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Rethinking Microeconomics: A Proposed Reconstruction

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I. Introduction

Microeconomics is important because individual agents make choices, and choices have personal and social consequences. Incentives do matter, and they do affect individual choices. But it does not follow that individual decision making is characterized by the rules of so-called rational choice and rational expectations or by the reductive incentives they embody. Nor does it follow that aggregates can be analyzed in terms of representative agents. The historical, empirical and analytical evidence against this set of hypotheses is overwhelming. One purpose of this paper is to survey this evidence. But a larger purpose is to demonstrate that the central empirical findings of microeconomics do not require any such foundation, because they can be derived from a wide range of individual decision making modes. Aggregates are shown to be "robustly indifferent" to their microfoundations because shaping structures such as budget constraints and social influences which generally play decisive roles in producing aggregate patterns.

Once it is understood that very different types of microfoundations can give rise to the same market-level or economy-wide patterns, we can partition microeconomics into two types of propositions. Empirically grounded propositions which can be derived from a wide variety of microfoundations: downward sloping demand curves, differential income elasticities for necessary goods, income-driven consumption functions, etc. And propositions which depend on the specific characterization of individual behavior: where the assumed foundation is rational choice, this latter set includes the usual theorems on the efficiency, harmony and general optimality of market processes. The advantage of proceeding in this manner is that it greatly expands the room for the possible characterizations of individual economic behavior while retaining key microeconomic patterns which play an important role in economic analysis.

None of this implies that micro processes are unimportant. On the contrary, they play a central role in determining individual paths and evaluating the social implications of macro outcomes. In addition, they can become decisive at the aggregate level if and when people choose to act in concert, as in the case of a general work stoppage or a consumer boycott. Agency can be brought back into market analysis. We therefore need to understand how individual agents actually behave, how they actually react to changes in the macro environment, and to what extent the environment is in turn affected. Behavioral and experimental economics, psychology and sociology, can all have their say.

Two conclusions can be derived at this point. First, that a correspondence with the aggregate empirical facts does not privilege any particular vision of micro processes: many roads lead to Rome. And second, when one examines how individuals actually behave, the *homo economicus* model of behavior is a devastatingly bad one.

It is worth noting that the current division of economic theory into micro and macro is a relatively new one. Classical theory typically began with the theory of price which provided the foundation for the analysis of growth, employment and foreign trade. It was Keynes who first suggested the modern partition between the analysis of the behavior of individual agents and that of economic aggregates (Janssen, 1993, p. 5). In Keynes' hands, the latter operated by different rules than the former (see section IV of this paper for an analysis of this logic).

Lucas took the very opposite tack: macro must be integrated into micro. The resulting Lucas Critique of Keynesian-type macroeconomics embodied four propositions. Structure is said to emerge from individual decision rules of agent. A change in environment, e.g. in policy, will change individual behavior and therefore change the structure. Hence models based on past patterns cannot be used to predict effects of potential change in environment because the structure will itself change in response to the change in environment. It follows that we need a theory of micro-behavior to predict how macro-outcomes respond to a change in environment (Salehnejad, 2009, pp. 22-25). Lucas' central conclusion was that if the integration of macro into micro was properly done, "the term 'macroeconomic' will simply disappear from use and the modifier 'micro' will become superfluous. We will simply speak … of economic theory" (Lucas, 1987, pp. 107-108), quoted in Grabner 2002, p. 11).

The neoclassical microfoundations project builds on this general foundation by adding five additional distinct claims. Individual agents are assumed to maximize expected utility or profits. Their expectations are essentially correct in equilibrium. Equilibrium is assumed to obtain in practice. The collective behavior of a particular type of agent can be modeled in terms of a single representative agent with rational behavior and rational expectations. And only macroeconomics derived from microeconomics in this manner can be considered rigorous. It was understood that this particular approach to economics still had to consistent with observed empirical laws of microeconomics such as price and income effects on demand, as well as with observed macroeconomic patterns in output, consumption and investment. But interestingly enough, this approach did *not* feel itself as bound to observed patterns in individual behavior: the assumption of individual hyperrational behavior remained sacrosanct.

All of these themes will be explored in some detail in this paper. Part II takes up the primary issues in the relation of between micro-processes and macro-patterns: rational choice, complexity theory and "emergent" properties of aggregates (the latter being a modern expression of the age-old notion that a whole can be greater than the sum of its parts). It is argued that there is no reason to be tied to the standard model of hyperrational behavior, which is neither descriptive of actual behavior nor useful as a normative standard. This critique also applies to much of game theory, Becker's theory of the family, and so-called Analytical Marxism. It is also shown that the aggregate outcomes cannot be characterized by means of a "representative agent" except in except in trivial cases. The real function of the notion of a hyperrational representative agent is that it serves the mission statement of neoclassical economics: it portrays capitalism as efficient and optimal, which makes it perfectly instrumental in that particular sense. The claim that only micro-derived macroeconomics can be rigorous is, so to say, rigorously deconstructed with reference to the well known tension between Quantum Mechanics and General Relativity Theory. Finally, a sharp distinction is made between the notion of equilibrium as a state which is attained and held, and that of equilibrium as a turbulent gravitational process which achieves a rough balance only through offsetting positive and negative errors. Part III presents an analytical framework for robust microeconomics. It is demonstrated that stable aggregate patterns arise from the underlying shaping-structures (budget constraints, income distributions), not from the details of individual behaviors. By way of illustration, I show that the major empirical patterns of consumer theory (downward sloping demand curves, Engels curves for necessaries and luxuries, aggregate consumption functions) and of production theory (aggregate production functions) can be all be derived from a variety of different microfoundations. Under normal circumstances, macro outcomes are "robustly insensitive" to the details of micro processes. Part IV considers the methodological implications of the preceding results. The Lucas Critique is reconsidered and shown to be wanting in key respects. Five methodological rules for good macroeconomics are then derived, and illustrated with reference to Keynes consumption function and Kalecki's theory of price. The concluding part of the paper provides a summary and draws out some further implications of this analysis.

II. Micro-processes and macro-patterns

> "In the social sciences we are suffering from a curious mental derangement... the orthodox doctrines of economics, politics and law rest upon a tacit assumption that man's behavior is dominated by rational calculation …[even though] this is an assumption contrary to fact" (Wesley Clair Mitchell, 1918, p. 161).

II.1. Representing individual human behavior

There is a great difference between studying how people actually behave and positing how they should behave. When we wish to know how and why people behave as they do, we turn to behavioral economics, anthropology, psychology, sociology, political science, neurobiology, business studies and evolutionary theory. We discover that evolutionary roots, cultural heritages, hierarchical structures and personal histories all influence our behavior: we are socially constructed beings, within the limits of our evolutionary heritage (Angier, 2002 ; Ariely, 2008, Ch. 4-5, 9; Zafirovski, 2003). There is a large body of evidence which shows that we do not consistently order preferences, we are poor judges of probabilities, we do not address risk in a "rational" manner, we regularly commit a wide variety of reasoning errors, and we generally base our behavior on habits and rules of thumb (Agarwal and Vercellli, 2005, p. 2; Anderson, 2000, p. 173; Conlisk, 1996, pp. 670-672; Simon, 1956, p. 129). In the end, "we not noble in reason, not infinite in faculty[1]". On the contrary, we are "rather weak in apprehension… [and subject to] forces we largely fail to comprehend" (Ariely, 2008, pp. 232, 243). And as any advertiser could tell us, our preferences are easily manipulated and our responses quite predictable.

Despite all of this evidence, neoclassical economics stubbornly insists on portraying individual as egoistic calculating machines, noble in reason, infinite in faculty and largely immune to outside influences. The introduction of risk, uncertainty and information costs changes the constraints faced, but not the basic model of behavior (Furnam and Lewis, 1986, p. 10). I will call this the doctrine of "hyperrationality" so as to distinguish it from a more the general notion of "rationality" which refers to the belief or principle that actions and opinions should be based on reason. The point here is to avoid the neoclassical habit of portraying hyperrationality as perfect and actual behavior as imperfect[2]. It is a topsy-turvy world indeed when all that is real is deemed irrational.

The question is not whether economic incentives matter, but rather *how* they matter. Economic incentives certainly do influence individual choices and social outcomes. But so do economic opportunities and a variety of non-economic motivations and limitations. The question at hand is: why does neoclassical economics insist on a supremely reductionist representation of individual human behavior? There are two dimensions that need to be addressed: hyperrationality as a model of actual behavior; and hyperrationality as a behavioral ideal.

On the first score, hyperrationality plays an instrumental role in the depiction of capitalism as *the* optimal social system, because (among other things) this portrayal requires that all individuals know exactly what they want and get exactly what they choose[3]. This immanent necessity drives a variety of attempts to justify its reliance on such assumptions. There is the Ptolemaic claim that we must adhere to the assumptions of hyperrationality because this is what (real) economists do. There is the empirical claim that it is a good approximation to how people actually behave, the claim suffering only from the minor defect of requiring its defenders to scale the "mountain" of contrary

[1] Hamlet: "What a piece of work is a man! how noble in reason! how infinite in faculties!" *Hamlet*, II.2.319, quoted in Conlisk (1996, p. 669).

[2] For instance, in his otherwise excellent exposition of the complexities of actual behavior, Airely (2008, pp. xix-xx) specifically refers to the neoclassical notions of "rationality" (i.e. to hyperrationality) as "assumptions about our ability for perfect reason" and labels actual behavior as "irrational…[because of] our distance from perfection".

[3] "There is by now a long and fairly imposing line of economists … who have sought to show that a decentralized economy motivated by self-interest would be compatible with a coherent disposition of economic resources that could be regarded as superior .. to a large class of possible alternative dispositions" (Arrow and Hahn, 1971, pp. vi-vii, cited in Sen 1977, pp. 321-322.). Similarly, Samuelson (1963, p. 233) notes that Friedman's defense of hyperrationality is motivated by the desire "to help the case for (1) the perfectly competitive laissez faire model of economics, which has been under continuous attack from outside the profession for a century and from within since the monopolistic competition revolution of thirty years past; and (2), but of lesser moment, the "maximization-of-profit" hypothesis, that mixture of truism, truth, and untruth".

evidence (Conlisk, 1996, p. 670)[4]. There is the convenience-based argument that hyperrationality gives analytically tractable results, which as Kirman (1992, p. 134) notes "corresponds to the behavior of a person who, having dropped his keys in a dark place, chose to look for them under a street light since it was easier to see there!" At the other extreme, there is Friedman's (F-twist) argument that since hyperrationality yields good empirical results, any critique of its assumption is not relevant (Samuelson, 1963, p. 232). The problem with Friedman's hypothesis is that a given set of assumptions contains empirical implications beyond than those which any particular user has chosen to investigate, and at least within the rules of scientific discourse, other users cannot be forbidden to explore other pathways. Indeed, different sets of assumptions often give rise some common set of empirical predictions, so that the only way to distinguish among the models is to expand the empirical range until their predictions differ. In so doing, it is precisely the assumptions which matter[5]. We will pursue this point in the next section.

There is also the claim that it "is possible to define a person's interests in such a way that no matter what he does he can be seen to be furthering his own interests" (Sen, 1977, p. 322). Problems immediately surface if this proposition is taken seriously. For instance, if you get satisfaction from other people's well-being, then one might argue that you are just as self-interested as someone who cares nothing for others. This applies equally well if you get pleasure from other people's pain (the latter being, after all, "merely" negative well-being). On this pathological scale, the narcissist, the Samaritan and the psychopath are treated as being fundamentally alike. Even so, only the assumption of narcissism "works" properly for orthodox economics: the interactions among individuals implied by the other two generally create "externalities", and these have to be ruled out in standard general equilibrium models because they undermine the depiction of capitalism as the optimal social system (Sen, 1977, p. 328).

The theory of revealed preference is an operational version of this same "definitional egoism" hypothesis (*ibid*, p. 323)[6], and its attempt to impute hyperrational motivation to actual behavior leads to well known difficulties. At the very least, this hypothesis

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[4] The claim that hyperrationality is a good approximation to actual behavior, at least in the domain of economic transactions, subsumes the claim that people "learn optima through practice" (Conlisk, 1996, p. 683). This either supposes that people desire to behave hyperrationally, and succeed in realizing this desire, which is precisely what is in dispute; or that they are somehow punished if they don't (the survival argument). The latter hardly applies to consumer behavior, for "we seldom read in obituary pages that people die of suboptimization" (Conlisk, 1996, p. 684). And insofar as the market does weed out less successful managers or owners of firms, this hardly implies that hyperrationality and perfect competition provide good models of the behavior of surviving firms. This issue is discussed further at the end of this paper.

[5] Samuelson (1964, p. 736) says that "the whole force of my attack on [Friedman's hypothesis] is that the doughnut of empirical correctness in a theory constitutes its worth, while its hole of untruth constitutes its weakness... I regard it as a monstrous perversion of science to claim that a theory is *all the better for its shortcomings*; and I notice that in the luckier exact sciences, no one dreams of making such a claim ... there is no reason to encourage tolerance of falsification of empirical reality, much less glorify such falsification."

[6] Chai (2005, pp. 8-11) calls this the "interpretive" dimension of the rational choice approach, but at least in economics it has largely been a method of defense.

requires individual behavior to exhibit particular patterns to at least justify an imputation of hyperrationality may be imputed to it[7]. If a person chooses x over y and y over z, but also z over x, such behavior contradicts the notion of hyperrationality and is deemed irrational. So too does the choice of x over y in one context and y over x in another. If such ranking switches occur over time once or twice, one could try to rescue the theory by assuming that the person's "tastes" have changed in the interval. But this is dangerous territory, since the stability of the preference structure is an essential attribute of this doctrine and tastes cannot be allowed to change too often[8]. Whimsy is definitely forbidden. An even deeper problem is that all such efforts to impute particular motivations to human behavior fail to take account an important source of information, which is the account people give of their own motivations (*ibid*, pp. 322-323, 325, 335-336, 342-343). To set aside such information one has to claim that while people know exactly what they want and what they can get, they somehow do not know what they know. This imposes a certain logical strain on the whole argument. Binmore (2007, p. 2) tells us that "[E]ven when people haven't thought everything out in advance, it does not follow that they are necessarily behaving irrationally." He goes on to argue that even "mindless animals" such as "spiders and fish" can "end up behaving as though they were rational" because evolution has programmed them to do so. This at any rate establishes that what the orthodoxy means by "rational behavior" is merely any behavior in which *some* outcomes can be mimicked by a model of rational behavior. One can easily imagine outcomes of fish and spider behavior that orthodox economists might not claim as their own.

Game theory is cut from the very same cloth. Its putative strength is that it allows for strategic interactions among hyperrational self-interested agents[9]. Since potential interactions require strategic considerations, players' expectations come to play a crucial role (Hargreaves Heap and Varoufakis, 1995, pp. 24-25). Unfortunately, these are modeled in an entirely self-serving manner: players are either assumed to hold an infinite regress of entirely correct beliefs in which "Alice [correctly] thinks that Bob thinks that Alice thinks that Bob thinks…"[10]; or they are conveniently assumed to arrive at the same outcomes through "some adjustment process" (Binmore, 2007, pp. 14-16). Not

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[7] Needless to say, consistency of choices does not imply that the underlying motivations are indeed hyperrational, since a "consistent chooser can have any degree of egoism we care to specify (Sen, 1977, p. 326).

[8] Indeed, Stigler and Becker (1990, p. 192) specifically argue that one should proceed by taking tastes as unchanging and the same across individuals, and search instead "for the subtle forms that prices and incomes take in explaining differences among men and periods".

[9] Kreps (1990, p. 41) says that "[t]he great successes of game theory in economics have arisen in large measure because game theory gives us a language for modeling and techniques for analyzing specific dynamic competitive interactions". Of course, the language in question is just a dialect of hyperrationality.

[10] The notion of Common Knowledge of Rationality (CKR) embodies the assumption that each player is instrumentally rational [i.e. hyperrational], believes all others also are, and believes that they believe him to be, and so on. The notion of Consistent Alignment of Beliefs (CAB) further postulates that all these beliefs are consistent, in the sense that if two hyperrational individuals have the same information, they must draw the same inferences and arrive at the same conclusion. Aumann assumes that hyperrational individuals will come to hold the same information, i.e. will move from CKR to CAB (Hargreaves Heap and Varoufakis, 1995, pp. 24-28).

surprisingly, game theory has been contradicted by the empirical evidence from the very start (Hargreaves Heap and Varoufakis, 1995, p. 240). Yet it has managed to exert a great influence on the social sciences, even presenting itself as "a framework within which one can realistically discuss what is or is not possible for a society" (Binmore, 2007, p. 65). One of the most striking features of game theory is its reliance on cardinal utility. Game theory revolves around the assumption that each player values outcomes in terms of particular payoffs: these payoffs are either measured in "utils" (Hargreaves Heap and Varoufakis, 1995, pp. 5, 9, 66) or that they are in terms of money which each person implicitly values in the same way. Both of these assumptions require cardinal utility, and the second even requires identical cardinal utility across individuals (Hargreaves Heap and Varoufakis, 1995, pp. 5, 9, 66)[11]. In the latter case utility is even comparable across individuals, which makes it equivalent to the version of cardinal utility which was banished from orthodox economic doctrine in the early 20th century because of its association with arguments in favor of an equal distribution of income"(Black, 1990, p. 778; Hutchinson, 1966, pp. 283, 303; Strotz, 1953, pp. 384-385, 396).

Becker's (1981) work on the family is the most influential general application of hyperrationality. His approach it built upon the foundational assumptions of neoclassical economics: utility maximizing behavior; equilibrium analysis (here of the "marriage market"); and at least initially, stable preferences (Pollak, 2002, pp. 1-8, 41). As in game theory, the focus is on the interactions of a small number of agents, in this case the members of the family. Families are treated as producers of "children and other commodities" and marriage as an "optimal assignment in an efficient market with utility-maximizing participants [which] has the property that persons not assigned to each other could not be made better off by marrying each other" (Becker, 1987, pp. 282, 284). Becker's innovation is that he allows at least one utility maximizing family member to care about the consumption of the others[12]. He uses this framework to explain fertility, monogamy and polygamy, health and education (quality) of children, the sexual division of labor, marriage, and divorce. Pollak (2002, pp. 28-35) points out that instead of Becker's approach one could use game theory instead, since the latter is equally consistent with neoclassical assumptions. Thus one could instead analyze family behavior from vantage point of bargaining models. But then, a crucial question arises: if there are many possible approaches, how do we choose among them? Pollak lists "[a]esthetics, mathematical tractability, … parsimony [, and] empirical evidence" as possible criteria.

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[11] Strotz (1953) notes that von Neumann and Morgenstern propose a *particular* formula for creating a weighted average of risky choices which allows us to rank sets of choices. This ranking is Bernoulli's original "moral expectation". As with standard ordinal utility functions, any function that could give the same rankings as those dictated by the above formula would serve just as well. The content of such a function can also be expressed as a set of behavioral axioms of rational choice in the presence of risk. Strotz concedes that people might not behave in this way in practice, and notes that in light of the experimental evidence it might be better to represent actual behavior a different manner. In any case, the saving grace of this new type of cardinal utility is that it is usually not interpersonally comparable and hence does not risk a resurrection of utilitarian welfare economics.

[12] Becker defines altruism as any less-than-completely-selfish behavior ", but one could argue that altruism means something more general. In any case, in Becker it is the "head" of household who is the sole "altruist", all others being standard egoists (Becker, 1987, pp. 282-283; Pollak, 2002, pp. 11-12).

Indeed, he points to the empirical evidence as an important basis for an argument against the *auxiliary* assumptions used in Becker's model of the family. Yet it is striking that he himself never refers to the empirical evidence against the *common foundational* assumptions upon which both approaches rest.

Perhaps the most extraordinary application of hyperrationality occurs in Analytical Marxism, whose doctrines were outlined clearly and concisely by its leading philosopher Gerald Cohen (1978, pp. xvii-xxiv). This is an anti-dialectical and anti-holistic attempt to ground Marxist notions in neoclassical methodology. It "believes that [neoclassical] economics is essentially sound" and consequently relies on rational choice theory, game theory, and associated neoclassical mathematical techniques to derive its conclusions. In keeping with that tradition, it attempts to "explain molar phenomena by reference to the micro-constituents and micro-mechanisms that respectively compose the entities and underlie the processes which occur at a grosser level of resolution". This is particularly critical to the economics and social techniques of Roemer and Elster. Hence, Analytical Marxists "reject the point of view …[that] social formations and classes are depicted as entities obeying laws of behaviour that are not a function of their constituent individuals". In other words, as a branch of neoclassical economics it denies the notion of emergent properties. As Cohen puts it, "behaviours of individuals are always where the action is, in the final analysis".

All of the foregoing pertains to the claim that hyperrationality is a useful tool in analyzing actual behavior. But hyperrationality has also been defended as a behavioral ideal. Rational choice is the ideal basis for action in Descartes, Spinoza, Leibnitz, Bentham and Mill, even though they all admit that this is not how people actually behave. This normative aspect is central to welfare economics and social choice theory. In philosophy it has been used to define a standard of "how individuals ought to behave" (theoretical reason) " to which rational actions ("practical reason") should conform (Chai, 2005, pp. 2-4)[13]. It is generally recognized that "such a conception requires 'an ideal agent of great inferential sight" who does not really exist (Chai, 2005, p.4). It is further admitted that it may give rise to "perverse consequences" for the individual or the group, as in the Prisoner's Dilemma (Chai, 2005, p.6). In economics, this lineage stretches from Walras to Arrow-Debreu and Lucas. Walras' own interest was in the representation of an "ideal" or "perfect" economy, and this certainly the aim of the Arrow-Debreu general equilibrium model. Grabner (2002, p. 8) quotes Lucas to the effect that "a 'theory' is not a collection of assertions about the behavior of the actual economy but rather an explicit set of instructions for building a parallel or analogue system - a mechanical, imitation economy"(Lucas, 1980, p. 696-697)[14]. From this point of view, differences between these idealized representations and the real world are to be treated as "deficiencies in the latter"

[13] Buchanan and Tullock use rational choice as method of modeling appropriate collective choices. Rawls use rational choice as method of modeling decisions of individuals operating under a veil of ignorance, in relation to alternative institutions of justice (Chai, 2005, p.3).

[14] Even if hyperrationality is accepted as a valid starting point, this does not ensure that any given aggregate such as a market or nation would behave in the same manner as a representative individual (Grabner, 2002, p. 6).

(Grabner, 2002, p. 6). But then the question arises: what makes these approaches ideal in the first place? It is not hard to argue that that the human capacity for reason is far more complex than hyperrationality, since true reason always takes place in a social context to whose values it is subordinate (Hayek, 1969, pp. 87-95). The model of hyperrationality, celebrates a person who is actually a "social moron" (Sen, 1977, p. 336). It is hard to swallow this representation except for one thing: it provides the foundation for the claim that the market is the ideal economic institution and capitalism the ideal social form. This is its real rationale.

An alternate normative argument is that it is desirable to teach people to behave in a self-interested manner because it makes markets work better, and markets in turn are desirable because they are superior to other social forms of the division of labor (Hayek, 1969, pp. 96-104). This is currently the dominant argument in development economics, and is the official basis of the efforts of the World Trade Organization, the World Bank, and other similar international agencies to speed the creation of markets and of "market friendly" institutions throughout the developing world (Shaikh, 2007). "Shock therapy" is merely most extreme application of this doctrine. But once it is admitted that hyperrationality does not obtain in practice, the optimality of capitalism can no longer be sustained on theoretical grounds[15]. The remaining alternative is to stress capitalism's undeniable historical strength as a source of growth and of rising standards of living for many within its effective boundaries. But then one must also address its equally undeniable history of violence, inequality, and persistent state intervention (Chang, 2002 ; Harvey, 2005).

One last defense of the standard operating procedure comes from the claim that without the assumption of hyperrationality, "economic theory would degenerate into a hodgepodge of *ad hoc* hypotheses … which [would] lack overall cohesion and scientific refutability" (Conlisk, 1996, p. 685). This is an interesting conjuncture, because it could be argued that the doctrine of hyperrationality is itself rife with *ad hoc* assumptions which have already been scientifically refuted. Nonetheless, the anxiety behind this *cri de coeur* lingers: what indeed happens if we operate from the basis of actual behavior? I will return to this question in the last section of this paper.

II.2. Representing aggregate behavior

Aggregate behavior is the foundation of macroeconomics. In this domain, neoclassical macroeconomics rests on two fundamental claims: that individual behavior can be usefully modeled as hyperrational; and that aggregate outcomes can be treated as the behavior of a single "representative" hyperrational agent. The first of these has already been addressed. As for the second, it is simply false. The behavior of a whole cannot be characterized by that of any of its constitutive elements because a whole is more than the

[15] For instance, Bhagwati (Bhagwati, 2002, p. 4, footnote 3) typically relies on the argument that free trade was superior to managed trade or to autarchy, without mentioning that all the proofs he cites themselves rely on perfect competition within and between nations.

sum of its parts, or as it is now fashionable to say, aggregates have emergent properties. More precisely, emergence is a phenomenon “whereby well-formulated aggregate behavior arises from localized, individual behavior” and is generally insensitive to variations in the individual behaviors (Miller and Page, 2007). *Aggregation is robustly transformational.*

The first implication of emergence is that the average agent, which is another name for the aggregate, will generally be very different from the representative agent. The key is the presence of shaping-structures, i.e. positive and negative reinforcement gradients, which transform heterogeneous individual behaviors into stable aggregate patterns.

One well-known example in the physical world is the Ideal Gas Law, $P \cdot V = R \cdot n \cdot T$, which says that the product of the pressure (P) and volume (V) of an ideal gas is some constant (R) times the product of the quantity of the gas (n) and its temperature (T). Forms of this law were originally derived as empirically powerful macroscopic hypotheses by Boyle (1662), Charles (1787), and Gay-Lussac (1802). But with the rise of the notion that a gas was really a mass of constantly moving particles, it became important to reconcile the new microscopic view with the previously derived macroscopic laws. Theorists portrayed a gas as a myriad of unruly particles careening around within a container (the shaping structure), colliding with each other and with the container walls (negative enforcement gradients)[16]. The resulting individual paths are too varied, and too complex, to characterize analytically. Yet at a statistical level we can say that over some given interval of time, roughly equal numbers of particles will strike equal macroscopic areas on the walls of the containers. These collisions with the walls create the pressure exerted by the gas. In any given container, the greater the volume of the gas, the greater the number of particles, and hence the greater the number of collisions with any given area on the walls. Similarly, the greater the temperature, the more rapid the motion of the particles, and hence the greater the number of their collisions with the walls. In either case, the pressure exerted by the gas is greater. And so, with help of appropriate statistical techniques it became possible to arrive once again at the macroscopic law $P \cdot V = R \cdot n \cdot T$, this time as a relationship that emerges from the interaction of heterogeneous individual particles with the shaping structure of the container walls. The aggregate gas law now appears as an “emergent” property of the shaped (i.e. contained) ensemble itself, and cannot be reduced to, or deduced from, any single "representative" particle.

Exactly the same conclusion applies to economic processes. Consider consumer theory first. The shaping structure is the budget constraint defined by the level of an individual’s income. In the simplest of cases, all individuals are assumed to be hyperrational and exactly alike in preference structure, so that there is a clearly defined neoclassical representative agent. Kirman and Koch (1986) have shown that variations in the distribution of income are nonetheless sufficient to give rise to emergent properties in the aggregate, so that even in this simple case the average agent will be different from the

[16] Bernoulli (1738), Herapath (1816), and Waterston (1843) developed the kinetic theory of gases, which was eventually used by Clausius (1850) , Maxwell (1859) and Gibbs (1876-1878) to derive the gas laws (Brush, 1985).

representative agent (Kirman, 1992, p. 128). Hildebrand and Kneip (2004, pp. 2-3, 6-7,20, 26-26) have studied the behavior of an aggregate population of heterogeneous intertemporal utility maximizers, each of whom maximizes some objective function possibly subject to uncertainty. The maximization problem leads to a relation between general variables, preference parameters of individuals, and the consumption of each individual. Aggregate consumption per capita then depends on the joint distribution of the explanatory variables across the population, which makes this joint distribution an explanatory variable in its own right at the aggregate level. They find that even when this joint distribution is time invariant, the shape of the aggregate consumption function is generally completely different from that of individual functions. Forni and Lippi (1997, pp. iv-vii) also study neoclassical models based on intertemporal maximization of heterogeneous agents, this time under rational expectations. Quadratic functions are assumed in the optimization step so that the solutions are linear stochastic equations. Even so, aggregation creates new properties: microeconomic features such as cointegration among variables, or Granger-causality, do not carry over to the aggregate; the parameters of the macroeconomic model do not bear any simple relation to those of the individuals; and overidentifying restrictions at the level of micro theory do not apply to the macro parameters. Kirman (1992, pp. 122-124) notes that even if heterogeneous individuals have homothetic utility functions, the Weak Axiom of Revealed Preference (WARP) does not carry over to the aggregate so that the collectivity may prefer x to y in one situation but y to x in another. Kirman concludes that it is completely "illegitimate [to]… infer society's preferences from those of the representative individual, and use these to make public policy choices" (ibid, p. 124).

Production theory encounters the same difficulties in going from individual industries to an aggregate production function. Once we confront a world of heterogeneous goods, then we need to find some way to construct aggregate measures of output and capital. Joan Robinson (1953-1954) argued that it was not possible to create a measure of aggregate capital which would be consistent with an aggregate production function. An aggregate production function (APF) represents the optimal set of production coefficients corresponding to any given real wage rate-profit rate (factor price) pair. Sraffa (1960, pp. 38, 81-87) showed that in a world of heterogeneous products and multiple potential methods of production (blueprints) in each industry, the aggregate capital-labor ratio corresponding to the optimal technique could be lower at a lower rate of profit. This would contradict any notion of a neoclassical aggregate production function, since that requires higher capital-labor ratios to be associated with lower rates of profit. In response to Joan Robinson's challenge, Samuelson (1962) set out to explain how a Sraffa-type book of blueprints could be reconciled with a well-behaved neoclassical production function. Unfortunately, his Surrogate Production Function turned out to depend critically on the assumption that all industries have the same capital labor ratio. Pasinetti (1969) and Garegnani (1970) demonstrated conclusively that the parable of an aggregate production function could not be sustained under more general conditions. Indeed, Garegnani (ibid, p. 421) demonstrated that the only case in which surrogate production function behavior held was with equal capital-labor ratios in each industry. This is a delicious historical irony, because it implies that prices must conform to the simple labor theory of value (Shaikh, 1973, pp. 11-14, 66-83)[17]. On the neoclassical side, Franklin Fisher has thoroughly studied the problem of moving from microeconomic well-behaved production functions assumed to exist at the level of the firm to an aggregate production function. His conclusion is that even in the simple case of constant returns to scale at the firm level, "the conditions for aggregation are so very stringent as to make the existence of aggregate production functions … a non-event". As he notes, this invalidates standard procedures for "the specification and estimation of the aggregate demand curve for labor", for "the measurement of productivity" which in effect amounts to the "misinterpretation of the Solow residual", and for the "use of aggregate production functions to validate the neoclassical theory of distribution" (Fisher, 2005, p. 490).

The APF literature has also repeatedly encountered the problem of emergent properties at the aggregate level. Houthakker (1955-56) showed that a particular distribution of simple fixed-coefficient technologies at the micro level can mimic an aggregate Cobb-Douglas production function even though the presence of fixed coefficients at the micro level rules out any notion of marginal products and their associated distribution rules. Fisher (1971) simulated the aggregate behavior of systems in which N firms are each assumed to have a microeconomic Cobb-Douglas production function. He found that the aggregate relation between output, capital and labor does not generally mimic a Cobb-Douglas production function except when the simulation is constrained *a priori* to make the aggregate labor share roughly constant over time. Shaikh (1973, Ch. 3) demonstrated that a socially determined stable labor share was sufficient to explain the apparently good fit of Cobb-Douglas APF's, given that that aggregate profits and wages sum to aggregate value added. Shaikh (1987) further showed that a strictly non-neoclassical economy characterized by a single dominant linear technique (which implies equal capital-labor ratios, and hence relative prices conforming to the simple labor theory of value), a constant labor-share, and Harrod-neutral technical change would look just like a well-behaved aggregate Cobb-Douglas production function undergoing neutral technical change. This is so even though the existence of a single dominant technique implies that the marginal products of capital and labor cannot even be defined due to the fact that per worker output and capital cannot vary as the wage rate-profit rate pair changes. As in Fisher's experiment, an aggregate pseudo production function obtains because of the constancy of the wage share and the fact that the data is "shaped" by an accounting identity which says that $Y \equiv w \cdot L + r \cdot K$. where Y, L, K, w, r represent aggregate value added, labor, capital, the wage rate and the profit rate, respectively. Shaikh (2005) introduces a "Perfect Fit" procedure which always makes it possible to transform a fitted production function that does not work well into one that appears to work almost perfectly, even when such a procedure entirely misrepresents the true form of the underlying production relations and types of technical change. Felipe, McCombie and various co-authors have repeated shown that multifactor productivity estimates of technical change are simply estimates of the weighted average of the rates of change of

[17] The originator of the aggregate production function Paul Douglas (1976, p. 914), as cited in McCombie and Dixon (1991, p. 24), was clear about the political significance of its apparent empirical strength: "the approximate coincidence of the estimated coefficients [of a Cobb-Douglas APF] with the actual shares received … strengthens the competitive theory of distribution and disproves the Marxian".

real wages and profit rates (Felipe and Adams, 2001 ; Felipe and Fisher, 2003 ; Felipe and McCombie, 2003 ; McCombie and Dixon, 1991).

The representative agent hypothesis is therefore only valid in very special cases. In the case of consumer theory, it is sufficient that all individuals have exactly the same utility functions and all have the same income. In the case of production theory, it is sufficient that all firms have the same capital-labor ratio and the same wage and profit rates. However, these are trivial cases, because by construction there is effectively only one agent in each domain. More generally, in order to get the desired neoclassical results, it is necessary to ensure that "the operative preferences of all individuals, and the optimizing plans of all firms, ... [are] identical at the margin" so that there is effectively only one actor in each sector (Martel, 1996, pp. 128). In the absence of such extremely restrictive (and self-serving) assumptions, the hypothesis generally fails (Grabner, 2002, pp. 17-20; Kirman, 1992, pp. 117-128; Martel, 1996, pp. 128-136). Not surprisingly, the notion of a representative agent has been greeted with a certain degree of disdain by some prominent critics. Martel (1996, p. 128) says that the assumptions required to derive a representative agent are “patently false ...[so that] any correspondence between the predictions of representative agent models and actual aggregates is fortuitous". Hahn (2003, p. 227) speaks of “the nonsense of the representative agent which arises in macroeconomics“. Kirman (1992, p. 125) says that the assumption of a representative agent “is far from innocent; it is the fiction by which macroeconomist can justify equilibrium analysis and provide pseudo-microfoundations” and that it “deserves a decent burial … as an approach to economic analysis that is not only primitive, but fundamentally erroneous" (*ibid*, p. 119). And Franklin Fisher (2005, p. 489) refers to the aggregate production function as an “imaginary” construct, “a pervasive, but unpersuasive fairytale”.

II.3 Aggregate relations, microfoundations, and the question of rigor

A common assertion in both orthodox and heterodox economics is that aggregate relations are not “rigorous” unless they are derived from some microfoundations (Cohen, 1978, pp. xxiii-xxiv; Little, 1998, pp. 6-7; Phelps, 1969, p. 147; Weintraub, 1957). As a methodological claim, this runs into a three major difficulties.

Consider physical laws. The Gas Law was originally proposed as an empirically powerful macroscopic principle in the seventeenth century, but was not derived from atomic foundations until the nineteenth century. Did the Gas Law only become “rigorous” only when it was derived from statistical thermodynamics? The (Nobel Laureate) physicist Robert Laughlin points out that there are many other physical laws, such as those involving hydrodynamics, crystallization, and magnetism, which are well known and widely used even though they have never been derived from microscopic foundations (Laughlin, 2005, pp. 35-40). Do we declare all them not rigorous? What about Einstein’s General Theory of Relativity? Both Quantum Mechanics and General Relativity were formulated in the early part of the twentieth century, and each has “been fantastically well confirmed by experiment”. But General Relativity “is thoroughly classical, or nonquantum". Because they operate at different scales, no experiment so far has been able to explore the domain where they overlap. Many attempts to unify the two have been tried: twistor theory, noncummutative geometry, supergravity, and most recently, string theory and M-theory (Smolin, 2004, pp. 67-68). Yet a full century after their inception, no theoretical approach has managed to unify the two. Shall we then say that General Relativity is not rigorous? Or shall we more plausibly reject the claim that only microfoundations can bestow rigor on a law?

Secondly, since the problem at hand involves a lack of explicit connection between microscopic and macroscopic patterns, a further difficulty immediately arises. For instance, if Quantum Mechanics and General Relativity have not (yet) been explicitly reconciled, why not say that it is Quantum Mechanics which is not rigorous, given its century-long failure to arrive at the most basic laws of our universe? Einstein himself felt that quantum mechanics was inferior to relativity theory, since it had "no compelling conceptual foundations", and he tried to derive the former from the latter. Others have also long argued that "quantum mechanics derives from classical foundations rather than the other way around". From this point of view, the randomness supposedly inherent in quantum mechanics can viewed as the chaotic behavior of particles subject to purely deterministic classical laws (see the discussion of chaos in section V.2 below). This approach has been recently revived by physicists such as (Nobel laureate) Gerard't Hooft, Massimo Blasone, and others (Musser, 2004, pp. 89-90). In economics, it would imply that what we really need is an adequate macrofoundation for microeconomics, rather than the other way around (Hahn, 2003). It should be noted, incidentally, that in physics no one is free to brush off the uncomfortable implications of their assumptions. There is no F-twist here.

The third problem with the neoclassical "rigor" argument is even more severe: it is perfectly possible to derive empirically supported macro-patterns *from microfoundations that are known to be false*. Consider the Gas Law once again. Nowadays we say that the gas law is derived from kinetic theory as the result of the complex interactions among atoms obeying Newton's laws as they collide with each other like billiard balls (Laughlin, 2005, pp. 30-31). The trouble with this explanation is that "[a]toms are not Newtonian spheres … but ethereal quantum-mechanical entities lacking the most central of all properties of an object – an identifiable position" (*ibid*, p. 42). Thus the traditional derivation of the ideal gas law begins with "the wrong equations and [still] gets the right answer" (*ibid*, p. 97). Laughlin argues that this can only occur because the gas law is an emergent property which is "robustly insensitive to details" (*ibid*, p. 97): the interactions of wavelike entities in a contained gas gives rise to a *new* stable relationship which does not depend on the details of the interaction. This is not to say that the details are unimportant at the microscopic level. It only says that they are not critical at the macroscopic level. As noted at the beginning of section II.2, this a general property of emergent phenomena: they are generally insensitive to variations in individual behaviors (Miller and Page, 2007).

Economists investigating the problem of linking micro behavior to aggregate patterns have also come to understand that aggregation is transformational. Martel (1996 p. 134) quotes Leijonhufvud (1968) to the effect that this "is a large part of what Keynes was getting at in *The General Theory*". Alchian (1950,p p. 211, 221) points to the unimportance of the assumption of individual rationality for the derivation of economic patterns at the macro-level. He links the macro patterns to the requirement for positive profit which acts as a survival filter for firms. In this respect, chance, particular circumstances, imitative behavior and trial-and-error processes may be more important in determining positive profit than hyperrational behavior at the level of individual firm. Aitchison and Brown (1957, pp. xvii, 101-102, 116-140) discuss a variety of ways in non-hyperrational behavior can give rise to a lognormal distribution in some variables such as the size distribution of personal incomes, business concentration, labor turnover, and household consumption expenditures. In an earlier line of work which he subsequently abandons, Becker (1962) builds on Alchian's lead by demonstrating that downward sloping market demand curves can be derived not only from the assumption of hyperrationality, but equally well from impulsive behavior and inertial behavior. The key factor in each case is the shaping structure of the budget constraint defined by the average individual's level of income. The assumption of hyperrationality is definitely not required. Hildebrand (1994) suggests that one should leave "preferences and choices [to] ... psychiatrists" and focus instead on establishing the statistical conditions under which basic economic patterns such as downward-sloping market demand curves can be derived (Dosi, Fagiolo, Aversi, Meacci and Olivetti, 1999, p. 141). Hildebrand (1994) and Trockel (1984) provide the pioneering work in this regard.

In each of these cases, economic shaping structures create limits and gradients that channel aggregate outcomes: the positive profit survival criterion in the case of the firm, individual economic characteristics in the case of income distribution, and the budget constraint in the case of individual consumer choice. Each of these gives rise to stable aggregate patterns which do not depend on the details of the underlying processes. And precisely because many roads can lead to any particular result, we cannot be content with considering a model valid simply because it yields some observed empirical pattern. Other facets may yield conclusions which are empirically falsifiable, for which the model must also be held responsible. By implication, policy conclusions which depend in part on empirically unsupported implications must be taken with many grains of salt.

III. Shaping structures, economic gradients and aggregate emergent properties

Heterogeneity of individual behaviors gives rise aggregate emergent properties, thereby destroying the notion of a representative agent. But in order to know which particular aggregate properties obtain in a given situation, we need to understand how shaping structures operate and why they can give rise to stable aggregate patterns. In what follows, I will demonstrate that the major empirical patterns of consumer behavior can be derived from two key shaping structures: a given level of income, which restricts the choices that can be made; and a minimum level of consumption for the necessary good which introduces a crucial nonlinearity. The patterns in question are downward sloping market demand curves, income elasticities of less than one for necessary goods and more than one for luxury goods (Engel's Law), and aggregate consumption functions that are linear in real income in the short run and include wealth effects in the long run (Keynesian type consumption functions). The analytical derivations will be supplemented by the simulation of four radically different models of individual behavior: a standard neoclassical model of identical hyperrational consumers in which a representative agent obtains; a model of heterogeneous hyperrational consumers in which a representative agent does not obtain; a model with diverse consumers in which each one acts whimsically by choosing randomly within the choices afforded by his or her income (this is Becker's irrational consumer); and a model inspired by Dosi *et al* (1999) in which consumers learn from those around them (their social neighborhood) and also develop new preferences (mutate) over time. Despite their differences, all of the models give rise to the very same aggregate patterns. The essential point is that the same macroscopic patterns can obtain from a great variety of individual behaviors. This way of proceeding harks back to an earlier approach initiated, and subsequently abandoned, by Becker (1962).

III.1 An Analytical Framework for Robust Microeconomics

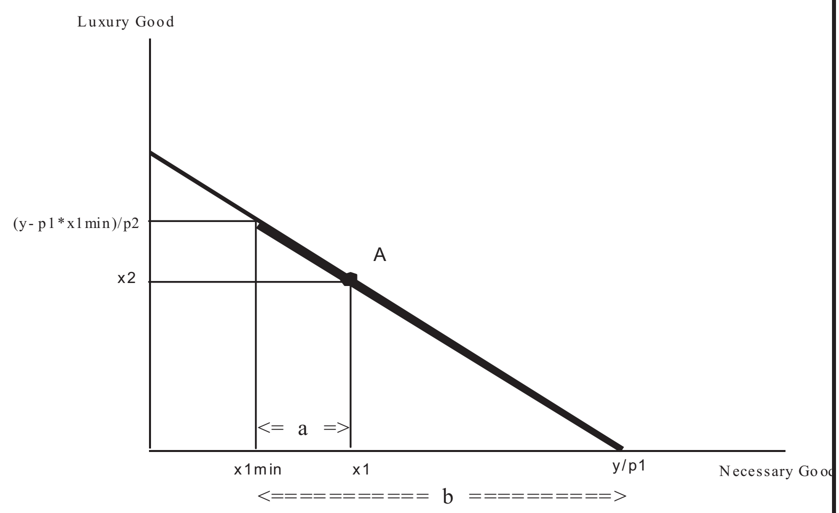
Assume that income (y) is partitioned into two (exhaustive) uses of funds on items x_1, x_2 which have corresponding relative prices p_1, p_2. Let x_1 represent a necessity, meaning that it requires some positive minimum $x_{1\min}$. Then the feasible range of the budget constraint for any individual is the segment between $x_{1\min}$ and $x_{1\max} \equiv \frac{y}{p_1}$ as shown in Figure 1. The corresponding consumption limits for the luxury good arises when discretionary income $\left(y - p_1 x_{1\min}\right)$ is spent entirely on luxuries.

(3.1) $y = p_1 x_1 + p_2 x_2$

(3.2) $x_{1\max} = \frac{y}{p_1}$

(3.3) $x_{2\max} = \left(\frac{y}{p_2}\right) - \left(\frac{p_1}{p_2}\right) x_{1\min}$

Figure 1: Budget Constrained Choice



Individuals will generally vary from one another in many attributes, not just income. Let us suppose that individuals are generally heterogeneous in their inclinations, complex in their motivations, occasionally whimsical in their choices, and susceptible to a variety of social influences. Individuals with income y will choose some bundle (x_1, x_2) within the feasible range, as shown by point A in Figure 1. Since the feasible range of the necessary good is defined by the limits $(x_{1\min}, x_{1\max})$ it is convenient to think of a consumer as choosing a particular proportion (π) of this feasible range. We only require only that set of individuals with income y will generate a given proportion π, which makes our results compatible with a wide variety models of consumer behavior (see section III.5 below). It will be subsequently useful to note that π also represents the average discretionary propensity to consume, which is the ratio of discretionary consumption of the necessary good $(p_1x_1 - p_1x_{1\min})$ to discretionary income $(y - p_1x_{1\min})$. In Figure 1 this is the ratio of line segment a to line segment b.

(3.4) $$\pi \equiv \frac{(x_1 - x_{1\min})}{(x_{1\max} - x_{1\min})} = \frac{(p_1x_1 - p_1x_{1\min})}{(y - p_1x_{1\min})}, \text{ so that } 0 \le \pi \le 1$$

I will assume that both $x_{1\min}$ and π are independent of prices. Then for each π we can derive the corresponding per capita consumption demand for the necessary good (from equations (3.2) and (3.4)) and for the luxury good (from equations(3.1),(3.3) and (3.5)). These are our fundamental equations of consumer choice.

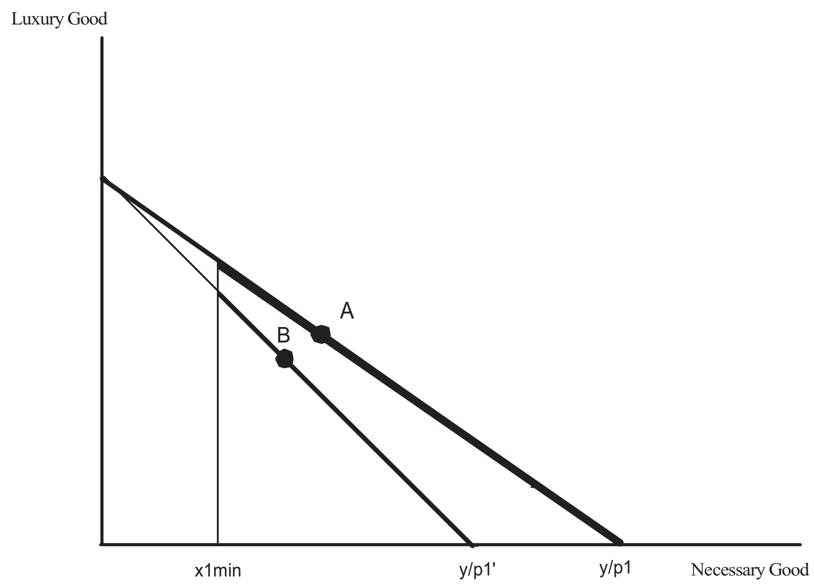
(3.5) $x_1 = (1-\pi)x_{1\min} + \pi\left(\frac{y}{p_1}\right)$

(3.6) $x_2 = -\left(\frac{p_1}{p_2}\right)(1-\pi)x_{1\min} + (1-\pi)\left(\frac{y}{p_2}\right)$

III.2 Downward Sloping Demand Curves

It is apparent from equations (3.5)-(3.6) that for each good the quantity demanded responds negatively to a rise in its price at any given income. This negative response is the bedrock of microeconomics (Becker, 1962, p. 4). Yet we will see that it requires no specific model of consumer behavior. As they stand, the per capita demands (x_1, x_2) from the preceding equations define a single *point* on the budget line corresponding to a particular per capita income (y), as in Figure 1 previously. A rise in any in good's price, say p_1, would lower the corresponding intercept and rotate the budget line inward as shown in Figure 2 (Becker, 1962, p. 4). Thus the feasible range of x_1 is lowered. But with the mean proportion π being given, the new x_1 must split this smaller feasible range into the same fractions as before. Thus x_1 must decline. The demand curve is therefore negatively inclined. Equation (3.6) tells us that the demand for x_2 will be similarly be lowered by any rise in p_2. There also exists a cross-elasticity effect of p_1 on x_2 from equation (3.6), but not one of p_2 on x_1 from equation (3.5), the asymmetry arising from the existence of a physical minimum for x_1.

Figure 2: A Rise in the Price of the Necessary Good



More formally, we can derive algebraic expressions for direct and cross price-elasticities of demand from equations (3.5)-(3.6).

(3.7) $e_{x_1,p_1} = -\left(\dfrac{\pi y}{\pi y + (1-\pi)\, p_1 x_{1\min}} \right)$, so that $\left| e_{x_1,p_1} \right| < 1$ (price elasticity, necessaries)

(3.8) $e_{x_2,p_2} = -1$ (price elasticity, luxuries)

(3.9) $e_{x_1,p_2} = 0$ (cross price elasticity, necessaries)

(3.10) $e_{x_2,p_1} = -\left(\dfrac{p_1 x_{1\min}}{y - p_1 x_{1\min}} \right)$ (cross price elasticity, luxuries)

III.3 Income Elasticities and Engel's Law

One of the best known empirical findings in microeconomics is that people buy proportionately less of necessary goods, and hence proportionately more of other (luxury) goods, as their income increases (Allen and Bowley, 1935, p. 7; Houthakker, 1987, pp. 143-144). That is to say, the income elasticity of necessary goods is less than one, while that of luxury goods is greater than one. This is known as Engels' Law of consumer demand. Houthakker (1992, p. 224) remarks that this law appears to be something of a mystery. Yet it follows directly from our fundamental equations of consumer choice.

The simplest case is when both the mean proportion π and $x_{1\min}$ are both constant across income classes. Then for given prices p_1, p_2, equations (3.5)-(3.6) indicate that quantities demanded vary positively with income. Moreover, because the first equation has a positive intercept and the second a negative one, the income elasticity of demand for the necessary good x_1 is less than one, and that of the luxury good x_2 is greater than one. More formally, we can derive the expenditure shares and income elasticities directly from equations (3.5)-(3.6)[18]. It is evident that the expenditure share on necessities declines as income increases, while that of luxuries rises. In the same vein, the income elasticity of necessaries is less than one, while that of luxuries is greater than one. Note that the income elasticity of x_1 is equal in size, but opposite in sign, to its demand elasticity at any given real income the income elasticities of x_1 is the same as its demand elasticity at any given real income (y/p_1), as can be seen by comparing equations (3.7) and (3.13).

(3.11) $$\left(\frac{p_1 x_1}{y}\right) = (1-\pi)\left(\frac{p_1 x_{1\min}}{y}\right) + \pi$$ (expenditure share, necessaries)

(3.12) $$\left(\frac{p_2 x_2}{y}\right) = -(1-\pi)\left(\frac{p_1 x_{1\min}}{y}\right) + (1-\pi)$$ (expenditure share, luxuries)

(3.13) $$e_{x_1,y} = \left(\frac{\pi y}{\pi y + (1-\pi) p_1 x_{1\min}}\right), \text{ so that } 0 < e_{x_1,y} < 1$$ (income elasticity, necessaries)

(3.14) $$e_{x_2,y} = \left(\frac{y}{y - p_1 x_{1\min}}\right), \text{ so that } e_{x2,y} > 1$$ (income elasticity, luxuries)

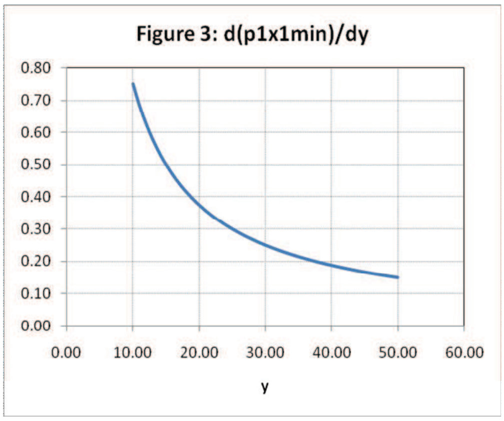
Even though the simple case examined above is sufficient to derive Engel's Law, the resulting relation between the income and the expenditure on either good (the Engel's curve) is linear as long as π and $x_{1\min}$ are constant across income classes. For instance,

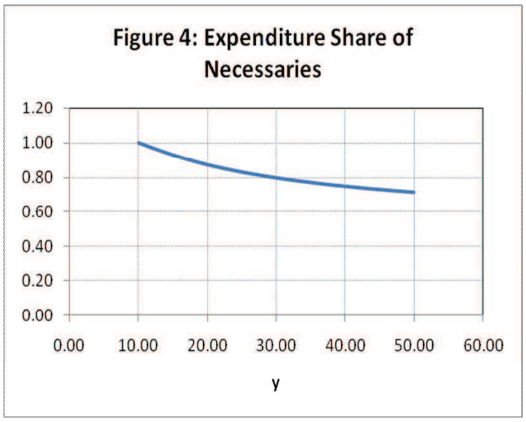
[18] Under the present simple assumptions, the income elasticity of the necessary good has the same absolute size as its price elasticity (compare equations (3.13) and (3.14)).

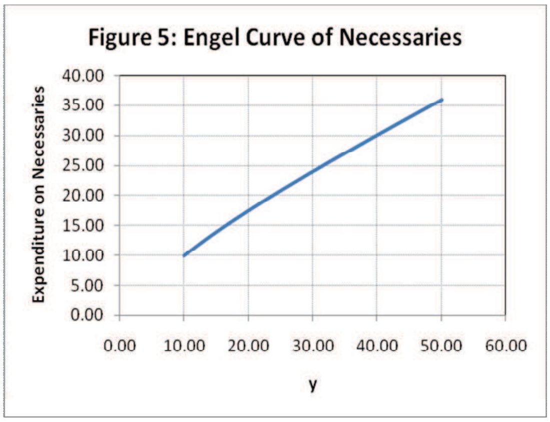
equation (3.11) translates into the expenditure function $p_1x_1 = (1-\pi)\,p_1x_{1\min} + \pi y$, which has the slope $\frac{d(p_1x_1)}{dy} = \pi$, so that the expenditure function is linear in income. But it is very plausible that the *minimum* level of necessaries, which is always socially defined (Trigg, 2004), rises as real income (y/p_1) rises but not as fast as income, so that it declines as a share of income. In that case the slope of the Engel Curve becomes $\frac{d(p_1x_1)}{dy} = (1-\pi)\frac{d(p_1x_{1\min})}{dy} + \pi$, which is still positive but declining as income rises. In other words, the Engel curve for necessary goods will exhibit *saturation*.

The same result obtains if instead π declines with discretionary income. To see this, we rewrite equation (3.4) as $(p_1x_1 - p_1x_{1\min}) = \pi(y - p_1x_{1\min})$, which is a linear relationship between discretionary expenditure on necessary goods and discretionary income. Since π is the slope of this curve, as π falls the curve gets flatter. This saturation property carries over the relation between total expenditure on necessaries and total income, both of which only differ from their discretionary counterparts by a common minimum expenditure on necessaries. Figures 3-5 display the results of case in which $x_{1\min}$ rises more slowly than income, Figures 6-7 the case in which π declines with income, and Figures 8-9 the characteristic patterns in actual data.

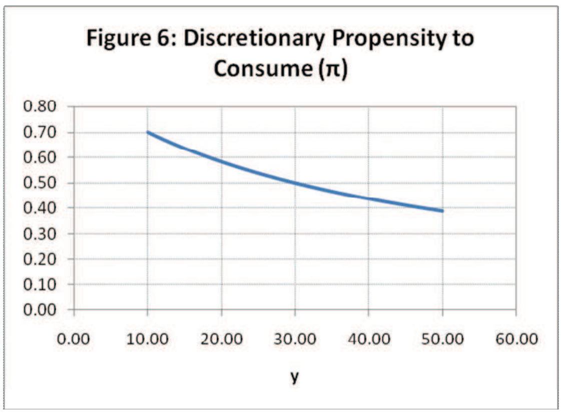
Case I: $x_{1\min}$ rises more slowly than income

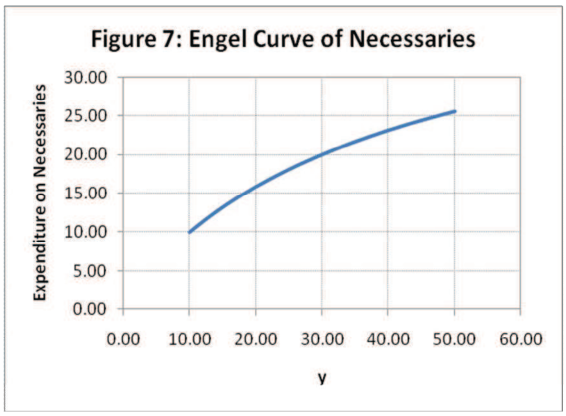






Case II: π declines with income





Empirical Patterns

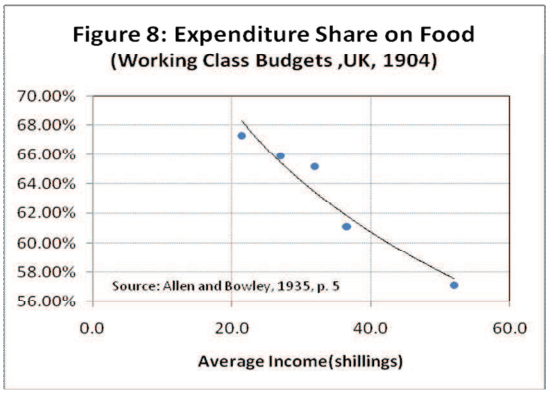


Figure 8: Expenditure Share on Food
(Working Class Budgets ,UK, 1904)

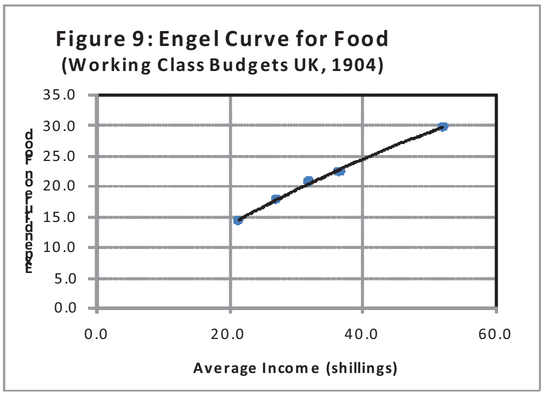


Figure 9: Engel Curve for Food
(Working Class Budgets UK, 1904)

III.4 Aggregate Consumption and Savings Functions

Our previous discussion has been couched in terms of two general goods whose purchases exhaust some particular per capita income. If the income in question is aggregate per capita income, the two goods must be aggregate consumption and savings (net additions to financial assets). For obvious reasons, consumption would the necessary good. The average per capita demand for each good would then be determined by the economy-wide mean proportion π, which would be stable over time if the variations of mean proportions vary across income class and on the distribution of income are stable.

Let Y, C, S = real aggregate income, consumption, and savings respectively, ΔFA = real net additions to financial assets, p_f = the price of financial assets, all relative to the price of consumption goods. Then we can directly translate per capita equations (3.5)-(3.6) into their aggregate equivalents by multiplying through by the population size N.

(3.15) $Y = C + p_f \Delta FA$

(3.16) $C = (1-\pi)C_{\min} + \pi Y$

(3.17) $S \equiv p_f \Delta FA = -(1-\pi)C_{\min} + (1-\pi)Y$

It is particularly striking that equations (3.16)-(3.17) looks like textbook *linear* Keynesian consumption and savings function. Insofar as $C_{\min}$ is taken as given, they would correspond to short-run functions with π and $(1-\pi)$ being the marginal propensities to consume and save, respectively. At a more general level, one must recognize that the socially defined minimum level of aggregate consumption $C_{\min}$ is likely to be changing over time. It might be tied the level of household wealth, which would itself change over time as savings added to the stock of wealth. In this way, the long run aggregate consumption function would include a wealth effect. It is also likely that π would also be changing over time, in response to changes in the social environment. The important point here is that all of these results are "robustly insensitive" to the particular models of individual behavior: they are driven instead by shaping structures such as the budget constraint and a minimum level of consumption.

Although I will not do it here, it is possible to extend the preceding analysis by incorporating debt into it. Debt allows an agent to escape the immediate constraints of income. Total expenditures can therefore deviate from income, but only to a certain degree because there are limits to the amount of debt a given level of income support under given institutional conditions. Debt essentially transforms the budget constraint into a budget restraint.

III.5 Simulations: Insensitivity of Aggregate Relations to Microfoundations

The preceding derivations of demand curves, Engel curves and aggregate consumption functions required only three assumptions: that individuals are subject to a budget constraint; that there is a minimum level of consumption for a necessary good; and that any given population arrives at some stable average consumption basket (characterized by the discretionary propensity π). The purpose of this section is to demonstrate that such conditions are perfectly consistent with a wide variety of microfoundations. Four very different models of microeconomic relations are employed here. Despite their differences, all models give rise to the very same market demand and Engel curves precisely because aggregate results are robustly insensitive to the specification of microfoundations (Laughlin, 2005, pp. 97, 144-145).

The standard Neoclassical Homogenous Agents model is our benchmark model. Each consumer maximizes a Cobb-Douglas utility function subject to a budget constraint determined by his/her income, and each consumer behaves in exactly the same manner in each period. All consumers have identical preference structures, so the average consumer is also the representative agent. Maximizing the utility function subject to the budget constraint yields two familiar demand curves (Varian, 1993, pp. 63-64,82-83,93-94).

(3.18) $u = x_1^{\alpha} x_2^{\beta}$

(3.19) $y = p_1 x_1 + p_2 x_2$

(3.20) $x_1 = \left(\frac{\alpha}{\alpha+\beta}\right)\left(\frac{y}{p_1}\right)$

(3.21) $x_2 = \left(\frac{\beta}{\alpha+\beta}\right)\left(\frac{y}{p_2}\right)$

To adapt this familiar model to our concern we have to allow for a minimum level of the necessary good (X_{1min}). One way "to specify a minimum level of consumption in a person's utility-maximization problem … is to specify a fixed amount of consumption … such that the contribution of consumption to utility is positive only if the consumption level is greater than a fixed amount. This is analogous to the specification of a fixed input cost in a production function. Compared to the utility function without the minimum level of consumption, this specification is equivalent to shifting the indifference curve up" (Lio, 1998, p. 108). With this adjustment, the neoclassical system becomes

(3.22) $$u = (x_1 - x_{1\min})^{\alpha} x_2^{\beta}$$

(3.23) $$y = p_1 x_1 + p_2 x_2$$

(3.24) $$x_1 = \left(\frac{\beta}{\alpha+\beta}\right) x_{1\min} + \left(\frac{\alpha}{\alpha+\beta}\right)\left(\frac{y}{p_1}\right)$$

(3.25) $$x_2 = -\left(\frac{p_1}{p_2}\right)\left(\frac{\beta}{\alpha+\beta}\right) x_{1\min} + \left(\frac{\beta}{\alpha+\beta}\right)\left(\frac{y}{p_2}\right)$$

From the definition of the discretionary propensity to consume π in equation (3.4) we get

(3.26) $$\pi \equiv \frac{(p_1 x_1 - p_1 x_{1\min})}{(y - p_1 x_{1\min})} = \left(\frac{\alpha}{\alpha+\beta}\right)$$

(3.27) $$(1-\pi) = \left(\frac{\beta}{\alpha+\beta}\right)$$

It is then evident that the demand curves derived from a Cobb-Douglas utility function, as shown in equations(3.24)-(3.25), are just particular instances of the fundamental equations of consumer choice previously summarized in equations (3.5)-(3.6). For purposes of simulation, we set each $\pi = 0.5$, which in this case amounts to assuming that $\alpha = \beta$ in the utility functions of the identical consumers.

The Neoclassical Heterogeneous Agents model comes next. Consumers are still strictly neoclassical, but now each agent has a distinct Cobb-Douglas utility function from which we derive a distinct discretionary propensity π. Individual values of π are selected from a uniform probability distribution ranging between 0 and 1, with a theoretical mean of 0.5 so as to match the previous case. This being a neoclassical model, each agent is assumed to behave in exactly the same manner in every period. Even though each agent is strictly neoclassical, the heterogeneity of their preferences implies that there is no representative agent[19]. Nonetheless, for reasons outlined in the general discussion, each individual will have demand functions of the form given in equations (3.5)-(3.6), and for any given distribution of income, there will exist an average demand curves of the same form based on the average propensity π .

In the Whimsical Agent model, which corresponds to Becker's (1962, pp. 4-6) model of the "impulsive" consumer, in each period each consumer randomly chooses a discretionary propensity π from a uniform distribution between 0 and 1. For any given individual the chosen combination of goods varies from period to period. Nonetheless, the average π is roughly the same across periods, which make the model comparable to the previous two neoclassical ones.

The Imitate-Innovate model, inspired by the work of Dosi, *et al.* (1999)[20], has two types of consumers: those who adapt their preferences to those in their social neighborhood; and those who develop new preferences (innovate). Agents are initially assigned randomly chosen incomes and discretionary propensities. In each successive round, the majority of individuals (80 percent in this particular run) are assumed to adapt their own discretionary propensities towards the average of those in their *immediate neighborhood*, the individual adjustment reaction coefficients being chosen from a uniform distribution between 0 and 1. This is intended to simulate a general tendency to form social norms. On the other hand, individuals in the remaining contingent (twenty percent) are innovators in this particular period and are assumed to randomly change their discretionary propensities. In each round, different individuals are picked to be imitators and innovators. It should be noted that the local interactions of small subsets of agents in such simulations may be considered as an alternative to game theorizations of small group interactions. As Kirman (1992, p. 132) points out, in actual practice "individuals operate in very small subsets of the economy and interact with those with whom they have dealings. It may well be that out of this local but interacting activity emerges some sort of self-organization which provides regularity at the macroeconomic level." In any case, even though the model is decidedly non-neoclassical, the overall results are exactly the same as those in the previous three models.

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[19] In order to ensure the existence of a representative agent, one has to make a number of auxiliary assumptions that serve to make "the operative preferences of all individuals, and the optimizing plans of all firms, ... *identical* at the margin" (Martel, 1996, p. 128).

[20] Dosi, *et al.* (1999, pp. 159-164) posit simple consumers whose preference structure is a string in which a "1" in a certain location represents demand for a particular good and "0" represents a lack of demand. The total string is subject to a budget constraint. The preference structure itself is also subject to mutations and combinations with past structures. This model generates S-shaped paths for the diffusion of new commodities, and downward sloping demand curves and Engel curves for commodities, all as emergent properties of the aggregate. The authors conjecture that aggregate demand laws are basically determined by social imitation and budget constraints. But my point is that because many models generate similar results aggregate results, we cannot judge the validity of the underlying structure at this level alone. We would instead need to broaden the field of testable implications in order to assess the microfoundations of the various competitors.

All simulations were undertaken in NetLogo, and the programs for the various models are listed in Appendix 3A[21]. For the sake of comparison, all models have the same fixed total income ($1,000,000), population (5000), minimum level of necessary consumption ($10) average income per capita ($200), and initial prices $p_1 = 1$ and $p_2 = 2$. The income distribution is set initially as a log normal distribution with a given minimum income ($50). Since the whole point is to demonstrate that π is the critical parameter for generating aggregate relations, all models are constructed to have roughly the same *average* discretionary propensities (0.5). The demand curve for x_1 is generated by raising its price from 1 to 1.5 by increments of 0.01, while for that for x_2 is generated by similarly raising its price from 2 to 3. Nominal income is held constant as each price ultimately increases by fifty percent, which means that real income (y/p_1) ultimately falls by a corresponding amount. For the sake of comparison, the Engel curve simulations are conducted by lowering nominal per capita income in the same amount by which real income declines as p_1 rises. This allows us to directly compare the numerical values of the income elasticities in various models with their own demand elasticities, as well as with the theory. Note that the *theoretical* income elasticities of x_1 is the same as its demand elasticity at any given real income (see equations (3.7) and (3.13)).

Figures 10-11 compares the theoretically expected demand curves of the necessary and luxury goods to the actual curves in the four simulation models. In the interest of saving space, cross demand curves and Engel curves are not displayed. All actual elasticities are listed in Table 3.1. It is evident that the very different microfoundations of the various models have essentially no effect on the aggregate results. For instance, in Figures 10-11 the market demand curves for the necessary good resulting from the NC Homogeneous model are identical to the theoretical curves derived from equations (3.5)-(3.6) because in this model all agents have identical unchanging propensities all equal to 0.5. In the NC Heterogeneous model agents have different propensities drawn from a random distribution with an unweighted theoretical mean of $\pi^* = 0.5$. The actual average π calculated at the aggregate level is equivalent to an income-weighted average of the individual propensities. This depends on the particular sampling distribution of the π's and on the particular sampling distribution of income generated at the first step of the run. Hence the average π can be a bit different from π^*. But since both the distribution of individual propensities and incomes are fixed at the first step in each run of this model, the average π remains constant over time. In the Whimsical model the average propensity is not constant over time. This is because each run of the model generates a new random set of individual propensities, so that even with an initially fixed distribution of income, the average propensity varies somewhat in each step. This in turn imparts a certain degree of variation to the demand curves in this model. The variability is the greatest in the Imitate-Innovate model because propensities are constantly changing: imitators adapt their propensities toward local social norms while innovators acquire new propensities. Nonetheless, all models generate essentially the same curves and elasticities as those predicted by the fundamental theoretical equations.

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[21] I am greatly indebted to Amr Ragab for helping me think through these four comparisons and for carrying out the corresponding simulations.

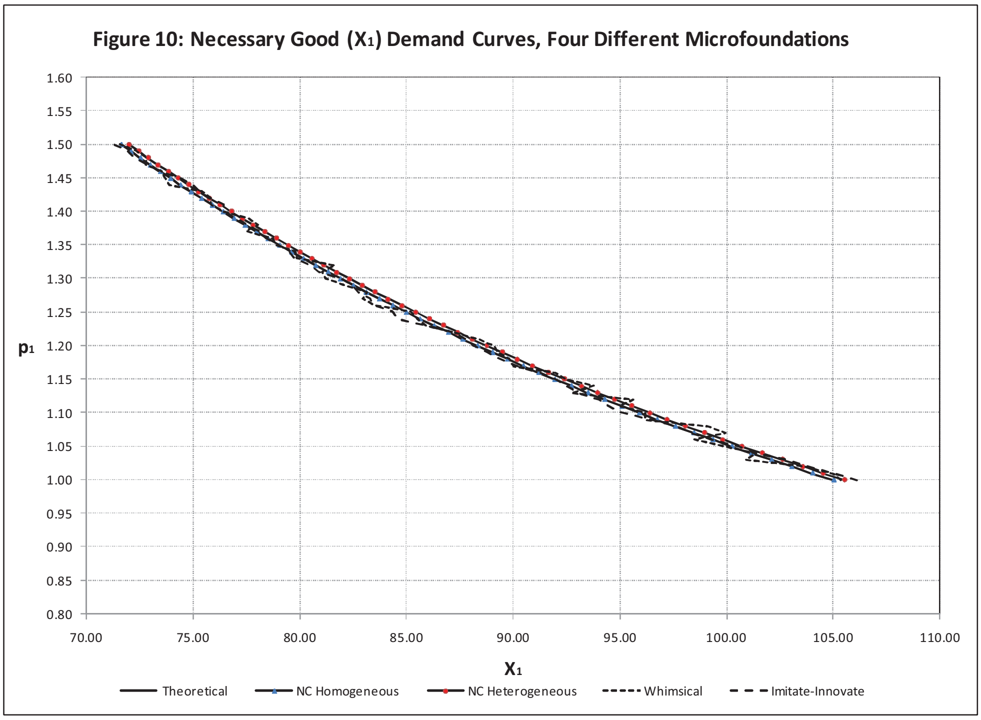


Figure 10: Necessary Good (X1) Demand Curves, Four Different Microfoundations
p1
X1
Theoretical
NC Homogeneous
NC Heterogeneous
Whimsical
Imitate-Innovate

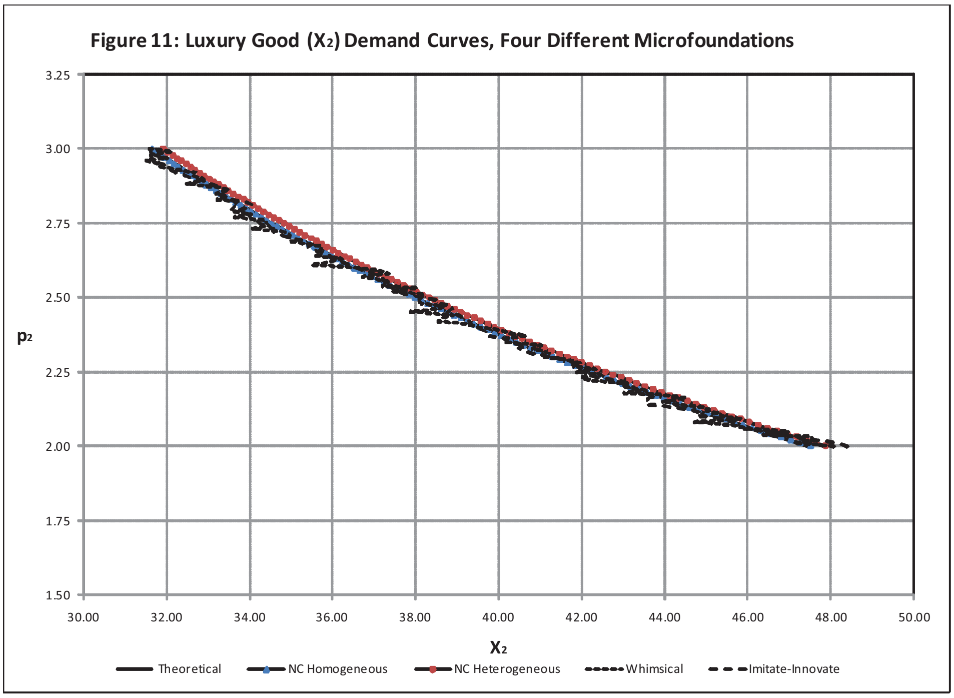


Figure 11: Luxury Good (X2) Demand Curves, Four Different Microfoundations
p2
X2
Theoretical
NC Homogeneous
NC Heterogeneous
Whimsical
Imitate-Innovate

Table 3.1: Average Elasticities						
Initial settings and parameter values: y = 200; π = 0.50, x_{1min} = 0, p_1 = 1, p_2 = 2.						
		Theoretical Value	Neoclassical Homogeneous	Neoclassical Heterogeneous	Whimsical	Imitate-Innovate
Description	**Notation**					
Demand Elasticity	$\varepsilon_{x_1 p_1}$	-0.93	-0.93	-0.93	-0.94	-0.97
Demand Elasticity	$\varepsilon_{x_2 p_2}$	-1.00	-1.00	-1.00	-1.01	-1.04
Cross-Demand Elasticity	$\varepsilon_{x_1 p_2}$	0.00	0.00	0.00	0.04	-0.05
Cross-Demand Elasticity	$\varepsilon_{x_2 p_1}$	-0.07	-0.07	-0.07	-0.05	-0.03
Income Elasticity	$\varepsilon_{x_1 y}$	0.94	0.94	0.94	0.94	0.97
Income Elasticity	$\varepsilon_{x_2 y}$	1.07	1.07	1.07	1.05	1.03

IV. A Methodology for Economic Analysis

Individual actions underlie market, industry, national and regional macro patterns. But the more aggregate sets have properties not possessed by the individual agents, which means that we cannot model the whole "as if" it was merely one large individual (Martel, 1996, p. 128). The representative agent is a convenient untruth.

It has been repeatedly demonstrated that heterogeneity among individual agents is the key factor in the failure the representative agent hypothesis (Kirman, 1992, p. 128). Forni and Lippi (1997, pp. x-xiii) find that even in simple cases the aggregation of heterogeneous agents means that relations among microeconomic variables need not carry over to more aggregate levels. Moreover, the dynamics at the macro level are generally quite different from those at the micro level (*ibid*, pp. x-xii).

This finding has led some economists to conclude that heterogeneity is *also* the key to aggregate patterns. For instance, Martel (1996, p. 137) suggests that "heterogeneity… may be a more important determinant *of market* behavior than the implications of individual utility maximization". Martel (*ibid*, pp. 137-138) cites Hildebrand (1994) and Grandmont (1992) to the effect that if utility maximizing consumers are sufficiently heterogeneous it becomes possible to have a "a market demand function having the desirable Hicksian stability properties".

But while heterogeneity destroys of the possibility of a representative agent, it is *not* the source of stable aggregate patterns. The whole point of the argument in the preceding section was that stable consumer and producer patterns can arise from shaping structures such as the budget constraint and the minimum level of the some goods. The agents in the

NC Homogenous model are identical, while those in the other models are decidedly heterogeneous. Yet all four simulation models yield the *same* demand and Engel curves and associated elasticities. At the same time, in the absence of budget constraints we could say nothing about the aggregate patterns. It follows that heterogeneity is neither necessary nor sufficient as a foundation of aggregate analysis.

IV.1 General Properties of Emergent Aggregates

A second lesson can be derived from the analysis in the preceding section. Despite the differences among agents in the four simulation models, they all have one common property: their consumption is dependent on income, on prices, and some minimum level of the necessary good. So we can represent the consumption of the i[th] agent as $c_i = f_i\left(y_i, x_{1\min}, p_1, p_2\right)$. The shapes of the individual consumption functions vary from model to model: they are simple and linear in the first two models, but in the last two models they are more complex because the parameters vary across individuals and over time. We have already seen that the aggregate consumption function can nonetheless be linear and stable over time in all cases: e.g. $x_1 = \left(1-\pi\right)x_{1\min} + \pi\left(\frac{y}{p_1}\right)$. What is equally interesting is that while the *particular shape* of the function can change as we move from micro to macro, *the relevant variables do not*. In all four models, the macro consumption function has the same arguments as the micro one: $C = F(Y, X_{1\min}, p_1, p_2)$.

Of course, not all variables survive the transition from micro to macro (Martel, 1996, p. 128). Implicit in the three models with heterogeneous agents are a variety of “social” factors which might determine individual incomes, minimum consumption levels, and propensities to consume. Yet insofar as this multitude of variables produces a stable average propensity, the existence of these factors does not matter at the aggregate level. What does matter is the existence of a theoretical connection between consumption and the particular variables that affect it, and some understanding of which of the latter count at the aggregate level. *This* is where microfoundations come into the picture.

IV.2 Five Rules for Good Macroeconomic Theory

So we can specify five characteristics of rigorous aggregate analysis. It should be rooted in some theory of the relevant factors at the micro level. It should allow for the fact that only a few of these factors may be relevant at the macro level. It should recognize that the aggregate functional form will be quite different from corresponding microscopic ones, which implies that there is no such thing as a representative agent. An implication of the last point is that we cannot reject some aggregate fitted function simply because it does not conform to functional form assumed, or even established, at the microeconomic level. Of course, if we can formally derive the expected aggregate form, as was done in the preceding section for aggregate consumption, then we can test it directly. Otherwise, within the limits of the theoretically expected functional relations, we must let tractability and empirical strength guide our choice of the exact functional form. Rigorous macroeconomists will also keep in mind that there will be many microfoundations consistent with any given aggregate pattern. Therefore they should not confuse empirical support for an aggregate hypothesis with empirical support for any particular microfoundation. For instance, a rise in aggregate income which leads to an increase in aggregate consumption hardly justifies the claim that all consumers are thereby happier. This last point is obviously important at a policy level. The proper place to test the validity some microscopic hypothesis is at the microscopic level, except when it is not testable at this level and also has a unique aggregate implication. Finally, rigorous economic theory must always keep in mind that equilibration is a hypothesis whose existence, stability, speed, and manner of operation must be explicitly addressed. In economic policy, for instance, the notion that aggregate supply and demand are continuously in equilibrium has very different implications from the notion that it takes 3-5 years (the inventory cycle) to bring about a rough balance between these ever moving variables.

Neoclassical economics pronounces itself to be modern and rigorous because it claims to be based on microfoundations. But its reliance on the notion of representative agents vitiates all such claims. This emperor has no clothes (Kirman, 1989). On the other hand, it is interesting to note that "old fashioned" macroeconomics does satisfy most of the requirements for rigorous aggregate analysis. Two classic instances can be located in the Keynes' (1935) treatment of the aggregate consumption function and Kalecki's (1968) analysis of the industry price level.

Keynes rests his analysis of aggregate consumption on underlying subjective and objective factors that, in addition to personal income, influence individual savings (non-consumption) behavior. Subjective factors include the desire to provide for future consumption and contingencies, to use passive and speculative investment to expand future income, to amass wealth, and for some, even to enjoy miserliness. Objective factors include windfall gains or losses, taxation, price controls, expectations, and changes in the interest rate. Keynes is careful to note that institutional and organizational factors shape and channel all such factors. At the aggregate level, it is real income which survives as the key determinant of real consumption, all other factors being expressed through their influence on the shape and level of the aggregate consumption function. Lastly, however varied individual consumption patterns may be, the aggregate consumption function is quite simple: $C = f(Y)$ such that the marginal propensity $dC/dY < 1$ (Hansen, 1953, Ch. 4).

Kalecki's theory of price follows a more concrete path from micro to macro. He begins by specifying the price of the i[th] firm as $p_i = m_i u_i + n_i \bar{p}$, where p_i, u_i represent the firm's unit prices and costs, $\bar{p}$ the average price in the industry, and m_i, n_i the monopoly power coefficient which determine the firm's price-fixing policy. These coefficients in turn reflect the relative size of various firms, their sales promotion apparatus, and even the power of trade unions among their employees. At the industry level, the price relation is transformed into the form $\overline{p} = \overline{\beta}\overline{u}$ where $\overline{\beta} \equiv \left(\frac{\overline{m}}{1-\overline{n}}\right) > 1$. Thus only the two main variables, price and unit costs, end up at the aggregate level, all others being compressed into a given aggregate degree of monopoly power. Moreover, the form of aggregate relation is different from the firm-level one (Kalecki, 1968, Ch 1, pp. 11-27).

Both authors therefore fulfill the first three requirements for rigorous macroeconomics: they ground their analysis in individual behavior; they recognize that only a few key variables remain at the aggregate level; and they posit different forms for macroeconomic relations than they do for corresponding microeconomic ones. And on the last requirement, although they do not explicitly addresses the possibility that a variety of different microfoundations might give rise to the same aggregate relations as the ones they posit, it is hard to imagine that they would find this aspect of political economy sensational[22].

V. Summary and Some Central Implications

The existence of stable recurrent patterns at market and of national levels raises two main methodological issues. How do we model the underlying micro processes? And what link is there between macro patterns and micro processes?

The standard neoclassical answer to the first question is that we must model microeconomic behavior in terms of egoistic choice, perfect knowledge and all the other accoutrements of what I call hyperrational behavior. Section II.1 takes up the debate around this issue. There is a large body of evidence indicating that hyperrationality is a bad representation of actual behavior. Nonetheless it is defended on a variety of grounds which range from the claim that it gives analytically tractable results to the one that it yields good empirical predictions. Since analytically tractable results are of little use if they are not empirically relevant, the focus inevitably shifts to the latter. It is at this point that recourse is usually made to Friedman's famous assertion that only predictions, not assumptions, matter. As many have pointed out, the fatal flaw in this argument is that assumptions about individual behavior are themselves *microeconomic predictions*. One cannot simply restrict one's view to those predictions which are consistent with the empirical evidence and ignore those which are not. The theory of revealed preference, game theory, Becker's theory of the family, and even Analytical Marxism are examined in this light.

[22] "MISS PRISM: ...Cecily, you will read your Political Economy in my absence. The chapter on the Fall of the Rupee you may omit. It is somewhat too sensational. Even these metallic problems have their melodramatic side" (Oscar Wilde, *The Importance of Being Earnest*).

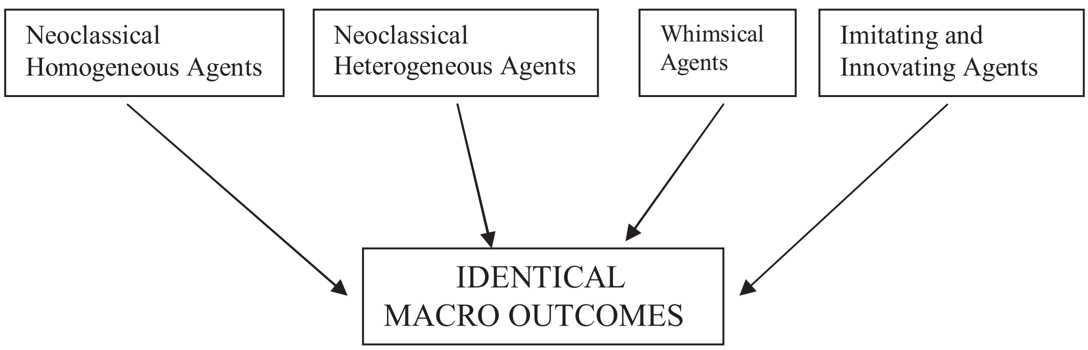
An alternated tack is to consider hyperrationality as an ideal guide for action. Proponents of this approach readily concede that individuals do not actually behave in this manner, but argue that they should. From this perspective, the real is always deficient. But one could equally well reverse this ranking, concluding instead that it is the model of hyperrational behavior which is deficient because social choice is a far more complex task than imagined within this narrow frame. *Homo economicus*, if he or she existed, would not only be a "social moron" but also a cultural one. Yet this inadequate construct continues to dominate standard economic discourse. I argue that the real reason for this is that the doctrine of hyperrationality serves the instrumental function of portraying capitalism as efficient and optimal. Indeed, as previously noted Lucas himself says "that microfoundations are not necessary for short-run forecasting but are important for determining the effects of policy on individual behavior." (Goldstein, 2006, p. 572, footnote 574). But then the real issue is to understand how heterogeneous individuals actually feel and behave.

Section II. 2 examines the relation between micro processes and macro patterns. The standard approach is to model aggregate consumer and producer behavior as the outcomes of the actions of a single hyperrational consumer and a single perfectly competitive firm, respectively. Unfortunately, it is well known in both domains that it is simply not possible to represent aggregates in this manner. It all individuals are exactly alike, the connection between micro and macro is trivial. And if all individuals happen to voluntarily align their behavior for some social reason, as in a boycott or a strike, the connection is exceptional. But otherwise, aggregates have emergent properties. The average agent, which is another name for the aggregate, will therefore be very different from the representative agent. Moreover, the average behavior will be insensitive to details of individual behaviors. *Aggregation is robustly transformational.*

Section II. 3 takes up the neoclassical claim that aggregate laws are not rigorous unless they are derived from some microfoundations. Three points of interest emerge here, which can be illustrated with reference to physics. First of all, there are many fundamental physical laws, such as the Einstein's General Theory of Relativity, which have *never* been reconciled with their putative microfoundations in Quantum Mechanics. This is so even though the two approaches have co-existed for a century. Secondly, the lack of integration between the two raises the possibility that it is Quantum Mechanics, not Relativity Theory, which lacks rigor because it lacks *macro*foundations. This was certainly Einstein's own view, and is shared by some other physicists. Thirdly, it is possible to arrive at an existing macro pattern from a *false* microfoundation. For instance, the Gas Law is generally derived from kinetic theory as the outcome of millions of billiard-ball-like collisions between atoms in the gas. Unfortunately, atoms are ethereal quantum entities which are nothing like billiard balls, lacking even an identifiable position. The parallels with economics are obvious. Since macroeconomics will have emergent properties, it can be perfectly rigorous even without being derived from microeconomics. Indeed, it is just as feasible to argue, as Hahn does, that microeconomics is not rigorous unless it has been situated in, and hence dependent upon, the macro economy. The individual must be conceived as socially *situated*, structured and shaped by nationality, gender, ethnicity, and class. Finally, even if one does arrive at an established macroeconomic pattern via some microeconomic hypothesis, the fact that it is possible to arrive at a correct result from an incorrect foundation requires us to assess the empirical validity of each contending foundation.

This last point becomes central in section III, where it a variety of differing microfoundations are shown to all yield exactly the same market patterns. Building on Becker's early work (1962), sections III.1-III.4 demonstrates that certain major empirical consumption patterns can be derived solely from two shaping structures: the budget constraint and a minimum level of consumption for necessary goods. These two are sufficient to derive downward sloping market demand curves, income elasticities of less than one for necessary goods and more than one for luxury goods (Engel's Law), and Keynesian type aggregate consumption functions that are linear in real income in the short run and incorporate wealth effects in the long run. All that is required is that any given population arrives at some stable proportion of *average* consumption. Four different models of individual behavior are used to illustrate the general point: a representative agent model with identical neoclassical consumers; a model of heterogeneous neoclassical consumers in which a representative agent does not obtain; a model in which each consumer acts whimsically to choose some consumption basket within reach of his or her income constraint (this is Becker's impulsive consumer); and a model in which some consumers imitate those in their social neighborhood while others develop new preferences (innovate). All four cases give identical aggregate results, because it is the socially-constructed shaping-structures, not the microfoundations, which play the key role. Figure 13 summarizes the main point of this section.

Figure 13: Micro-Independence of Emergent Macro-Properties



Section IV distills four lessons for macroeconomic analysis. Heterogeneity among agents means that microeconomic features such as Granger-causality, cointegration among variables, overidentifying restrictions and even particular dynamic properties do not carry over to the aggregate level. Heterogeneity therefore implies that aggregate fitted functions do not have to match the functional form assumed at the microeconomic level. However, heterogeneity is *not* necessarily the source of stable aggregate patterns, since the latter can arise directly from shaping structures.

Although the functional form can change as we move from micro to macro, certain key variables do carry over. For instance, in the case of the four different agent- based models of consumption, income, prices and the minimum level of necessary-good consumption continue to be relevant at the aggregate level. But other social factors which implicitly determine the variations among individual agents only show up through their effects on aggregate parameters. Thus macro relations *are* grounded at the micro level, but not in the manner specified by neoclassical theory. This is where the social shaping structures play a key role, because they provide limits and gradients whose effects channel individual actions.

Rigorous macroeconomics must therefore ground its analysis in individual behavior, recognize that only a few key variables carry over to the aggregate level, and generally posit distinct functional forms at the macro level. Keynes and Kalecki are eminent examples of this. Keynes builds his analysis of aggregate consumption on personal income and a variety of subjective and objective factors that influence individual savings (non-consumption) behavior. He is also careful to note that institutional and organizational factors play an important role. Despite all of this, the only requires that aggregate real consumption be a function of real income with the property that the marginal propensity to consume be less than one. Kalecki's theory of price follows a similar path from micro to macro. It begins with an equation for the price of an individual firm which depends on the relative size of the firm, its sales promotion apparatus, the union power of its employees. Yet the industry price level has a different function form, and depends only on the industry's average unit costs and average degree of monopoly power (through which all others variables are expressed). Similar paths can be traced in Marx, Schumpeter, and many others great economists. Macroeconomic analysis was already rigorous before it was diverted by neoclassical analysis into the theoretical *cul-de-sac* of a hyperrational representative agent.

It should also be noted that since there will generally be many microfoundations consistent with any given aggregate pattern, one should not confuse empirical support for an aggregate hypothesis with empirical support for any particular microfoundation. A rise in aggregate income may well be associated with many consumers being less happy, say if it was largely due to an increase in the incomes of some particularly disliked group. Such considerations can be are important at a policy level.

Three further issues are important. There is the claim that if we abandon the assumption of hyperrationality, "economic theory would degenerate into a hodgepodge of ad hoc hypotheses … which [would] lack overall cohesion and scientific refutability" (Conlisk, 1996, p. 685). I have argued throughout that the doctrine of hyperrationality is itself built upon scientifically untenable assumptions. So here it is useful to consider what happens if when we do indeed abandon this doctrine and instead build our microfoundations around actual behavior.

We certainly gain an understanding of the true complexity of individual behavior. We do not necessarily lose predictability, since individual behavior can be quite predicable. Predictability does not require hyperrationality. Reason continues to play a role in explaining human behavior, but alongside emotion, beliefs, and illusion. Incentives matter, but are not all-important. An obsessive fixation on hyperrationality is neither necessary nor warranted. What we do lose in this move is the notion that hyperrationality has a privileged claim on behavioral modeling (Zafirovski, 2003, pp. 1, 6-8). And with this, we also lose the claim that so-called free markets and free trade always make us better off, as well a host of associated notions about the untrammeled virtues of capitalism and the intrinsic defects of state activities (Ariely, 2008, pp. xx, 47-48, 232).

We also gain an important insight into the question of how millions of individuals and firms interacting through the market manage to arrive at consistent outcomes. The classical answer is that this is brought about by the invisible hand through the constant undershooting and overshooting of variables around ever moving centers of gravity. This is both the reflection and the means of the "forcible articulation" of individual producers into a social division of labor. Keynes recognizes this when he speaks of the higgling of the market and of the possibilities of persistent unemployment (Dutt, 1991-1992, p. 210, footnote 215). It is Walras who abolishes all the turbulence and turmoil associated with the actual process, substituting in its place an idealized notion of immediate and optimal articulation which goes under the name of general equilibrium. Neoclassical economics has sought to justify this idealization ever since. And much of *heterodox* economics has also accepted this as an appropriate benchmark, thereby being forced to portray the real world (rather than the theory itself) as being full of "imperfections". This book is devoted to the argument that this bipolar arrangement does not provide an adequate framework for the analysis of capitalism.

Perhaps the greatest benefit of abandoning the doctrine of hyperrationality is that we gain the ability to provide a more general explanation of empirical phenomena in consumer and production theory. Because such phenomena are traditionally grounded in assumed hyperrational behavior, the existence of these patterns is often taken as a validation of this starting point. But we have seen that many different forms of individual behaviors can give rise to very same aggregate patterns, because the determining factors are structural, not personal. This is an instance of the general fact that aggregate (group, market, national) outcomes have emergent properties which are quite different from those of individual agents. The motivations and expectations of individuals remain important at the microscopic level and in the social interpretation of outcomes (people may or may not be happy about events). But except in the trivial case where all individuals happen to be identical, or where they choose for social reasons to march in lock-step, the aggregate will have a character of its own. Thus while we can always to characterize the whole by means of an "average agent", this average will not generally fulfill the behavioral characteristics of a "representative agent". Indeed, since the aggregate will generally be "robustly insensitive" to the individual behaviors", we cannot use a particular empirical correspondence to impute support for other features, including the assumptions, of some specific model of individual behavior. For instance, just because some artfully chosen model or game happens to mimic some feature of reality, one cannot thereby conclude that it "explains" the observed outcome. A further implication is that in the absence of additional information one can only address policy implications which depend on a proven empirical correspondence, but not those which rest on some invalid or unproven assumptions about the underlying process. Thus even if two theories are both correct in (say) predicting the output effects of a budget deficit, in the absence of further evaluation of their other implications, one cannot draw further social implications from either theory. Friedman's evasion will not serve.

The second issue has to do with the existence of a variety of shaping structures other than budget restraints. As we have seen, the latter plays a central role in both consumption and production patterns. But the process of arbitrage is an even more important shaping structure whose character requires some comment. Within neoclassical economics each consumer and firm is assumed to face a uniform price for any commodity, which they take as given when they make their maximizing calculations. But the assumption of a uniform price requires two further assumptions: that as buyers, consumers and firms move towards cheaper producers of any given good; and that as sellers, firms adjust their prices to attract buyers. Thus whereas consumers and firms are assumed to be passive maximizers in one domain, they are implicitly assumed to be active price-seeking and price-setting agents in another domain – acting act behind their own backs, so to speak. This contradiction is covered up in the Walrasian parable by the device of an auctioneer who simply announces a single price for each product, and covered up in the theory of perfect competition by asserting that perfect knowledge implies a single price. It should be noted that a similar outcome is obtained for wage rates of any given type of labor, whose price (like that of any other product) is assumed to be perfectly equalized even in the short run. There is no process in these cases. The law of one price is essentially tacked onto the theory of perfect competition (Mirowski, 1989, p. 236), because "the received theory of perfect competition ... contains no coherent explanation of price formation" (Roberts, 1987, p. 838) .

The theory of perfect competition also assumes that all firms within an industry are exactly alike, so that a uniform selling price for each product implies a uniform profit rate for each firm, even in the short run. But since short run profit rates can differ among industries, it is assumed that in the long run the mobility of capital will have driven down higher profit rates and driven up lower ones until all are exactly equal. Both short run and long run outcomes to equilibrium-as-an-achieved-state. The short run assumptions ensure that profit rates are equal across all firms within a given industry, and the long run assumptions ensure that profit rates are equal across all industries. Hence in the long run equilibrium of perfect competition, any firm, no matter where it is located, will have exactly the same rate of profit as any other firm (Mueller, 1990, p. 4).

It follows that any differences among wage rates, product prices, and the profit rates of individual firms is putative evidence of the "imperfection" of the real world. Theories of "imperfect" competition, which are thoroughly tied to the notion of imperfect competition, begin at this point. Kalecki's theory of price formation previously discussed in section IV of this paper is a classic case in point: firms within an industry are each assumed to offer different prices for the same product according to the degree of monopoly they possess, and profit margins as well as profit rates differ across firms and across industries according to various degrees of monopoly (Kalecki, 1965, pp. 11-20).

The theory of real competition is constructed very differently from the theory of perfect competition. Firms are assumed to *set trial prices*. Competition among firms then binds together the prices offered for any given product. Firms with prices higher than the average tend to lose market share and those with prices lower than the average tend to gain market share, other things (such transportation and search costs) being equal. Firms adjust their prices in light of these feedback processes. What obtains is an enforced distribution of selling prices around some ever moving average price. This is the competitive law-of-roughly-one-price.

The rough equalization of selling prices within any given industry implies a corresponding distribution of intra-industry rates of profit which depend not only on the distribution of selling prices but also on the variations in conditions of production among firms within an industry. Of the latter, some particular set will represent the best generally reproducible ("regulating") conditions of production. It will be the rates of profit of these regulating conditions which will be of concern to new investment in any given industry. Industries with regulating rates of profit which are higher than the national regulating rate will experience accelerated inflows of capital, which will drive up their supply relative to their demand and thereby lower their prices and profit rates. The opposite process will obtain in industries with regulating rates lower than the national average. Since demand, supply, and even methods of production are constantly changing, the end result is an enforced oscillation of regulating rates of return around the national average. This is the competitive law-of-roughly-one-profit-rate.

The perfect and real competition theories both assume arbitrage as a fundamental shaping structure. But while perfect competition envisions exact equalities in some achieved states of equilibrium, real competition envisions ever present differences in a turbulent process of fluctuations around moving centers of gravity. The commonality of arbitrage, like that of budget restraints, should not be taken to mean that the form and content of this process are the same in these two theories.

The third issue has to do with another fault line between the current Walrasian orthodoxy and its challengers. The Walrasian approach insists the consumer and the firm be treated in a perfectly *symmetrical* manner. The guiding principles (maximization) and the very tools (iso-curves and budget constraints) are formally identical in both cases. The post Keynesian tradition typically treats macroeconomics as an asymmetrical power struggle power between consumers and businesses, with the latter having an element of oligopoly power not possessed by the former. The classical economists make an even stronger argument: capital is the dominant force and profit the veritable bottom line of capitalism. This leads them back to production, to the surplus product as the objective foundation of profit, and to competition as the means by which profit regulates exchange. It is important to note that profit is a potentially objective measure[23], subject to constant evaluation by the firm's managers, by the stock market, by the banks and by the public in general. Profit is the survival condition for firms (Simon, 1979, p. 502)[24]. Individual firms are punished by extinction if they make persistent losses, and can be threatened even if they merely make lower profits than their competitors. Hence the constant pressure to cut costs so as to improve their odds of survival. In turn, these individual imperatives give rise to a series of ordering mechanisms, mechanisms, such as the tendency to equalize prices for a common good and the tendency to equalize profit rates across industries. Marx speaks of competition among firms as a war, and it is this, the *imposed rationality* of warfare, which their objective guiding principle (Shaikh, 1978, p. 7). Individual consumers face no such objective winnowing process. They are of course subject to social influences which form the "macro-foundations" of their microeconomic behavior (Colander, 1996 ; Hahn, 2003, p. 227; Leijonhufvud, 1996, p.42). But within these confines they can operate out of habit, out of tradition, or even out of whimsy. Theirs is the domain of the social-subjective. Hence in the classical approach embodies an even greater asymmetry between the treatment of businesses and that of consumers.

[23] The fact that profit is a potentially objective measure does not mean that is true levels are immediately apparent. Indeed, the stated levels of profit can be disguised for extended periods of time. Enron's meteoric rise and subsequent crash is a case in point: while its rise was predicated on exaggerated claims, its fall was due precisely to the unraveling of these exaggerations. The financial crisis that exploded in 2008 is another stark reminder of the same process. When true profitability asserts itself against a cloud of fictitious claims, "all that is solid melts into the air, all that is holy is profaned" {Marx, 2005 #835@`, p. 10}

[24] As Simon (1979, p. 502) points out, the fact that profit is the survival condition for firms need not imply that firms seek to "profit-maximize" in the neoclassical sense.

References

Agarwal, Bina and Alessandro Vercellli. 2005. *Psychology, Rationality and Economic Behavior: Challenging Standard Assumptions*. Basingstoke: Palgrave.
Aitchison, J. and J.A.C. Brown. 1957. *The Lognormal Distribution, with special reference to its uses in economics*. Cambridge: Cambridge at the University Press.
Alchian, Armian A. 1950. "Uncertainty, evolution, and economic theory." *The Journal of Political Economy*, 58(3), pp. 211-221.
Allen, R.G.D and A.L. Bowley. 1935. *Family Expenditures: A Study of its Variation*. London: Staples Press Limited.
Anderson, Elizabeth**.** 2000. "Beyond homo economicus: new developments in theories of social norms." *Philosophy and Public Affairs*, 29(2), pp. 170-200.
Angier, Natalie. 2002. "Why We're So Nice - We're Wired to Cooperate," In *New York Times*. New York.
Ariely, Dan. 2008. *Predictably Irrational: The Hidden Forces That Shape Our Decisions*. HarperCollins.
Arrow, Kenneth J. and Frank Hahn. 1971. *General Competitive Analysis*. San Franscisco: Holden-Day
Asimakopulos, A. 1991. *Keynes' general theory and accumulation*. Cambridge: Cambridge University Press.
Becker, Gary S. 1962. "Irrational Behavior and Economic Theory." *Journal of Political Economy*, 70, pp. 1-13.
____. 1981. *Treatise on the Family*. Cambridge, MA.: Harvard University Press.
____. 1987. "Family," In *The New Palgrave: A Dictionary of Economics,* ed. J. Eatwell, M. Milgate and P. Newman, 281-286. London: The MacMillan Press.
Bhagwati, Jagdish. 2002. *Free Trade Today*. Princeton: Princeton University Press.
Binmore, Ken. 2007. *Game Theory: A Very Short Introduction*. Oxford: Oxford University Press.
Black, R.D. Collison. 1990. "Utility," In *The New Palgrave: Marxian Economics,* ed. M. M. edited by John Eatwell, and Peter Newman, 776-779. London: Macmillan.
Blanchard, Olivier. 2000. *Macroeconomics*. Upper Saddle River, New Jersey: Prentice Hall.
Brush, Stephen G. 1985. "Kinetic Theory," In *The Encyclopedia of Physics,* ed. R. M. Besancon, 634-638. New York: Van Nostrand Rheinhold Co.
Chai, Sun-Ki. 2005. "Rational Choice: Positive, Normative, and Interpretive," In *asa05_proceeding_22402*, 1-20.
Chang, Ha-Joon. 2002. *Kicking Away the Ladder: Development Strategy in Historical Perspective*. London: Anthem Press.
Cohen, Gerald Allen. 1978. *Karl Marx's Theory of History: A Defence*. Princeton: Princeton University Press.
Colander, David. 1996. "The macrofoundations of micro," In *Beyond microfoundations: Post Walrasian macroeconomics,* ed. D. Colander, 57-70. Cambridge: Cambridge University Press.
Conlisk, John**.** 1996. "Why bounded rationality?" *Journal of Economic Literature*, 34(2), pp. 669–700.

Davies, Glyn. 2002. *A History of Money from Ancient Times to the Present Day*. Cardiff: University of Wales Press.
Dosi, Giovanni; Giorgio Fagiolo; Roberta Aversi; Mara Meacci and Claudia Olivetti. 1999. "Cognitive Processes, Social Adaptation and Innovation in Consumption Patterns: From Stylized Facts to Demand Theory," In *Economic Organization and Economic Knowledge: Essays in Honour of Brian J. Loasby,* ed. S. C. Dow and P. E. Earl. Cheltenham, U.K: Edward Elgar.
Douglas, Paul**.** 1976. "The Cobb-Douglas Production Function Once Again: Its History, Its Testing, and Some Empirical Values." *Journal of Political Economy*, 84, pp. 903-915.
Dutt, Amitava Krishna**.** 1991-1992. "Expectations and equilibrium: implications for Keynes, the neo-Ricardian Keynesians, and the Post Keynesians " *Journal of Post Keynesian Economics*, 14(2), pp. 205-224.
Felipe, Jesus and Gerard F. Adams**.** 2001. "A Theory of Production': The Estimation of the Cobb-Douglas Function, A Retrospective View." *Eastern Economic Journal*, 31(3), pp. 427-445.
Felipe, Jesus and Franklin M. Fisher**.** 2003. "Aggregation in Production Functions: What Applied Economists Should Know." *Metroeconomica*, 54(May), pp. 208-262.
Felipe, Jesus and John S. L. McCombie**.** 2003. "Some methodological problems with the neoclassical analysis of the East Asian miracle." *Cambridge Journal Economics*, 27(5), pp. 695-721.
Fisher, Franklin M. 1971. "Aggregation Production Functions and the Explanation of Wages: A Simulation Experiment." *The Review of Economics and Statistics*, LIII(4), pp. 305-325.
____**.** 2005. "Aggregate Production Functions - A Pervasive, But Unpersuasive, Fairytale." *Eastern Economic Journal*, 31(3), pp. 489-491.
Forni, Mario and Marco Lippi. 1997. *Aggregation and the Microfoundations of Dynamic Macroeconomics*. Oxford: Clarendon Press.
Foss, Murray F. 1963. "The Utilization of Capital Equipment: Postwar Compared with Prewar." *Survey of Current Business*, 43, pp. 8-16.
Furnam, Adrian and Alan Lewis. 1986. *The Economic Mind: The Social Psychology of Economic Behavior*. New York: St. Martins Press.
Gandolfo, Giancarlo. 1997. *Economic Dynamics: Study Edition*. Berlin: Springer.
Garegnani, Pierangelo**.** 1970. "Heterogeneous Capital, the Production Function and the Theory of Distribution " *Review of Economic Studies*, 37(3), pp. 407-436.
Garegnani, Piero**.** 1979. "Notes on consumption, investment, and effective demand: a reply to Joan Robinson." *Cambridge Journal of Economics* 3(3), pp. 181-187.
Godley, Wynne and Marc Lavoie. 2007. *Monetary Economics: An Integrated Approach to Credit, Money, Income, Production and Wealth*. Houndsmills, Basingstoke, Hampshire: Palgrave Macmillan.
Goldstein, Jonathan P. 2006. "Marxian Microfoundations: Contribution or Detour?" *Review of Radical Political Economics*, 38(4), pp. 569-594.
Grabner, Michael**.** 2002. "Representative Agents and the Microfoundations of Microeconomics." *Seminar paper, Institute for Advanced Studies, Vienna, Austria*.
Grandmont, Jean-Michael**.** 1992. "Transformations of the commodity space, behavioural heterogeneity, and the aggregation problem." *Journal of Economic Theory*, 57, pp. 1-35.

Hahn, Frank. 2003. "Macro foundations of micro-economics." *Economic Theory*, 21, pp. 227-232.
Hansen, A. 1953. *A Guide to Keynes*. New York: McGraw-Hill Book Company, Inc.
Hargreaves Heap, Shaun P. and Yanis Varoufakis. 1995. *Game Theory: A Critical Introduction*. London: Routledge.
Harrod, R.F. 1939. "An Essay in Dynamic Theory." *The Economic Journal*, 49(March), pp. 14-33.
Harvey, A.C. and A. Jaeger. 1993. "Detrending, Stylized Facts and the Business Cycle." *Journal of Applied Econometrics*, 8, pp. 231-247.
Harvey, David. 2005. *A Brief History of Neoliberalism*. Oxford: Oxford University Press.
Hayek, Friedrich A. 1969. *Studies in Philosophy, Politics and Economics*. New York: Clarion Book, Simon and Schuster.
Hildebrand, Werner. 1994. *Market Demand*. Princeton, New Jersey: Princeton University Press.
Hildebrand, Werner and Alois Kneip. 2004. "Aggregate Behavior and Microdata." *Bonn Econ Discussion Papers, Bonn Graduate School of Economics*, (Discussion Paper 3/2004), pp. 1-30.
Houthakker, Hendrik S. 1955-56. "The Pareto Distribution and the Cobb-Douglas Production Function in Activity Analysis." *Review of Economic Studies*, 23, pp. 27-31.
____. 1987. "Engel's Law," In *The New Palgrave: A Dictionary of Economics,* ed. J. Eatwell, M. Milgate and P. Newman, 143-144. London: MacMillan Press.
____. 1992. "Are There Laws of Consumption?," In *Aggregation, Consumption and Trade,* ed. L. Philips and L. D. Taylor, 219-224. Dordrecht: Kluwer Academic Publishers.
Hutchinson, T. W. 1966. *A Review of Economic Doctrines: 1870-1929*. Oxford: Oxford University Press.
Janssen, Maarten C.W. 1993. *Microfoundations: A Critical Inquiry*. London.
Kalecki. 1965. " Theory of Economic Dynamics," In ed. M. 2nd edition: London.
Kalecki, Michal. 1968. *Theory of Economic Dynamics*. Monthly Review Press.
Keynes, J.M. 1935. *(1964) The General Theory of Employment, Interest, and Money*. New York: A Harbinger Book, Harcourt, Brace & World, Inc.
Kiel, Douglas L. and Euel Elliot. 1996. "Exploring Nonlinear Dynamics with a Spreadsheet: A Graphical View of Chaos for Beginners", ch 1 in , Douglas L. Kiel and Euel Elliot (eds.), , ." In *Chaos Theory in the Social Sciences: Foundations and Applications,* ed. D. L. Kiel and E. Elliot, 19-30. Ann Arbor: University of Michigan Press.
Kirman, Alan and K. Koch. 1986. "Market Excess Demand Functions in Exchange Economies: Identical Preferences and Collinear Endowments." *Review of Economic Studies*, 53(3), pp. 457-463.
Kirman, Alan. 1989. "The Intrinsic Limits of Modern Economic Theory: The Emperor has No Clothes." *The Economic Journal*, 99(395, Supplement: Conference Papers (1989)), pp. 126-139.
____. 1992. "Whom or What Does the Representative Individual Represent?" *The Journal of Economic Perspectives*, 6(2), pp. 117-136.
Kreps, David M. 1990. *Game Theory and Economic Modeling*. Oxford: Clarendon Press.

Kurz, Heinz. 1986. "Normal Positions and Capital Utilization." *Political Economy: Studies in the Surplus Approach* 2(1), pp. 37-54.
Laughlin, Robert B. 2005. *A Different Universe: Reinventing Physics from the Bottom Down*. New York: Basic Books.
Leijonhufvud, Axel. 1968. *On Keynesian Economics and the Economics of Keynes*. New York: Oxford University Press.
Leijonhufvud, Axel 1996. "Towards a not-too-rational macroeconomics," In *Beyond microfoundations: Post Walrasian macroeconomics,* ed. D. Colander, 39-56. Cambridge: Cambridge University Press.
Lio, Monchi 1998. "The Inframarginal Analysis of Demand and Supply and the Relationship between a Minimum Level of Consumption and the Division of Labour, in , edited by , Macmillan 1998: pp. 108-126]," In *Increasing Returns and Economic Analysis,* ed. K. J. Arrow, Y.-K. Ng and X. Yang, pp. 108-126. New York: Increasing Returns and Economic Analysis.
Little, Daniel. 1998. *Microfoundations, Method, and Causation: Essays in the Philosophy of the Social Sciences*. Edison, New Jersey: Transactions Publishers.
Lucas, Robert E. Jr. 1980. "Methods and Problems in Business Cycle Theory." *Journal of Money, Credit and Banking*, 12, pp. 696-713.
____. 1987. *Models of Business Cycles*. Cambridge, Massachusetss: MIT Press.
Martel, Robert J. 1996. "Heterogeneity, aggregation and a meaningful macroeconomics," In *Beyond microfoundations: Post Walrasian macroeconomics*
ed. D. Colander, 127-143. Cambridge, England: Cambridge University Press.
Marx, Karl. 1967. *Capital, Vol II*. New York: International Publishers.
McCombie, John and R. Dixon. 1991. "Estimating Technical Change in Aggregate Production Functions: A Critique." *International Review of Applied Economics*, pp. 24-46.
Miller, John H. and Scott E. Page. 2007. *Complex Adaptive Systems: An Introduction To Computational Models Of Social Life*. Princeton: Princeton University Press.
Mirowski, Philip. 1989. *More Heat Than Light: Economics as Social Physics, Physics as Nature's Economics*. Cambridge: Cambridge University Press.
Mitchell, Wesley Clair. 1918. "Bentham’s felicific calculus." *Political Science Quarterly*, 33(2), pp. 161-183.
Mueller, Dennis C. 1986. *Profits in the long run*. Cambridge: Cambridge University Press.
____ ed. *The dynamics of company profits: an international comparison*. Cambridge: Cambridge University Press, 1990.
Musser, George. 2004. "Was Einstein Right?," In *Scientific American*, 88-91.
Pasinetti, Luigi L. 1969. "Switches of Technique and the Rate of Return in Capital Theory." *Economic Journal*, LXXIX, pp. 508-531.
Phelps, Edmund. 1969. "The new microeconomics in inflation and employment theory." *American Economic Review*, 59(2), pp. 147-160.
Pollak, Robert A. 2002. "Gary Becker's Contribution to Family and Household Economics." *National Bureau of Economic Research*, pp. 1-47.
Pugno, Maurizio. 1998. "Harrod's Economic Dynamics As a Persistent and Regime-Changing Adjustment Process," In *Economic Dynamics, Trade and Growth: Essays on*

Harrodian Themes, ed. G. Rampa, L. Stella and A. P. Thirlwall, 153-177. London: Macmillan Press.
Roberts, John. 1987. "Perfectly and imperfectly competitive markets," In *New Palgrave: A Dictionary of Economics,* ed. J. Eatwell, et. al. London: Macmillan Press Limited.
Robinson, Joan**.** 1953-1954. "The Production Function and the Theory of Capital." *Review of Economic Studies*, XXI(2)(55), pp. 81-106.
Salehnejad, Reza. 2009. *Rationality, Bounded Rationality and Microfoundations: Foundations of Theoretical Economics*. Palgrave Macmillan.
Samuelson, Paul A. 1962. "Parable and Realism in Capital Theory: The Surrogate Production Function." *Review of Economic Studies*, XXXIX(3)(80), pp. 193-206.
____**.** 1963. "Problems of Methodology: Discussion." *American Economic Review*, 53, pp. 227-236.
____**.** 1964. "Theory and Realism: A Reply." *American Economic Review*, 54(5), pp. 736-739.
Sen, A.K. 1977. "Rational fools: a critique of the behavioral foundations of economic theory." *Philosophy and Public Affairs*, 6(4), pp. 317-344.
Shaikh, Anwar. 1973. "Theories of Value and Theories of Distribution," In *Department of Economics*, 174. New York: Columbia University.
____**.** 1978. "Political Economy and Capitalism: Notes on Dobb's Theory of Crisis." *Cambridge Journal of Economics*, (2), pp. 233-251.
____. 1987. "Humbug Production Function," In *The New Palgrave: A Dictionary of Economics,* ed. J. Eatwell, M. Milgate and P. Newman, 690-692. London: MacMillan Press.
____**.** 2005. "Nonlinear Dynamics and Pseudo-Production Functions " *Eastern Economics Journal*, 31(3).
____. 2007. "Globalization and the myth of free trade," In *Globalization and the Myth of Free Trade,* ed. A. Shaikh, 50-68. London: Routledge.
____**.** 2009. "Economic Policy in a Growth Context: A Classical Synthesis of Keynes and Harrod." *Metroeconomica*, 60(3), pp. 455-494.
Shapiro, Mathew D. 1989. "Assessing the Capacity and Utilization." *Brookings Papers on Economic Activity*, 1, pp. 181-241.
Simon, Herbert A. 1956. "Rational choice and the structure of the environment." *Psychological Review*, 63(2), pp. 129–138.
____**.** 1979. "Rational Decision Making in Business Organization." *American Economic Review*, 69(4), pp. 493-513.
Smolin, Lee. 2004. "Atoms of Space and Time," In *Scientific American*, 66-75.
Sraffa, Piero. 1960. *Production of Commodities by Means of Commodities*. Cambridge: Cambridge University Press.
Stigler, George J. and Gary S. Becker. 1990. "De Gustibus Non Est Disputandum," In *The Limits of Rationality,* ed. K. S. Cook and M. Levi, Ch 5, pp. 191-216. Chicago: University of Chicago Press.
Strotz, Robert H. 1953. "Cardinal Utility." *American Economic Review*, 43(2), pp. 384-397.
Su, Vincent. 1996. *Economic Fluctuations and Forecasting*. New York: HarperCollins College Publishers.

Trigg, Andrew B. 2004. "Deriving the Engel Curve: Pierre Bourdieu and the Social Critique of Maslow's Hierarchy of Needs." *Review of Social Economy*, 62, pp. 393 - 406.
Trockel, W. . 1984. *Market Demand: An Analysis of Large Economies with Non-Convex Preferences*. Berlin: Springer-Verlag.
van Duijn, J.J. 1983. *The Long Wave in Economic Life*. London: Allen and Unwin.
Varian, Hal R. 1993. *Intermediate Microeconomics: A Modern Approach*. New York: W.W. Norton
Weintraub, Sidney**.** 1957. "The Micro-Foundations of Aggregate Demand and Supply." *Economic Journal*, 67(September), pp. 455-470.
Zafirovski, Milan**.** 2003. "Human Rational Behavior and Economic Rationality." *Electronic Journal of Sociology*.
Zarnowitz, Victor**.** 1985. "Recent Work on the Business Cycles in Historical Perspective: A Review of Theories and Evidence." *Journal of Economic Literature*, XXIII(June), pp. 523-579.