in trait j, or the degree at which agent H internalizes the social cost of deviation (analogous to what North calls "first party enforcement"). This cost parameter comes from the "hardwired" valuation by the agent of group welfare. This is akin to Crawford and Ostrom's (2005) "delta parameter" which reflects the internal valuation of group welfare embodied in the agent. High level of "trust" among the members redounds to high $c_j(1)$ (Fukuyama, 1995; Knack and Keefer, 1997). This value is hardwired through inheritance or learning again by group selection on cultural variation (Richerson, Boyd, Heinrich, 2004) .

By contrast, $c_j(2) > 0$ is the group-institutionalized sanction parameter (referring to what North calls "second party enforcement"). The term $c_j(2)$ is parametric to the individual but potential a choice variable to the group. The more important is z_j for group welfare, the higher is the corresponding $c_j(2)$. For non-crucial z_j, $c_j(2)$ may be zero. This reflects the liberal democracy's (JS Mill) principle that every member is free to act for as long as his action doesn't generate a negative spillover for society. Let c be the m-vector of c_js and h^T be the transpose of the m-vector of deviations.

A. Deterministic z*

When z* is known with certainty, individual welfare F is defined in analogy to "Inclusive Fitness" in this way:

$$F(z) = V(z) – C(z) = V(z) - ch^T$$

This is a formal rendition of what Ostrom (2009) calls bounded rationality. The agent chooses his optimal type z^ by maximizing F with respect to z. For twice differentiable and concave V(z), z^ is given implicitly by the following m equations:

$$((\partial V(z^\wedge)/\partial z_j) / 2c_j) = z_j^\wedge - z_j^*, \quad j=1,2\ldots,m$$

When V(z) is linear in z (the simplest case), the following are true:

(a) $z_j^\wedge - z_j^* > 0$ since $\partial V(z^\wedge)/\partial z_j > 0$: when the trait z_j is privately beneficial for the agent, he/she tends to exceed the ideal for finite c. (An analogous minimization problem results if $\partial V(z^\wedge)/\partial z_j < 0$, or z_j is privately distasteful to the agent, and $\partial C/\partial z_j > 0$, or the group rewards undertaking z_j.. In this case F(z) is minimized and $z_j^\wedge - z_j^* < 0$, or $z_j^\wedge$ will fall short of z_j^*).

(b) As c_j rises, $z_j^\wedge - z_j^*$ falls: the deviation from ideal norm falls as its cost rises.

(c) As $c_j \rightarrow \infty$, even small deviation from the ideal z_j^* becomes prohibitively costly and avoided.

(d) As z_j^* rises, $z_j^\wedge$ also rises.

(e) F(z^(c, z*)) is the best the agent H can realize at any given norm enforcement environment [c, z*].

(f) At any given time, society is characterized by a profile of types {z^} of all of its members.

Assumption 4: The ideal z* and the optimal z^ changes as we move from one external environment in **Ω** to another.

The rate of change depends upon the rate of change of the environment and the speed with which this is communicated and processed by the members. This rate may have risen for example with new technologies (SMS, say).

Genetically programmed or instinctive altruism manifested by for example sterile females in the bee or ant colonies is mimicked here by c(1) approaching infinity. This internal alignment is genetically (biochemically) enforced. Thus, there is no deviation at all. Among humans, the Japanese samurai ethic, the *Bushido*, exemplifies a behavior type that is culturally hardwired and internally enforced. In this ethic, the ideal z* under certain circumstance calls for self-immolation (hara-kiri) for the sake of the group. When this is true of all members of a society, the order that prevails does not require external sanctions which may be costly.

The optimal z_j^ rises as z_j* rises. An invasion by an alien group that threatens the survival of agent i's group raises the ideal z_j* (where the trait, say belligerency, raises group capacity to resist and repulse the intrusion) leading the individuals to raise z_j^ and resulting in higher member patriotism and belligerency.

Where c(1) is low or zero at the outset, greater coherence can still be enforced by group sanctions manifested by higher c(2). Group sanctions can however be very costly for the group and thus be limited. There is evidence for example that the larger is the group, the harder is the attainment of cooperative outcome. If the member can exit the group easily, group-imposed sanctions will not bite. Thus, the Ostrom conditions can be understood as lowering the transactions cost of punishment leading to higher c(2) and closer to norm behavior. If c = 0, then members act as they please and social disorder or entropy rules. For some traits, there may exist an interval around z_j* where $c_j = 0$, that is, some freedom to roam or experiment is tolerated.

We consider the case where z_j is a socially relevant non-market good such as the use of a Common Property Resource. Then the ideal z_j* will reflect the ideal sustainable usage by the agent as seen by group wisdom and arrived at by repeated practice. If punishment for deviation c is high enough (as in the Ostrom environment due to identification with group goals $c_j(1)$ is high), face-to-face and repeated small number interaction, homogeneous membership, allowance of punishment for deviants leading to high c_j (2)), every agent will approximate the ideal usage and the tragedy of the commons will be avoided. If c is very small (large number of members, high cost of sanctions, heterogeneity and so less identification with group goals) deviations will be large and the commons tragedy rears its head. If his/her group realizes that a more stringent norm better serves group welfare in a changed environment, then it will reduce z_j* and z_j^ will also fall for given c. The increase in the sanctions attached to smoking in public induces smaller z_j^. Thus, the emergence of the cooperative solution in CPRs is easily follows from this narrative.

B. Uncertain z*

It is our contention that z_j* is only imperfectly known to the agent, that is z_j* is a random variable with the distribution function only imperfectly (provisionally) known to the agent. Let the (provisional) density function of the distribution of z* be f(z*). If the distribution the z_js are independent of each other, then the expected fitness of the agent is

$$E\{F(z)\} = V(z) - \sum\{\int c_j(z_j - z_j^*)^2 f_j(z_j^*)dz_j^*\}$$

Then the optimal z^ will be given implicitly by the following m equations:

$$((\partial V(z\hat{})/\partial z_j)/2c_j = \int[(z_j - z_j^*) + ((z_j - z_j^*)^2/2)(f_j'(z_j^*)/ f_j(z_j^*))]\, f_j(z_j^*)dz_j^*, \;\; j = 1,2,\ldots,m$$

Once more, the right hand side is defined over (z_j-z_j*) and the behavior with respect to c_j is similar. Note that if the probability distribution over z* is degenerate, this reduces to deterministic case above. The added insight is that now z_j^ depends upon the provisional density function f(z*) and its slope f'(z) which in turn depends upon the information set of the agent. How this probability distribution evolves can generate herding behavior which in turn generate bubbles and crashes.

V. Accounting for Anomalies

a. Conditional Cooperation:

If agents have a choice over types, then they can parlay different types to suit their perception of emerging environment. Their reading of the environment depends upon the information set they have. If his/her information indicates that the counter-party (the environment) will respond selfishly, then choosing type "selfish" is best reply. If there is some probability that my counter-party will match generosity with generosity (i.e., reciprocal type), he may choose type "generous" (Fehr and Gächter 2000; Bolton and Ockenfels 2000; Falk, Fehr, and Fischbacher 2002; Panchanathan and Boyd 2004). Zero contribution in public goods game under anonymity arises because the parties assume their counter-party to have no choice but to act selfishly. This will not necessarily happen if parties know their counterparties have a choice.

This change in the chosen types due to environmental change is manifested in "tit-for-tat " or "grim strategies" in repeated games: the agent chooses the "cooperative type" in the absence of new information and so continues for as long as one's cooperation is reciprocated. Once the other party reneges, a new environment emerges where the opportunistic type is favored. This leads to full cooperation in infinitely repeated games (folk theorem) (Fudenberg and Maskin, 1986; Friedman, 1972) and episodes of partial cooperation in finitely repeated games (Kreps et al., 1982, the "Gang of Four theorem"). Note that the change in behavior (type) is triggered by a change in the environment. The ideal behavior or norm operative in different environment is different. Altruism is applauded when directed to members of the group but may be condemned when directed to potential enemy. The animosity against so-called "collaborators" after WWII reflected such condemnation.

The agent is responding to the changing environment (the revealed entry of opportunism) by adopting a type that reduces the cost for that new environment. If players can each choose their type and this is common knowledge, there is ample room for cooperative outcomes. In other words, Ostrom's "conditional cooperators" will prosper.

In this connection we propose the concept of the *Ostrom Space:* the social neighborhood where the probability of the counter-party being reciprocal is high enough so that choosing the reciprocal type is at least a weakly dominant strategy. Within the confines of the family group, a member's altruism has a very high probability of being reciprocated and so altruism will normally dominate. In small close-knit communities, agents readily take on a conditional cooperator type rather than the opportunistic type since the loss attached being reciprocated with selfishness is almost sure. There are times when the Ostrom space encompasses the whole nation as in times of war with other nations. In many primitive societies, the Ostrom space is the “tribe”. It can be as small as the “family.” The stability of the Ostrom space is a live issue because it can be invaded by exploiters (see Henrich, 2002).

As the collective grows in size, the group outgrows its Ostrom space and (1) the internal impulse to cooperate erodes and (2) the capacity to monitor and mete punishment on deviants erodes (c(2) falls). The centrifugal forces take over. Opportunism rises and collective action failures emerge.

b. Herding and Fat Tails

How does MLCT deal with the existence of herding and “fat tails”? It is in the choice of type based on the agent’s reading of the new environment that herding and fat tails emerge. Suppose z* is known only up to a probability distribution which is evolving in view of the fact that the ambient environment and/or the information set is dynamic, the agent’s reading of the environment and thus his choice of type z_j^ could very well be accompanied by imitation and mimicry leading to herding behavior. It has been shown that herding behavior generates non-normal distribution (Cont and Bochaud, 2000; Eguiluz and Zimmerman, 2000; Nerei, 2008). The basis of practically all the work here is “imperfect information” about the probability distribution, the extraction of information from other members’ actions and Bayesian updating by agents. Nerei (2008) puts the problem of excess volatility or fat tails in financial returns in this way:

“There has been a long quest for the explanation for the anomaly [of excess volatility]. A traditional economic explanation for the excess volatility of the volumes and returns relies on traders’ rational herd behavior. In a situation where a trader’s private information on the asset value are partially revealed by her transaction, the trader’s action can cause an avalanche of similar actions by the other traders. This idea of chain reaction through the revelation of private information has been extensively studied in the literature of herd behavior, informational cascade, and information aggregation. However, there have been few attempts to explain the fat tail in this framework.”

Nerei then proceeds to show that the chain reaction of information revelation leads to the fat-tail distributions of the traders’ aggregate actions and stock returns.”

Nerei models a large number of traders who choose whether to buy one unit of the asset or not to buy at all. They each receive imperfect private information on the true value of asset. They are also able to observe the actions of others which convey information on their underlying private information. The resulting rational expectations equilibrium is a mapping from the space of private information of all traders to the aggregate actions. The larger the aggregate action becomes, the higher is the traders’ subjective belief that the asset value is high, making the buy decision more likely. Thus, the traders’ actions become positively correlated and there emerges a perfect strategic complementarity in the actions of agents. That is, the payoff to shifting rises as more and more people shift. In this case, the agent shifts from being a fence-sitting type to a true believer in high asset value precipitated by a shift in his probability distribution incorporating in a Bayesian fashion information from actions of others around him.

The case of choice over type is analogous. Consider a choice between two types: conservative and aggressive. The agent is initially conservative. New information concerning the environment is starts to flow. He/she decides whether to stay conservative or shift to being aggressive in view of the emerging new information about the environment. His private information about the change in environment is imperfect. He can observe and use other agents' actions as cues but cannot observe their private information. The more people are observed to adopt the aggressive type the more likely is it that aggression is the new normal in the sense of social sanctions being attached to being at variance with it. If he fails to shift when everyone else does, he/she sticks out and/or gets punished (realizes less profit if a commodity trader or ostracized as was erstwhile flying hero Charles Lindberg who opposed the entry of the USA into the WWII). If he/she shifts type but the majority stays, he/she gets punished (suffers heavy losses as a wild speculator or dunced as a "war freak"). This state of affairs creates a strategic complementarity leading to herding and cascades. The more people adopt, the higher is the cost of not adopting. These imply rapid changes in behavioral tendencies which in turn lead to sometimes drastic changes in market outcomes. In the hey-day of pre-2007 bubble, an investment banker was viewed as a loser and may even get fired if he/she did not switch to the high return, high risk CDO bandwagon.

VII. Neo-Classical Theory as a Special Case

Neo-classical consumer theory despite its weakness had many triumphs. How does Neo-classical consumer theory fit in with this view? Neo-classical consumer theory assumes that the set of types confronting each agent is a singleton. He/she has effectively no choice over his/her type. Multi-level choice theory says each agent confronts a set of types with more than one elements and he/she chooses his/her type from that set depending on the circumstances. He/she may shift types depending upon his/her reading of the social environment and his/her group's best interest in that environment. Neo-classical consumer theory is therefore a special case of multi-level choice where neither the environment nor the information set is allowed to change. How do the theorems of Neo-classical Economics fit in? These theorems are generally valid under the *ceteris paribus* proviso. The theorems will still hold if we expand the *ceteris paribus* set to include the profile of agent types. In MLCT, the validity of these theorems as social statement will be *of shorter duration* than when types are fixed.

Example: Again let $U = Ax_1^a x_2^{1-a}$, $0<a<1$, $Z = (A,a)$ where "A" is just a blowup parameter and the exponent "a" is properly the taste parameter. Suppose x_1 a home good and x_2 is imported. Under initial presumptions that both goods are produced under ethical conditions, "a" takes the value a_n^ reflecting a_n* giving the demand for each at given prices. After it becomes public knowledge that x_2 is produced using child labor (change in E), the normative ideal a rises from a* to a_w* and a^ now takes the value a_w^ > a_n^. Then the demand for good x_2 falls while the demand for x_1 rises without any change in the prices. If the sentiment is widespread enough, the price of x_2 may fall. Shifting norms is also the basis of the billion dollar advertizing and celebrity endorsement industry.

VIII. Recapitulation

In the following pages, we reviewed the set of empirical observations that Neo-Classical consumer theory based on the homo economicus with fixed preference cannot comfortably account for. Two genres are especially compelling: one, the prevalence of conditional cooperative behavior in laboratory experiments and field studies and second, the frequency of financial bubbles and cascades that can only issue out of “fat tailed distributions” generated by herding behavior among market agents.

To account for these anomalies, we propose a multi-level choice theory where (a) agent type is not fixed but rather chosen from a set of types, (b) each agents belongs to a group that prescribes the ideal type for the agent, (c) deviations from the ideal elicits sanctions which are either “hardwired” or “institutional”, that is, explicitly meted out by the group. The agents then maximizes what amounts to an “inclusive fitness” utility function to choose his/her optimal type. Thus, an agent may choose reciprocal behavior when the likelihood of reciprocity in his counter-party is high; he will choose selfish behavior otherwise. In other words, he/she assesses the situation or context of the game. This makes for cooperative behavior dominant in certain social neighborhoods called Ostrom spaces. The ideal types are only imperfectly known, i.e., only up to a provisional probability distribution. Agents look to others’ actions as cue to the true probability distribution and follow a Bayesian updating. This means that the shifts in types may be governed by herding behavior that give rise to “fat tailed” distributions.

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