Spring 2016

Three Rationalities: An exploration of three views on rationality in Economics

Martin Smith Sanders IV
Rollins College, msanders@rollins.edu

Three Rationalities

An exploration of three views on rationality in Economics

Martin Smith Sanders IV

Abstract

This paper conducts an exploration of three rationalities within economic thought: core, bounded, and ecological. Assumptions, policies and other key underpinnings of the rationalities are discussed and compared. Concluding remarks summarize the key points of each rationality and briefly discuss avenues for future research.

Introduction

Economics, at a foundational level, is the study of decision-making in regards to the allocation of resources. The term "resources" does not simply refer to raw materials, but really encompasses anything that is used or consumed by decision-making agents (e.g., labor or even time), be they individuals, firms, or governments. This paper argues that there are three broad viewpoints on that decision making process: core rationality, bounded rationality, and ecological rationality. Exploration of these different, fundamental rationalities that exist within the different perspectives of economics can serve in explaining, at least partially, how different points of view, such as neoclassical or behavioral economics, arrive at the conclusions and policy recommendations that they do.

The purpose of this paper in exploring and comparing these three types rationality used by agents in decision-making is not to ultimately make a case for which rationality type is the best or most accurate model of human rationality. Instead, this paper should be viewed as a teaching tool: one that explains what core, bounded, and ecological rationalities are in the

context of economic decision-making; illustrates the differences between them; and connects them with economic perspectives and policies.

Before delving into these three types of rationality, it is important that this paper clearly establishes what category of rationality the types discussed in this paper fall into. In Western thought, the concept of rationality has been discussed and debated among scholars since the ancient Greeks. As such, the concept of rationality today is rather broad with different categorizations and types. The category that the rationalities discussed in this paper fall under is instrumental rationality, which can be roughly defined as identifying and implementing means in order to achieve an agent's particular ends (Kolondy & Brunero, 2016). Instrumental rationality does not really concern itself with the value of the end. In other words, instrumental rationality deals with the question of "how" to achieve an end rather than the question of "why," which is the focus of proponents of "intrinsic" rationality, such as Immanuel Kant with his concept of the categorical imperative (e.g., it doesn't matter if saving a man's life serves your ends, there is a compelling, intrinsic reason, or "why" to do so.) In short, this paper will be discussing different approaches in economic thought to how agents go about achieving their ends (whether they are fully aware of them or not) rather than if those ends are worth achieving in the first place.

Core Rationality

Explanation

Core rationality is a model of human rationality that is generally accepted and used by most mainstream/neoclassical economists. In essence, the decision-making agents in core rationality can be viewed as "complete" or "wholly" rational. These agents are consistently logical (i.e., they are in possession of the property of transitivity) in their decisions with regards to their preferences and these agents are assumed to have complete knowledge (completeness property) of these preferences. Core rationality is a broad form of rationality that is general enough to be employed in other fields such as biology and political science. When used in economics it is often more narrowly construed as "economic rationality," which make the additional assumptions of agents being motivated by material incentives (as opposed to spiritual or emotional incentives) and that agents are self-regarding (as opposed to being altruistic or other-regarding.)

In formal economic discourse, core rationality is defined within the context of utility theory, which makes certain key assumptions. The first assumption can be described as comparability, which means that all choice or option bundles that an agents faces can be compared with one another (Denzau, 1992). A comparison between bundles A and B can lead to an agent determining that A is at least as good as B, B is at least as good as A, or that he is indifferent between bundles A and B. The assumption of comparability between bundles implies that agents have complete preferences over all goods (e.g., agents know what they want). In terms of indifference curves (graphical representations of all consumption bundles that an agents

views as equally satisfactory,) the assumption of comparability means that every point on a commodity plane has an indifference curve that runs through it (1992).

Another assumption is that of transitivity, which means that agents are transitive in their decision making (1992). To explain with an example, suppose an agent is comparing bundles A, B, and C. The agent determines that A is at least as good as B and that B is at least as good a C. Being transitive, the agent then determines that A is at least as good as C. The assumption of transitivity implies that agents make logically consistent decisions in regards to maximizing utility. In regards to indifference curves, this means that only one distinct indifference curve passes through any point on a commodity plane (1992).

The assumption of monotonicity, in the simplest of terms, means that agents prefer more to less or that "more is better" (1992). If bundle A has equal or more of the same goods as bundle B, then this implies that A is at least as good as B, but if bundle A simply has more goods than B, then the agent will prefer bundle A over B. In terms of indifference curves, the assumption of monotonicity is what gives indifference curves negative slopes, which implies that commodities can be substituted for one another and means that an agent will be indifferent between two bundles composed of two distinct goods each if each bundle compensates for a smaller quantity of one good with a larger quantity of another.

Convexity of preferences is another key assumption, which, in simple terms, states that agents have a taste for a variety of goods rather than for a large amount of one good (1992). A mixed bundle containing amounts of two different goods is considered to be at least as good as or even strictly preferred to "extreme" bundles containing an "extreme" amount of only one or the other goods. As an agent acquires more of a particular good, the agent becomes less willing

to substitute the other good for more of that particular good. To illustrate with an example, assume a Transylvanian angry mob acts as one and can be treated as one agent. The mob is faced with different bundles composed of differing amounts of pitchforks and torches. If the assumption of convexity of preferences holds, the greater amount of pitchforks the mob acquires, the amount of torches the mob is willing to substitute for one additional pitchfork diminishes. Thus, the assumption of convexity implies diminishing marginal utility (the additional utility, or satisfaction, one obtains from consumption of an additional good or service). In terms of indifference curves, the curves demonstrate a diminishing marginal rate of substitution as more of a particular good is added along a particular axis of the commodity plane (1992).

To describe core rationality in "simpler" or "less formal" terms, core rationality describes decision making human agents as utility maximizing agents that have complete knowledge of their preferences (they know what they want) and behave/make decisions in a logically consistent manner while being subject to material constraints.

A simple, "textbook" like example used to explain marginal utility analysis provides an illustration of the key concepts of core rationality:

Suppose an individual (let's call him Sam) has a budget (a material constraint) of $50. Sam is faced with a choice between three different products: A, B, and C. A initially provides 5 "utils" (a pseudo unit of measurement of utility that is used only for illustrative purposes) and costs $25; B initially provides 4 "utils" and cost $10; and C initially provides 3 "utils" and costs $5. Given the law of diminishing marginal utility, which states that for each additional product consumed, the additional utility gained from that consumption diminishes, the consumption of any product in this example reduces the additional utility provided by another unit of that

product by 1 “utils.” Decisions are made on the basis of marginal utility provided divided by price (MU/P). So what does Sam do? In this example and in other simple marginal utility analyses, Sam does not choose all the items he wishes to buy all at once, but rather one at a time in a sequence. Since C initially has the highest MU/P (3/5) he first purchases 1 unit of C and has $45 left. An additional unit of C would now only provide 2 “utils” or and MU/P of 2/5. Since B and C now offer the same MU/P (2/5 vs 4/10 [simplifies to 2/5]) and C is only $5, Sam’s next purchase is another unit of C, leaving him with $40. In the third round of purchasing, B provides the highest MU/P (4/10), so Sam purchases a unit of B and has $30 remaining. In the fourth round, B still offers the highest MU/P (3/10), so he purchases another unit of B and has $20 remaining. This process goes on as such until the sixth round of purchasing when Sam has $5 remaining and has acquired a total of 3 units of B and C each, providing a total of 15 “utils.” A table summarizing this “textbook” example is provided below:

Table 1: “Textbook” Example Summary

Selection Round	Product Chosen	Marginal Utility/ Price (MU/P)	Remaining Budget
0	None	0	$50.00
1	C	3/5	$45.00
2	C	2/5	$40.00
3	B	4/10	$30.00
4	B	3/10	$20.00
5	C	1/5	$15.00
6	B	2/10	$5.00

So what concepts of core rationality were illustrated in the marginal utility analysis above? First, the assumption that individuals have complete knowledge of their preferences, as Sam was able to distinguish between the products in each round of selection in terms of how much satisfaction or "utils" he was able to derive from them in relation to price and thus demonstrates preferences between the products. Second, Sam made his decisions in a logically consistent matter. He either consistently chose the product that provided him the most satisfaction in relation to price that was within budget constraints. Knowledge of preferences and logical consistency are critical elements in the conception of core-rationality, but they are certainly not all that is underpinning it. Those that embrace core rationality make additional assumptions about decision-making agents.

First, since agents are utilizing logic in their decision making process, it is assumed that emotions, feeling, or moods do not exert influence in their decision making process. Second, agents are assumed to have no cognitive scarcity when making decisions between any number of options and thus experience zero cognitive opportunity cost. This implies that in the face of ever increasing choices, agents would still be able to make effective decisions that maximized their utility. Third, agents are often assumed to have perfect or complete information relevant to the decision that he is making (this assumption is relaxed about probabilities when discussing Subjective Expected Utility Theory [see below]). As an example, an agent that is shopping for rye bread in a particular grocery store is assumed to know the market price of rye bread, the utility that a loaf of rye bread will provide, the differences between high and low quality rye bread, and the production methods called for in making it.

An extension of the perfect information assumption is the assumption of rational expectations. If agents have access to perfect information and assuming "that in recurrent

situations the way the future unfolds from the past tends to be stable," they are able to make reasonable predictions about the future and act on those predictions (Sargent, 2008). For example, if a consumer receives news that a drought in Nebraska is causing a crop failure of sweet corn and the consumer knows that in the past a crop failure typically results in the shortage of that particular crop, the agent will predict or expect that there will be an increase in the price of corn at some point in the immediate future as quantity demanded outstrips the quantity supplied. Acting on such information, the consumer (assuming sweet corn provides him utility) will visit the grocery store in order to buy more of it before the price increase is reflected in its sticker price.

Further, it is assumed that there is both descriptive and procedural invariance. This means that despite different representations or descriptions of the same item or different procedures for eliciting a particular choice, the agent will still make the same/equivalent choice (Taylor, 2013). To illustrate descriptive invariance with an example, if an agent is given a choice between a dark chocolate bar labeled to be 75% cacao and an identical bar (including price) labeled to be 25% non-cacao, the agent will be indifferent between to those two options under core rationality. An example of procedural invariance under core rationality is if an agent is asked how many years of life in good health is equivalent to 40 years with impairment or disability and responds with "20 years," then the agent would answer "40 years" if asked how many years of impairment or disability would be equal to 20 years of good health (Dictionary Central, 2012).

The discussion of the further assumptions of core rationality has yet to take into account choice in the face of risk and/or uncertainty. Expected Utility Theory (EUT) deals with decisions in which the probabilities of outcomes are known (i.e., risk). EUT holds the assumptions of transitivity and completeness, but also contains the additional assumptions of expectation and

cancellation. The assumption of expectation essentially states that objective probabilities are treated as constants that are multiplied by the subjective preference attached to the outcome and the resulting yield of this is the expected utility, which the agent will maximize (Taylor, 2013). To provide an illustrative example, suppose an agent is given a choice between rolling a fair six-sided die where a result of 5 or higher results in winning a prize worth 10 "utils" and flipping a fair coin where landing on heads results in a prize worth 5 "utils." The expected utility for each option is 3.33 (0.33 * 10) expected "utils" and 2.5 (0.5 * 5) expected "utils." Since the agent is seeking to maximize his expected utility, he will, in this scenario, choose to roll the die.

The cancellation assumption states that agents are able to "eliminate any state of the world that yields the same outcome regardless of one's choice" (Kahneman & Tversky, 2000). Essentially, if the outcomes are identical in different option bundles, there is no impact on the agent's decision. Suppose that an agent has a preference for roasted butternut squash soup over cream of asparagus. Now suppose that agent prefers to have Caesar salad over spinach salad. Further, the agent would eat soup on days where the high is less than 65°F and would eat salad on days where the high is greater than or equal to 65°F. Whether or not the high was above or below 65°F has no impact on the agent's preferences for soup or salad.

The applicability of the cancellation assumption has been called into question through empirical research pointing out inconsistencies or paradoxes in decision making under EUT, the most famous example being the Allais Paradox, which demonstrates that the introduction of an independent event that produces identical outcomes in different option bundles does influence choice behavior (Pegg, 2016). The following table from Kahneman and Tversky's research is used by Pegg to illustrate the type of gamble (in this case, randomly picked balls numbered 1-100) where the Allais paradox occurs:

Table 2: Allais Paradox Gamble				
Lottery	**1 to 33**	**34**	**35 to 100**	**Preference**
A	2500	0	2400	18%
B	2400	2400	2400	82%
C	2500	0	0	83%
D	2400	2400	0	17%

Source: Kahneman & Tversky, 1979 (as cited in Pegg, 2005).

In the first experiment, participants were given a choice between lotteries A and B and given a choice between lotteries C and D in the second experiment. In the first experiment, most participants chose lottery B, which illustrates an aversion to risk, but in the second experiment, most participants chose C, which is the riskiest option between C and D. In EUT, if agents express an aversion to risk, then they should always express an aversion to risk as the assumption of cancellation means that agents would ignore identical outcomes in different option bundles or gambles. In the case presented above, the payout of the gambles in both experiments is equivalent if a ball at or between 35 and 100 is picked and if the event of picking a ≥ 35 ball were disregarded, then the two experiments would contain identical gambles. Agents who expressed risk aversion in the first experiment by picking gamble B should pick gamble D in the second. However, the table above shows that this is clearly not the case and that an independent event introducing payouts that would be ignored if the cancellation assumption held true did influence participants decision making, thereby calling the cancellation assumption into question.

Game theory, at least within the context of economics, is largely an extension of Expected Utility Theory, but has the important distinction of having the agent consider the possible or potential actions of others when making his choice. Though the assumptions of core

rationality with regards to individuals still apply, there are further assumptions to be included. Before delving into those assumptions, it is important that a clear definition of a game is established. A game is a situation in which "at least one agent can only act to maximize his utility through anticipating (either consciously, or just implicitly in his behavior) the responses to his actions by one or more other agents" (Ross, 2016). In these games, each agent (or player) faces a choice among different strategies, which are essentially plans of action that tells the player what to do for possible strategies other players might use. What agents believe or fail to believe about each other's strategy can have a significant impact on the outcome.

There are effectively two broad types of games: games with perfect information, in which the player knows everything that has happened in the game up to the point that the player takes his action, and games with imperfect information, where the player does not know everything about what has happened in the game up to the point where the player takes his action. Further, there are two categories of order of play: sequential move, where a player does know what their opponents have done or will do before the player makes his decision, and simultaneous move, where players do not know what strategy the other players have or will commit to before they make their decision.

Purely sequential move games are often logically simple games with perfect information where the optimal strategy is determined through the process of backward induction, where the player chooses their first action by considering each possible response and counter response that will result from each possible action the player can take. The player then determines which final outcome maximizes their utility and goes with the decision chain leading to that outcome (Ross, 2016). Simultaneous move games and mixed (containing both simultaneous and sequential moves) games are considered to be games with imperfect information.

To establish a better understanding, let us use the classic example of game theory: The Prisoner's Dilemma. Suppose two suspects are being held in separate cells and the police approach these inmates with the following deal to each of them: If one suspect confesses to his crime and implicates his partner and he does not confess, he is free to go and his partner faces 15 years in prison; if both of them confess, they each face a 7 year sentence; and if none of them confess, they each face just 3 year sentences. The matrix below illustrates the potential outcomes:

Table 3: Prisoner's Dilemma Matrix

Prisoner 1	**Prisoner 2**	
	Confess	**Not Confess**
Confess	7,7	0,15
Not Confess	15,0	3,3

For the purposes of this scenario, this particular example of the prisoner's dilemma is a simultaneous move game, meaning that neither prisoner will know what the other will do before they make their own decision. Each prisoner then evaluates the potential outcomes of their own possible actions. If Prisoner 1 confesses and Prisoner 2 does not, then Prisoner 1 will be released; if Prisoner 2 confesses as well, Prisoner 1 serves a 7 year sentence. Likewise, if Prisoner 1 decides to not confess he could face either a 3 year sentence or a 15 year sentence, depending on the actions of Prisoner 2. Assuming that Prisoner 1 maximizes his utility by spending the least amount time in prison as possible, he will choose to confess, as he could face either no jail time or just 7 years instead of 3 or 15 years in prison. Prisoner 2, facing identical circumstances, will confess as well.

Subjective Expected Utility Theory (SEUT) is largely the same as Expected Utility Theory, with the very important distinction that the probabilities are unknown (i.e., uncertain) and are thus subjective or what the agent believes the probabilities of particular outcomes to be. EUT's assumptions of Expectation and Cancellation are modified to account for subjective probability rather than objective probability. An illustrative example of SEUT in action is an agent picking one letter tile from 100 randomly assorted Latin alphabetical character tiles in an opaque cloth bag. Suppose the agent wanted to pick a tile with the letter 'A'. The agents has no idea as to what tiles are in the bag—they could all be A's or there could be no A's at all. As such, the agent is left with only what he believes to be the likelihood of picking an 'A' tile.

Like EUT, SEUT is beset by paradoxes, the most famous of which is the Ellsberg Paradox, which argues that when an agent is faced with a choice between gambles with a known probability and an unknown probability (uncertainty), the agent will almost always choose the gamble with a known probability, even if the probability of winning a payout in the gamble with a known probability is low (WNET, 2008). To illustrate, the experiment described in the brief Thirteen article, starts with a bag filled with 90 colored balls. 30 of those balls are red, and the remaining 60 are a mixture of blue and yellow balls, the proportions of which are unknown. Experiment participants presented with this bag has a choice between two gambles of drawing a ball at random from the bag: A, if red is picked, then each participant wins $100; and B, if blue is picked, the payout is $100. Under the Ellsberg paradox, since the participants know that there is a 1/3 chance of picking a red ball but do not know the probability of picking a blue ball (the mixture could have been almost all blue balls to almost none at all), most participants picked gamble A, even if they only had a 1 out of 3 chance of winning.

Now, with the same bag, the participants are presented with another choice between two gambles: C, if red or blue is picked, then each participant wins $100; and D, if yellow or blue is picked, the payout is $100. The participants now do not know the probability of picking either a red or a blue ball (as the probability of picking a blue ball still remains unknown) but do know that two-thirds of the contents of the bag are the yellow and blue ball mixture, so most of the participants pick gamble D. This is where the paradox lies, as the cancellation assumption (applies to SEUT as well as EUT) argues that the participants should have ignored the unknown probability of picking blue in both gambles C and D as they are identical outcomes. Thus, the participants would have only have compared the known probability of picking a red ball and the unknown probability of picking a yellow balls and if they had shown an aversion to uncertain probabilities like they did in the first experiment by picking gamble A, then they should have picked gamble C instead of D. However, the majority of participants picking gamble D shows another violation of the cancellation assumption.

Standard economics argues that the aggregate outcomes of exchanges between core rational agents, assuming no market failures, lead to allocative/economic efficiency, which is when goods and services that people desire are produced at their lowest possible cost given existing technology (Taylor, 2013). This allocative efficiency is usually represented graphically as the point of equilibrium found at the intersection of the supply and demand curves. The primary policy of standard economists is to promote allocative efficiency through Pareto optimality, which can be defined as the exercise of economic exchange until no agent can be made better off without making another worse off (2013). However, government policy is required to address the issues that Pareto optimality does not or cannot address (e.g., foreign and military affairs) as well as address market failures.

It is the consideration of the limits of Pareto optimality's reach and dealing with market failures that have proponents of core rationality (and by extension, economic rationality) not only concern themselves with the rationality of individual choice and the rationality of individual choice in the context of potential response from other agents, but also consider social rationality. Social rationality concerns itself with "the aggregation of individual inputs… into collective outputs" (e.g., voting for legislators that make laws that apply everyone within a nation state) (List, 2013). Social rationality attempts to explain how a collective body, such as a legislator, arrive at coherent collective preferences on the basis of the individual preferences of members of society. Given that individual preferences are economically rational, Kenneth Arrow proposed five properties of an ideal voting system that could lead to coherent collective preferences on the basis of individual preferences (Arrow, 1963). Unfortunately, these five properties collectively lead to Arrow's impossibility theorem or voting paradox as there was no voting system, including majority voting, that could satisfy all five of those conditions (Skousen & Taylor, 1997). The following are the five conditions of Arrow's impossibility theorem as found in Chapter 36 of *Puzzles & Paradoxes* by Mark Skousen and Kenna Taylor (1997):

1. **Group Rationality**. The voting rule used to aggregate individual preferences should be rational in that the resulting social preferences are complete and transitive.
2. **Unrestricted domain**. The voting rule used should allow for all possible combinations of individual preferences.
3. **Pareto optimality**. The voting rule should produce a preferred choice if it is preferred by all voters.
4. **Independence from non-agenda alternatives**. The voting rule relating to agenda alternatives should depend only on the preferences of individuals for those alternatives and not on the evaluation of non-agenda alternatives.
5. **Non-dictatorship**. The voting rule should not mirror a single individual's preferences over every possible set of alternatives.

As stated earlier, it is impossible to have a voting mechanism that holds all five of these conditions simultaneously. If, for example, the conditions 2, 3, and 4 hold true, then condition 1 can only hold true if condition 5 is violated (1997). Since there is no mechanism that can satisfy all five of these conditions, voting outcomes can be unstable, which can result in cyclical majorities and voting equilibrium not being achieved. However, voting paradoxes are less than certain due to real-world voting institutions being subject to voter manipulation strategies. Such strategies include log rolling, (a policy maker agrees to vote in favor of a policy that he would have otherwise opposed in exchange for another politician's support for a policy that the first policy maker is in favor of), agenda control (control of the order in which different potential policies are voted on), and strategic voting (agent voting for a policy or candidate other than his first choice out of a belief that his first choice has no chance of winning and wants to stop another option from being chosen) (1997).

Conclusions & Policies

Core rationality, in creating a model of an agent that essentially makes consistent logical decisions in the pursuit of maximizing utility, gives neoclassical economists the ability to construct relatively elegant and scalable economic models based in mathematics and deductive reasoning. One such simple model is the downward sloping demand curve. If the price of a good or service declines, then the quantity demanded of that good or service would increase as the ability of either an individual or entire market to purchase more of that good or service becomes possible under given material constraints.

In terms of policy, since core rational agents are logical decision makers, adherents to core rationality imply that individuals are best suited to making decisions that affect their

economic well-being, and thus support policies that maximize freedom of choice and puts those decisions in the hands of these individuals. In other words, adherents to core rationality advocate expansion of economic freedoms.

One such policy concerns the issue of privatization of social security in the United States. In the July 3, 2000 issue of *Business Week*, Harvard economist Robert J. Barro argued for personal social security accounts not because yields on private accounts would be higher than the current scheme (in fact, he argues that this isn't necessarily true given that the estimated higher return come with a higher risk,) but because such accounts would give the individual control over the assets that compose their personal account and thus could " tailor their own portfolios to their own preferences about risk vs. return" (Barro, 2000).

Volumes upon volumes of criticism have been written about standard economics, both in terms of methodology and policy. One common criticism of standard economics is that it does not include the addressing of inequalities in income/wealth distribution or of expanding property rights to more sectors of the population as core values and that the lack of the attention paid to these issues by standard economics has helped fuel the increase in unequal income/wealth distribution.

What this means is that though standard economists' push for policies that enhance economic freedoms and freedom of choice, they do not follow up with policies that would address or alleviate the material constraints that prohibit sectors of the population from benefitting from the expansion of economic freedoms. Some policies that expand economic freedom, such as lowering or eliminating estate taxes (requirement for filing starts with estates with combined gross assets and prior taxable gifts of $5,450,000 in 2016 [Internal Revenue

Service, 2016]) or eliminating restrictions on conducting investment abroad only have meaningful impact a small, wealthy subset of the population.

Further, not only does income/wealth inequality mean that sections of the population do not receive much benefit from expanded economic freedoms, but those greater freedoms exacerbate the growth of income/wealth inequality as individuals have the means to take advantage of those economic freedoms to further enrich themselves.

Bounded Rationality

Explanation

Bounded rationality does not readily accept and even challenges many of the assumptions made by core rationality, especially knowledge of preferences and consistently logical decision making. Behavioral economics, the most widely known school of economic thought that embraces bounded rationality, cites the results of numerous laboratory experiments to test how human being make choices and those results show that many of core rationality's assumptions do not hold up in the face of empirical examination (Simon,1976). Thus, behavioral economists, such as Dan Ariely, have argued that while human beings are certainly capable of engaging in rational decision, it is not unlimited but rather it is "bounded." To better explain bounded rationality, it is best to explore what some of those "bounds" are.

One such bound is relativity, which in this context means that individuals examine the choices in front of them only in relation to each other. In other words, they make local

comparisons to available alternatives (Ariely, 2010). Using an example drawn from Ariely (which he himself drew from research from Daniel Kahneman and Amos Tversky), a group of people were told that a pen is $25 at store A, but that same pen is only $18 at store B 15 minutes away. Since $7 seems like significant savings relative to $25, many people choose to make the journey to the other store for the cheaper pen. Suppose that instead of a $25 pin, it was a $455 suit being sold at store A and that at store B across town, the same suit is being sold for only $448. Would this group of people choose to make the journey to save $7 again? Under core rationality, since the time to get to store B and the money saved are the same in both scenarios, the answer would be yes. On the contrary, Ariely states that most people stated that they would not (2010). This flies in the face of core rationality's assumption of logical consistency as people are choosing in one scenario to make a trip to save $7 and yet refuse to make the same trip to save the same amount of money in another.

A phenomena related to relativity is the "decoy effect," which is essentially when an inferior version of one of two choices is introduced as a third option and significantly alters what agents choose as their most preferred option (Ariely, 2010). Ariely demonstrates this effect in an experiment he conducted on 100 students at MIT's Sloan School of Management when he presented three different options for subscriptions to *The Economist*: $59 for online access, $125 for the print edition, and $125 for print and online access. Most students (84) opted for the print and web offer, only 16 chose just online access, and none chose just the print edition. In the next round of experimentation, he removed the print-only option and there was a surprising result: over two thirds of the students (68 vs 32) chose just the online subscription instead of the print and online package (2010).

Again, this is evidence that challenges core rationality's assumption of logical consistency and it seems that the students in this experiment are not sure about their preferences. If the print and web offer was overwhelmingly preferred in the first round, why was this not so in the second when the print only offer was removed? Dan Ariely argues that if two options out of three or more are easier to compare to each other (often meaning that they are more similar), then people will focus on those two options and largely ignore the rest (2010). In this case, print only and print and online subscriptions were of the same price, thus allowing the students to make the easier direct comparison between those options in terms of what is offered and ignore the online only offer. When the print only option was removed, consumers had only the choice between a cheaper online access and a more expensive online and print package and thus the majority chose the online version.

As mentioned earlier in the previous section of this paper, core rationality assumes that individuals have unlimited cognitive capacity and ever increasing options present only benefits in terms of more opportunities to maximize utility. However, the phenomenon of choice paralysis, as outlined by the likes of Barry Schwartz, shows that that is not the case. In his book, *The Paradox of Choice*, Schwartz demonstrates that the abundance of choice in almost every facet of modern life (shopping, college, and even retirement plans) has led to more dissatisfaction among people as they either give up on making the choice or they are disappointed with the choice that they do eventually make (2004). Several factors that may contribute to this choice dissatisfaction in the face of an abundance of choice include: more time and effort to gather information in order to make informed decisions; the weight of opportunity costs (which go beyond just the "next best" alternative to all considerable alternatives); expected and experienced utility being poor predictors of actual utility; and anticipated regret.

Additionally, Schwartz made a distinction between individuals described as “satisfiers” (originally coined by Herbert Simon [1976]) and “maximizers.” While maximizers do in large part seek out to maximize their utility, satisfiers often will settle on an option that meets or exceeds certain minimum criteria. In drawing this distinction, Schwartz wanted to emphasize that those that suffer choice dissatisfaction or paralysis are maximizers, as finding the most satisfying option becomes more burdensome as the abundance of choice grows (2004). However, Schwartz expresses caution over labeling people as entirely a “satisfier” or entirely a “maximizer” as he clarifies that people are often “satisfiers” with certain types of goods and “maximizers” with others. Nevertheless, Schwartz’s distinction between “satisfiers” and “maximizers” presents a challenge to core rationality’s implicit assumption of all agents being utility maximizers.

Any discussion of bounded rationality would be incomplete without bringing up Kahneman’s pivotal idea of the dual model of decision making found in *Thinking, Fast & Slow*. In essence, Kahneman argues that there two modes of thinking: System 1, which is automatic, fast, and the agent has little to no voluntary control, and System 2, which is slow, deliberate, and the agent is largely in control (2011). System 1 typically handles automatic activities such as orienting to a sudden sound, performing rudimentary arithmetic, and understanding simple sentences. System 2, on the other hand, deals with more complex and mentally demanding activities, such as paying attention to one’s behavior at a formal party or solving a non-rudimentary calculus problem.

While it may seem that these systems may have their specified roles, conflict between both systems does occur. This can be seen in System 2 imposing self-control over the agent and subduing System 1’s reaction to an event. For example, suppose the agent painfully stubs his toe during his boss’s Christmas party. System 1 may have the agent try to grab and hold his foot and

perhaps shot expletives as a reaction, but System 2 would make the agent aware of where he is and make him grin and bear his pain in order to avoid making an embarrassing scene at his boss's party. Though System 2 may result in better or at least more deliberate outcomes, it comes at the cost of more cognitive effort, which can lead to System 1 dominating as it costs little cognitive effort.

Further, Khaneman categorizes the various types of "automation" conducted by System 1 into numerous heuristics and biases. An example of a heuristic can be found in what Kahneman describes as "substitution," which essentially means that when an agent is presented with a question that the agent can't answer quickly and easily, System 1 leads to the subconscious replacement of the original question with one that is easier to answer (2011). If, for example, an agent was asked about how happy he is about his life overall, the agent will actually answer the heuristic replacement question pertaining to his current mood. A related heuristic is known as the affect heuristic, which states that people's likes and dislikes shape their beliefs about the world (2011). For example, if an agent had a strong negative emotional reaction to the concept of genetically modified food crops, that emotional reaction would drive the agent to believe that the further development of GMOs would have unacceptably high risks and that the benefits would be negligible at best. In essence, if you asked that agent his opinion about public policy towards genetically modified food crops, the answer he provides is actually answering the question about how he *feels* towards genetically modified food crops. Clearly, this heuristic challenges the assumption of "emotional neutrality" in decision making made by core rationality.

Bounded rationality comes in more than the flavor provided by behavioral economists. Ecological economics uses myopic rationality, which is a category of bounded rationality that stipulates that agents under contemporary market systems reveal short run planning horizons and

narrow concern horizons. The problem from an ecological perspective is that myopic rationality implies that agents only consider their decisions in the present space and time and often ignore the potential future consequences of their individual actions as well as the collective consequences emerging from the (Taylor, 2016). Further, agents make their decisions within in the present and often ignore the further implications of their own individual choices and the collective consequences.

The cognitive capacity of an agent is a product of evolution where for most of human history, humans have primarily been concerned with meeting survival needs. This limits the ability of agents to fully consider the present and future of their decisions. Further, the time horizon for most humans is the near future and the concern horizon is hierarchically limited to oneself, followed by family, then friends, and etc., but the global ecosystem is rarely of concern. With regards to narrow time horizons, human agents in myopic rationality are assumed to be seekers of immediate satisfaction but environmental feedback can lead to future dissatisfaction (2016).

Additionally, myopic rationally acknowledges that humans are social creatures that compete for social status. Beyond goods that meet material need, most goods demanded are *positional goods* in the sense that the utility of the goods are provided by the desirability of the good by others. Acquiring these goods is a zero sum game as other agents are engaged in the same process. As agents seek to "one-up" others in their same social class, they will try to increase their income in order to acquire better positional goods and a higher social status, but have now entered into the same zero sum game with a new social class. This process often occurs in repeated succession which explains why it is called *rat race consumption* (2016).

Attenuated rationality is the type of bounded rationality utilized by Radical Economics. In essence, agent decision making is compromised and an agent's decisions are not authentically their own (Taylor, 2013). Members of the working class are unconsciously manipulated by business interests and their state allies whereas capitalists feel justified in their acquisition of power within society. Further, individual rationality is the product of illusions about the nature of social reality produced by the workings of capitalism and the attitudes it perpetuates. Class and political power shape the economic structure and cultural values within which individual choices are made. Both workers and capitalists effectively embrace a false image of society as being one made of materially incentivized, free individuals whose individual responsibility dictated by self-determined productive will lead to pervasive economic growth (2013).

Conclusions & Policy

Since bounded rationality refutes many of the assumptions made by core rationality, especially complete knowledge of preferences and logical consistency, it comes as no surprise that some degree of doubt is cast upon the models based upon core rationality's assumptions. However, Dan Ariely argues in *Predictably Irrational* that human beings are still capable of behaving in a way that approaches what core rationality models if they are made aware of the potential lapses in their decision making processes, such as only thinking in relative terms, and make efforts to overcome them (Ariely, 2010).

As mentioned earlier, bounded rationality argues that human agents do not hold a strong grasp on their preferences nor are always logical consistent. Supporters of bounded rationality, cast doubt on core rationality adherents' notion that individuals always "know what is best" for themselves and thus are less inclined to freely expand individual choice (Ariely, 2010).

However, bounded rationality adherents rarely calling for the removal of individual choice, but often advocate for policies that alter the choice architecture/framing. Using the example of retirement savings policy, Melissa Knoll argues for such architecture altering policy, such as narrowing the "choice bracket" when trying to persuade people to save for retirement (Knoll, 2005). In essence, instead of reminding people how much they need to have saved by the time they retire, which is usually a rather large amount of money, remind them of how much they need to save per day, which is a smaller, almost trivial amount.

Referring back to Kahneman's dual mental system, adherents to bounded rationality, such as Dan Ariely, would like to move agents towards using their System 2 processes (or at least achieving System 2 preferences) over System 1 without infringing on their liberty. One way to do this would be through "nudges," (term originally coined by Richard Thaler and Cass Sunstein [2008]) which can be roughly defined as any aspect of choice architecture that alters behavior or decision without taking away choices or significantly altering their economic incentives (Taylor, 2016). Further, nudges have to be cheap and easy to avoid. A simple example of a nudge would be a convenience store putting water and juices at eye level in its coolers instead of sugar laden sodas. As they are the first things that customers will notice when they approach the coolers, it is more likely that water or juice would be the items that they would purchase due to System 1 minimizing cognitive effort through minimization of search time. Nothing is stopping the agents from purchasing carbonated soft drinks, they are simply just not as prominently featured. Outright banning the sale of those sugar laden sodas would not be a nudge but rather a "shove."

Nudges can be divided into a couple of types, depending on who is putting the nudge in place. Self or personal nudges are nudges that individuals apply to themselves in order to use

certain System 1 incentives in order to override ones they wish to avoid (Taylor, 2016). These types of nudges certainly do not violate the liberty of the agent as it is the agent himself applying the nudge. Examples of nudges can be a self-imposed rule to avoid the candy aisle when one goes grocery shopping in order achieve the System 2 interest of maintaining a healthy weight or invest in certificates of deposits that come with a penalty for cashing them in before they have matured in order to meet the System 2 goal of adequate savings.

Another category of nudges is private business nudges which are often used to increase sales. In this and the subsequent categories of nudges, concerns are raised over impacting an individual's welfare. If a firm's "nudge" raises profits but results in a decline in an individual's welfare by priming System 1 when a System 2 preference is the goal (such as pastry shop using fragrance to attract customers to purchase carbohydrate laden sweets) , then this would be a false nudge. However, a true private business nudge does involve improving the individual or customer's welfare along with raising profits, such as placing salad options at the front of the buffet (salads cost less than other types of food and salads are healthier to eat for the customers) (2016).

The third category of nudges is public policy nudges which are used by governments to try to improve societal welfare by privileging System 2 goals over System 1 desires (2016). A classic example of the public policy nudge is the automatic or default opt-in to a 401k retirement plan for new employees. It helps meet the System 2 goal of saving for retirement by taking advantage of the System 1 preference of the status quo or not changing. Controversy over public policy nudges lies in whether it is a true nudge or a "shove," which violates liberty of choice. In terms of public policy, whether or not liberty of choice is violated can be determined by democratic voting processes (2016).

Ecological Rationality

Explanation

Proponents of ecological rationality share many of the same critiques and objections that proponents of bounded rationality make to many of the same assumptions of core rationality, including complete knowledge of preferences and logical consistency. To discuss in detail ecological rationality's refutations of core rationality's assumptions would largely be repeating material from the previous section. Arguably, ecological rationality could be considered another subdivision of bounded rationality due to the large overlap with bounded rationality of criticism it has for core rationality's assumptions. However, where ecological rationality is distinct enough from bounded rationality to warrant discussion of ecological rationality as a separate form of rationality.

Proponents of bounded rationality, especially behavioral economists, seem to have the implicit assumption of System 1 operations, such as heuristics and other mental shortcuts, to be inferior to System 2 operations. In other words, heuristics and other System 1 operations are regarded as obstacles to be overcome or "nudged" out of the way on the road to approaching a "truly rational" decision making process.

Scholars who are proponents of ecological rationality, such as Gerd Gigerenzer and Vernon Smith, hold a more nuanced view. Gigerenzer essentially argues that whether or not a decision or a decision process is rational depends on the context/circumstances in which it is

made (especially if those circumstances include an element of uncertainty) and argues that ecological rationality tries to establish what circumstances or environment in which a particular heuristic would work (Institute for New Economic Thinking, 2012). Thus, heuristics or System 1 processes are not necessarily flawed or second best in comparison to core rational or System 2 processes. Further, Gigerenzer argues that some heuristics can achieve better results than those of core rational processes in certain circumstances. One example of such a heuristic is the 1/N or "divide equally" heuristic. In essence, an agent would simply take an amount of money that he wished to use for investment and divide it equally among "N" number of funds. This stands in contrast to Harry Markowitz's rational Mean-Variance model for investment, which takes into account a swath of variables and historical market performance data in order to make investment decisions (2012). Gigerenzer states that given the predictive uncertainty of the stock market, a sufficiently large "N" or number of funds, and relatively small time frame or learning sample (e.g., 10 years) the 1/N heuristic model outperformed the Mean-Variance model. Gigerenzer argues that this is the case as heuristics, such as 1/N, are robust tools when faced with uncertain circumstances and that the Mean-Variance model was trying to optimize by accounting for risk in the face of uncertainty or unknown risk.

Vernon Smith, who developed his notion of ecological rationality independently from Gigerenzer, views ecological rationality in a more systemic scope in that he regards it to be the study of the undesigned system (analogous to Gigerenzer's heuristics) that emerges from human cultural and biological evolutionary processes that produce principles of actions, norms, and traditions (i.e., an analog to Gigerenzer's environment/circumstances) (2003). It attempts to understand the intelligence behind the rules, norms, and institutions that are formed through undesigned human interaction that people appear to follow or accept without necessarily being

able to articulate what those rules, norms, and institutions are. However, Smith argues that even if people cannot articulate those rules (and by extension, their preferences, which are unknown), they can be discovered through empirical research in the form of experimental economics, which is the study of economic decision making through controlled experiments.

One example Smith cites in support experimental economic research in being able to discover underlying rules and preferences is the emergence of the hub-and-spoke network organization in the airline industry after its deregulation in the late 1970's (2003). Marketing surveys conducted by the airlines at the time that showed customers wanting nonstop service between secondary cities were unable to reveal customers' unknown (and real) preference for a high frequency of daily departure and arrival times that were only revealed through market experimentation. Combined with the financial unsustainability in of nonstop service between secondary cities in a now deregulated industry, an ecologically rational equilibrium emerged in the form of the hub-and-spoke system which met both customers' unknown but real preference for frequent departure and arrivals and industry desire to maintain profitable load factors (2003).

Conclusions & Policy

If Gigerenzer and Smith are representative of proponents of ecological rationality, then it appears that they view human agents as less hindered (and even helped in certain circumstances) by System 1 processes than their bounded counterparts. As such, proponents of ecological rationality express wariness and even criticism for nudges (Gigerenzer, 2013) supported by proponents of bounded rationality.

However, the concern with nudges does not mean that proponents of ecological rationality do not see ways in which human decision making processes can be improved. For

example in his 2013 TEDx talk in Zurich, Gigerenzer argues that much of the public has a poor grasp of understanding probabilities and their implications, which often leads to less than optimal decision making. Rather than nudge people towards a rational, System 2 outcome, Gigerenzer advocates for educating the public so that they develop "risk literacy" and thus be able to make better decisions involving known probabilities themselves.

Conclusion

If the main points of this paper were to be summarized in a very "quick and dirty" fashion, then the following would be such a summary:

- **Core Rationality:** Agents know what they want (complete knowledge of preferences) and know what they are doing (logical consistency, perfect information, etc.). Therefore, economic freedom and freedom of choice should be expanded.
- **Bounded Rationality:** Without context or reference, agents often do not know what they want (uncertain preferences) and often do not know what they are doing (logical inconsistency). Therefore, freedom of choice should not be expanded but not restricted and agents should be nudged towards optimal/rational choices.
- **Ecological Rationality:** True agent preferences are unknown to the agent, but can be revealed, and whether or not the agent's decision process is rational depends

on the circumstances in which it occurred. Freedom of choice should not be restricted and agents should be better educated to make better decisions rather than nudged.

As stated at the beginning, the purpose of this paper was to serve as a teaching tool that explains what core, bounded, and ecological rationalities are in the context of economic decision-making; illustrates the differences between them; and connects them with economic perspectives and policies. If this research were to be continued or expanded, potential avenues of future research could include determining whether or not other forms of rationality (within in the context of economics) exist and exploring them as well as further elaboration on economic policies that would fall under any of the rationality types.

Works Cited

Ariely, D. (2009). *Predictably Irrational: The hidden forces that shape our decisions*. New York, NY: Harper.

Arrow, K. J. (1963). *Social choice and Individual Values*. New York, NY: Wiley.

Barro, Robert J. (July 2000). Privatizing Social Security: Where Both Sides Go Wrong. *Business Week*. Retrieved March 21, 2016 from http://rbarro.com/popular-writings/.

Denzau, A. (1992). *Microeconomic Analysis: Markets & Dynamics*. Homewood, IL: Irwin.

Dictionary Central. (n.d.). Procedural Invariance. Retrieved April 23, 2016, from http://www.dictionarycentral.com/definition/procedural-invariance.html

Gigerenzer, G. (2013, December 19). Risk literacy: Gerd Gigerenzer at TEDxZurich. Retrieved April 25, 2016, from http://tedxtalks.ted.com/video/Risk-literacy-Gerd-Gigerenzer-a.

Internal Revenue Service. (2015, December 2). Estate and Gift Taxes. Retrieved April 27, 2016, from https://www.irs.gov/Businesses/Small-Businesses-&-Self-Employed/Estate-and-Gift-Taxes.

Institute for New Economic Thinking. (2012, April 12). Gerd Gigerenzer: What Can Economists Know? 2/5. Retrieved April 24, 2016, from https://www.youtube.com/watch?v=DdEEwoKkfMA.

Kahneman, D. (2011). *Thinking, Fast and Slow*. New York, NY: Farrar, Straus, and Giroux.

Kahneman, D., & Tversky, A. (2000). *Choices, values, and frames*. Cambridge, UK: Cambridge University Press.

Knoll, Melissa A. Z. (2010). The Role of Behavioral Economics and Behavioral Decision Making in Americans' Retirement Savings Decisions. *Social Security Bulletin*, *21*(3), Retrieved March 20, 2016 from: http://www.ssa.gov/policy/docs/ssb/v70n4/v70n4p1.html.

Kolodny, N., & Brunero, J. (2016). Instrumental Rationality. *Stanford Encyclopedia of Philosophy*. Retrieved March 22, 2016, from http://plato.stanford.edu/entries/rationality-instrumental/.

List, C. (2013). Social Choice Theory. *Stanford Encyclopedia of Philosophy.* Retrieved April 24, 2016, from http://plato.stanford.edu/entries/social-choice/.

Pegg, E., Jr. (2005, January 31). Allais Paradox. Retrieved April 24, 2016, from http://mathworld.wolfram.com/AllaisParadox.html.

Ross, D. (2016). Game Theory. *Stanford Encyclopedia of Philosophy*. Retrieved March 24, 2016, from http://plato.stanford.edu/entries/game-theory/.

Sargent, T. (2008). Rational Expectations. *The Concise Encyclopedia of Economics*. Library of Economics and Liberty. Retrieved April 9, 2016 from: http://www.econlib.org/library/Enc/RationalExpectations.html.

Schwartz, B. (2004). *The Paradox of Choice: Why more is less*. New York, NY: Ecco.

Simon, H. A. (1976). *Administrative Behavior: A study of decision-making processes in administrative organization*. New York: Free Press.

Skousen, M. & Taylor, K., (1997). The voting paradox. In *Puzzles and Paradoxes in Economics* (pp. 175-181). Cheltenham, UK: Edward Elgar Publishing.

Smith, V. L. (2003). Constructivist and Ecological Rationality in Economics. *The American Economic Review, 93*(3), 465-508.

Taylor, K. (2016). The Ecological Economic Perspective (ECL). From unpublished manuscript.

Taylor, K. (2013). The RAD Perspective. From unpublished manuscript.

Taylor, K. (2016). STA: BEH. From unpublished manuscript.

Taylor, K. (2013). STA: Economic Conservative (CON) & Economic Liberal (LIB) & BEH Views. From unpublished manuscript.

Taylor, K. (2013). STA Utility Models: Modern Versions of Utility Theory for Expressing Rationality. From unpublished manuscript.

Thaler, R. H., & Sunstein, C. R. (2008). *Nudge: Improving decisions about health, wealth, and happiness*. New Haven, CT: Yale University Press.

WNET (2007). The Ellsberg Paradox. Retrieved April 25, 2016, from http://www.thirteen.org/curious/mind-brain-machine/the-ellsberg-paradox/.