Altruism and Economic Modeling:
A Proposal for a Budget Constrained Utility Optimization Model Addressing Altruism

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ECON 5900
Spring 2018

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April 13, 2018
Abstract

My paper proposes a model that explains consumption decisions involving altruism, a behavior that has largely been discussed by economists as only a theoretical matter. As economists throughout history have sought to model decision-making on various scales, they have made many assumptions. The assumptions of self-interest and utility maximizing are often treated as if they are synonymous. I first lay out that in order to maximize utility, actors make decisions in their own self-interest, as well as that of others. Then, I propose a model for the optimal allocation of wealth between self-interested and altruistic consumption, and constrain it based on a budget set. I then discuss a few applications of this model and consider how it may be extended upon or utilized in the future.
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Introduction:

Economics, as it is commonly taught and understood, is largely based on a complex set of models and formulas that in aggregate are ideally explanatory of human behavior and decision-making. The very nature of a model necessitates making assumptions in order to more simply illustrate a complex reality. Every economic model makes a series of assumptions, and while some are stronger than others, it is generally the aim to create a model that relates to empirical data with considerable accuracy. When a disparity arises between current models and observed behaviors, models must be modified, or new ones created, to accommodate.

Economists have always used simplified models to explain decision making, but the true rise of economic modeling as we know it began in the late 19th century. Several economists in different countries simultaneously began to standardize economic ideas by incorporating them into a series of models. At the most rudimentary level, supply and demand curves were born, relating price to quantity on either side of the market. This new line of thinking came to be known as “neoclassical economics”, first coined by Thorstein Veblen in 1900. Neoclassical economists built complex models that managed to make mathematical and intuitive sense of all sorts of behaviors. To do so, they asserted three primary assumptions:

1. People have rational preferences between outcomes that can be identified and associated with values.
2. Individuals maximize utility and firms maximize profits.
3. People act independently on the basis of full and relevant information.

These assumptions, while useful in constructing a framework for economics, are incredibly strong. As a result, we have reason to believe that models derived from these assumptions, while undoubtedly useful as a framework, are innately incomprehensive in their explanation of behavior. So, what do we do in response? We refine and expand upon existing work. That is what I will do in this paper.

Neoclassical economists have constructed a series of models that explain consumption at a personal, firm, and state level (many are generalizable to all three). I assert that a new consumption model ought to be created to account for an empirically relevant flaw in the above assumptions: the omission of altruism. I hypothesize that altruism is not only relevant to a better
understanding of decision making, but that a useful and simple consumption model can be created to account for it.

In the following pages, I plan to establish a working definition of altruism, explain how it has been generally omitted in models thus far, argue that it ought not be, and finally, propose and expound upon a model that captures the altruistic behaviors of individuals, firms, and states. However, before I proceed, I do want to add a brief disclaimer: I am in no way discrediting the foundational models upon which neoclassical economics is built, nor am I suggesting that an assumption of self-interested utility maximization should never have been made. No model is perfect or complete, and there is always room for expansion. The following work is merely a suggestion of a supplementary model, not an attempt to invalidate or replace existing models.

**Altruism v. Self-Interest:**

In undergraduate level macroeconomics courses, several consumption models are taught. They are meant to explain the general trends in how an individual might be expected to allocate their income depending on a set of exogenous variables. One of the many assumptions made by the models is that all actors are ultimately self-interested; that is, certainly prone to make every decision with regard to themselves. In fact, one of the most broadly applied assumptions is that actors make decisions to maximize their own utility (Mankiw 2015). There is, however, extensive literature that explores other factors that may motivate individual’s consumption habits besides his or her own personal benefit.

Current models are, in a sense, cleared of this accusation by asserting that all spending, selfish or selfless, is ultimately in interest of one’s own utility maximization because to be selfless is viewed as useful to some individuals. This idea, while it validates current models, does not decrease the relevance and usefulness of a new model that could perhaps draw distinctions within an actor’s consumption habits between self-interested spending and altruistic spending.

There are many interpretations of what economists mean when they talk about the assumption of “self-interest”, thus there are many interpretations of what one might be claiming about a decision that is “selfless” or “altruistic”. My working definition of self-interested behavior, derived from a paper combining psychology, biology, and economics, is any behavior that increases individual fitness (Simon 1993). “Individual fitness” increasing behavior is comprised of actions that explicitly make oneself better off. These behaviors might improve physical or mental health, provide financial stability, or satisfy some craving or interest. It is impossible to make a comprehensive list of behaviors that are self-interested and behaviors that are not, but qualitative judgments can generally categorize most behaviors. It may be said that an economist’s interpretation of “self” is a strict egoism (Harrison 1986) and any decision that is not made for entirely egoistical or fitness increasing reasons is self-less. Extensive literature in fields ranging from philosophy to environmental science speculate about what altruism (or selflessness, the two are synonymous here) actually denotes (Becker 1976 and Fehr 2003), but for the purposes of this paper, I assert that any decision to sacrifice resources in a manner that does not directly improve one’s own personal fitness is an altruistic decision.
Altruism and Economic Modeling

Altruism in decision-making may take many forms. Group identity may drive one to contribute resources to the fitness of a group rather than oneself. It has been shown that attitudes toward welfare policies, for instance, can be shaped by racial identity and a sense of loyalty to the background from which a wealthy individual may have come (Luttmer 2001). A strong moral or ethical conviction for fairness, justice, or equality may also lead to altruistic tendencies. Individuals who believe that the poor are typically victims of circumstance who deserve more than they are dealt tend to show strong support for and participation in wealth redistribution policies (Fong 2001).

Perhaps the most prominent and verifiable example of altruistic spending is that of a parent on a child. Time magazine recently stated that if an adult couple has a child in 2017, it will cost them $233,610 to raise that child to be a healthy 18 year-old, and that excludes the inevitable superfluous spending that most parents participate in (Gajanan 2017). That also ends at age 18. The tens of thousands of dollars that many parents spend on their child’s college education are no more useful in increasing their own personal fitness than raising the child was in the first place. Certainly, there are self-interested motivations behind spending on a child, but the spending habits of income earning parents in a typical family unit are altogether altruistic and, in a sense, inexplicable within a typical, self-interest assuming consumption model.

In all, interest in the well being of one’s family, belonging to a collective cause, maintaining a sense of self-righteousness, and many other causes may be behind altruistic behavior (Kolm 2006). The bottom line is that people tend to spend a considerable proportion of their wealth and resources in hopes of achieving outcomes that are entirely unrelated to their own fitness.

The Lack of an Altruism Model:

A consideration of altruism is often paired with and inspired by a skepticism toward “the economic man”, or “homo economicus”. Simply put, “the economic man” is a term used to describe an actor who fulfills the assumptions most economists make. He is utility maximizing, self-interested, rational, and well informed. The origin of the term is debated, but the concept itself is foundational. Adam Smith wrote in the Wealth of Nations: “It is not from the benevolence of the butcher, the brewer, or the baker that we expect our dinner, but from their regard to their own interest” (Smith 1776). This idea is essential to economic thinking, however many challenge it. Nobel Prize winner, Muhammad Yunus, for instance, opposes the idea of “the economic man” in favor of a more socially interested decision making framework. In his book, A World of Three Zeroes, he uses an entire chapter to contrast “The Economic Man” with “The Real Man”, arguing that “The Real Man” is motivated by many factors, including an altruistic drive (Yunus 2017).

Another relevant section of literature addresses a concept known as the dictator game. The dictator game is an idea within experimental economics. Essentially, an individual is given ten dollars and is asked if they want to keep all of it for themselves, or give a portion of it to a stranger. Often times, the individual elects to donate a portion of the money. While this may be evidentiary of altruism, it is far from comprehensive in its explanation of human behavior, and it is exposed to a great deal of bias. The subject may simply act altruistically to appear generous to the experimenter. The donation is in no way tied to the subject’s morals like giving to charity or
helping a friend in need might be. The decision is related to a chance acquisition of ten dollars in cash, rather than a deliberate allocation of hard-earned income. One experiment has even shown that individuals are as likely to take money from another as they are to donate it within the constraints of the dictator game experiment (Bardsley 2007). These are all reasons why the dictator game, while it does provide some insight to altruistic decision making, is far from providing the foundation for an actual decision making model.

As a whole, in exploring the literature, I found extensive research into just how motivated people might be to act altruistically. Many economists challenge the basic assumption of self-interest, and there seems to be a general consensus within the field of behavioral economics that this particular assumption might be a bit too strong. Furthermore, there is evidence that upcoming generations are increasingly concerned with the betterment of the lives of others (Paulin 2009), meaning that this assumption of self-interest may become even stronger in the future.

There was, however, essentially no literature that actually proposed a model to explain this behavior. A few articles speculate about how a model might be rendered, or proposed more specific models for particular altruistic behaviors, such as giving habits towards different charities (Landry 2006). In the literature I did not find a general consumption model that compares selfless behaviors and altruistic behaviors in an individual, firm, or state’s decision-making process. That is why I will propose such a model.

**The Model:**

As previously mentioned, this model is not meant to be comprehensive. It has many limitations, which I will later explain. Its structure is comparable to and inspired by several models taught in undergraduate-level macroeconomics courses, thus it has similar limitations to those models. I will first provide the model itself, beginning by defining several variables. Then, I will expound upon the model and describe how it might be used in a more pragmatic sense.

**Variables:**

\[
\begin{align*}
C_P &= \text{self-interested consumption} \\
C_O &= \text{altruistic consumption} \\
a &= \text{altruism coefficient } (\beta = 1/(1+a)) \\
    &\quad \text{- Will be higher as an individual desires to consume in a more self-interested manner} \\
    &\quad \text{- Generally, } 0 \leq a \leq 1 \\
W_0 &= \text{initial financial assets} \\
    &\quad \text{- Includes endowment, income, etc.} \\
A_P &= \text{assets remaining after spending on oneself} \\
A_O &= \text{assets remaining after spending altruistically} \\
g &= \text{weighted returns on investing in oneself}
\end{align*}
\]
Determining budget constraint:

\[ A_P = (W_0 - C_P)(1+g) \]  
\[ A_O = A_P - C_O = 0 \]

The above equation equals 0 because we will are assuming that actors consume the entirety of their wealth in order to maximize utility

\[ C_O = A_P \]  
\[ C_O = (W_0 - C_P)(1+g) \]  
\[ W_0 = C_P + C_O/(1+g) \]

Having obtained a utility maximization function and its respective constraint, we can apply the Lagrangian function to consolidate the two.

\[ \Lambda = U(C_P) + \beta U(C_O) - \lambda (C_P + C_O/(1+g) - W_0) \]

\[ \delta \Lambda / \delta C_P = U'(C_P) - \lambda \]  
\[ \delta \Lambda / \delta C_O = \beta U'(C_O) - \lambda/(1+g) \]  
\[ \delta \Lambda / \delta \lambda = -C_P - C_O/(1+g) + W_0 \]

Set equations 8, 9, and 10 equal to 0, thus:

\[ \beta U'(C_O) = U'(C_P)/(1+g) \]  
\[ U'(C_P)/ \beta U'(C_O) = 1+g \]

Maximize utility (V) by setting its derivative equal to 0

\[ d(V) = U'(C_P)d(C_P) + \beta U'(C_O)d(C_O) = 0 \]

\[ U'(C_P)d(C_P) = \beta U'(C_O)d(C_O) \]

\[ d(C_O)/d(C_P) = U'(C_P)/ \beta U'(C_O) = 1+g \]

This equality compares the slopes of the budget line and the indifference curve

Slope of the budget line: -(1+g)
Slope of the indifference curve: -U'(C_P)/ \beta U'(C_O)
Explanation of the model:

The above model is similar to several other well-known consumption models: it is maximizing the utility of consumption over two periods subjected to the constraint of income, or wealth. The defining aspect of this particular model is that the two periods are “self interested spending” and “altruistic spending”. To reiterate, the essence of this model is that there is a limited amount of wealth to allocate between two periods of consumption (self-interested spending and altruistic spending), and we are setting out to find the utility maximizing distribution of this wealth between the two periods.

One of the cruxes of this model is the “altruism coefficient”, denoted by $a$. This value relates to the tendency an actor has to act altruistically. It is important to note that, perhaps counter intuitively, the higher an actor’s altruism coefficient is, the more concerned they are with increasing their own fitness. (In a model showing consumption over two time periods, this coefficient is comparable to the impatience coefficient that measures how much an individual values spending now as opposed to later). The coefficient in effect weights the tendency to consume altruistically against the tendency to consume in a self-interested manner. In general it is safe to assume that this value is between 0 and 1, however in some unique cases it may be negative. For instance, a person with a terminal illness or an excessive amount of wealth might favor altruism so heavily that their altruism coefficient would be below 0.

In my model, an actor begins with an endowment, denoted by $W_0$. This endowment is the aggregate of the resources that they have to allocate between periods. The endowment, or wealth, may include inheritance, income, or any other source of resources that may be spent in a self-interested or altruistic manner.

From here, the actor’s consumption is broken into two periods. Mathematically, it is reasonable to consider self-interested consumption as the first period because it must be weighted for its benefit, which I will expound upon shortly. Intuitively it is reasonable to consider self-interested consumption as the first period because we do typically address our own needs first, and, if our endowment is particularly small, this may be the only period in which we actually consume. Also, the returns on self-interested consumption are generally more immediate and tangible.

Before addressing the two consumption periods further, it is important to establish a couple assumptions. First, we assume that the endowment is the actor’s entire pool of resources. The model is not time-dependent. Like a supply and demand curve, it may be dynamic in the sense that values can change, but the model at any given moment is capturing just one instance in time. Second, we are assuming that the actor exhausts his or her resources and saves nothing. To make this more realistic, we could in theory consider a decision to save money to be a form of self-interested spending.

First, an actor spends in self-interest. This is shown by equation 2, which denotes the assets the actor has after spending in this period. This value is multiplied by $(1 + g)$. This value gives a weight to the natural return to investing in oneself. In other words, a self-interested investment will to some degree increase your endowment in other periods. If you altruistically send a poor
child in another country to college, this has no weighted ramifications on your future assets. If you self-interestedly send yourself to college, this has a natural benefit to yourself and ultimately increases your wealth.

The second consumption period, denoted by $A_0$ in equation 3, applies to altruistic spending. This period consists of taking the assets you have from the first period, $A_P$, and spending the remainder of them altruistically.

Using the substitution and algebra in equations 4 and 5, the two formulas for the two periods can be rearranged to form a budget constraint equation, equation 6. Now, we have a utility function that involves maximizing utility between two variables with one weighted by the altruism coefficient (equation 1), and we have a budget constraint equation (equation 6). With two equations of these corresponding natures, we can use the Lagrangian equation to perform an optimization. The Lagrangian equation ultimately provides us with a two-sided equation: one side is the slope of the budget line, and the other is the slope of an indifference curve that can be superimposed on the budget set. (Equations 7-15 contain most of the math required to obtain the aforementioned equation.) Holding firm to neoclassical axioms, we know that when the slope of a budget line and the slope of an indifference curve are equal, an actor is consuming at maximum utility because this is the point at which the indifference curve can not be moved out any further without leaving the constraints of the budget line. Thus, we have built a consumption model comparable to any constrained optimization model that most economists are familiar with.

As mentioned, this model is limited by its explicit and implicit assumptions, many of which are very strong. One strong assumption that is specific to this model is the idea that it is possible to assign a binary categorization to our self-interested and altruistic consumption. Most decisions are made up of a complex interplay of drives and attitudes, yet this model requires us to reduce those decisions to one category or another. Another strong assumption is that self-interested consumption ought to be weighted for its returns, and altruistic spending shouldn’t. While this assumption is reasonable and helpful for the model, it is a bit reductive of actual reality. For instance, sending a child to college certainly has returns as the child is more likely to become independent and eventually even assist his or her parents financially late in their lives. These assumptions are strong, and there are many more, but such is the nature of any model. Clearly, because of these assumptions, this model does not perfectly describe reality, but the assumptions themselves do not undermine its ability to helpfully describe one aspect of decision-making.

The model consists of several variables, so it requires real values to achieve a more pragmatic purpose, but it does serve the general purpose of a model. If data is provided, variables can be determined in real value, and useful information can be derived. For instance, given an endowment, altruism coefficient, and return on self-interested investment for an individual, the model might be used to determine their utility maximizing allocation of their endowment. Likewise, if the allocation of the endowment is provided, we could derive their altruism coefficient, which could then be reapplied in future periods to determine how they ought to allocate their resources at a later date when they have a new endowment and return on self-interested investment.
Additionally, this model, like any other model, is flexible and can be applied in many interesting ways. One technical application evolves through simple algebra. By setting the slopes equal to one another and moving around a couple variables, we arrive at the following equation:

$$U'(C_P) = (1+g) U'(C_O) (1/(1+a))$$

This equation is essentially a comparison of the marginal benefit of self-interested spending and the marginal benefit of altruistic spending. Less technically speaking, this model could be applied to a number of real world situations. One very perplexing possibility analyzes how altruism varies between the rich and poor. There have been past experiments that try to capture how likely a people of different incomes are to return an envelope containing cash to its rightful owner, for instance (Andreoni 2017). This, however, is merely an experiment and is difficult to strictly interpret. With this model, we could perhaps generate a data set of many individuals, their incomes, and their altruism coefficients, and analyze the data to draw substantial conclusions.

**Conclusion:**

The above model has limitations and could certainly be expanded upon. It could be developed to include multiple time periods, or different subcategories of altruism, for instance. It is however very useful when applied properly. I would be interested to see it applied in social research. Perhaps, because it standardizes a measure of altruism with a calculable coefficient, this model could investigate how altruism varies between different groups. Are the poor or rich more altruistic? Are religious people really more selfless with their money? How does altruism develop as an actor ages? All these questions and more could be answered in a more formal manner than previously possible by applying this model. As is the case with any model, this model simplifies one aspect of behavior, but is broadly useful in understanding how individuals make economic decisions.
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