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Do Social Preferences Matter in Competitive Markets?*

Paul Heidhues† and Frank Riedel ‡

Abstract

Experimental evidence stresses the importance of so–called *social preferences* for understanding economic behavior. Social preferences are defined over the entire allocation in a given economic environment, and not just over one's own consumption as is traditionally presumed. We study the implications for competitive market outcomes if agents have such preferences. First, we clarify under what conditions an agent behaves as if she was selfish—i.e. when her demand function is independent of others' behavior. An agent behaves as if selfish if and only if her preferences can be represented by a utility function that is separable between her own utility and the allocation of goods for all other agents. Next, we study equilibrium outcomes in economies where individual agents behave as if selfish. We show that one can identify a corresponding *ego–economy* such that the equilibria of the ego–economy coincide with the equilibria of the original economy. As a consequence, competitive equilibria exist and they are *material efficient*. In general, however, the First Welfare Theorem fails. We introduce the class of *Bergsonian* social utility functions, which are social utility functions that are completely separable in all agents' material utility. For such social preferences, the Second Welfare Theorem holds under a suitable growth condition. We also establish that in uncertain environments, agents with social preferences typically do not behave as if selfish. Furthermore, in the presence of public goods, both demand and equilibrium outcomes depend on social preferences.

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1 Introduction

Economists assume almost exclusively that economic agents are selfish: They attempt to maximize their material well-being ignoring the material well-being of others in the economy. While self-interest seems one of the most important human traits, it is also obvious that agents are not purely selfish in the above way.[1] The question of how non-selfish preferences affect the functioning and desirability of market outcomes is a basic question that dates back to at least Edgeworth's (1881) seminal work on exchange markets,[2] which among other things addressed the impact of altruistic preferences in exchange situations. This article reconsiders these questions from the perspective of more recently developed social preference models, in which agents are motivated either by altruistic or spiteful considerations, depending on the endogenous circumstances.

The vast amount of experimental evidence demonstrating that subjects do not behave purely selfishly has inspired a variety of 'social preference' models (for a survey see Sobel (2005)). Broadly, one may classify these models into allocative social preference models in which—as in the standard model—agents preferences are defined over outcomes. In contrast to the standard model, however, the preferences of an agent depend not only on the consumption vector that he receives but also on the entire allocation in the economy (see for example Fehr and Schmidt (1999) and Bolton and Ockenfels (2000)).[3] The other class of social preference models are those in which agents, in addition, care about how a social outcome is reached.[4] Throughout this article, we focus on the class of allocative social preference models.

One of the central tenets, which are part of the 'behavioral economics folklore' is that—in line with experimental evidence—social preferences do not matter in competitive markets. For the case of allocative social prefer-

[1]As Adam Smith (1759)) put it "How selfish soever man may be supposed, there are evidently some principles in his nature, which interest him in the fortunes of others, and render their happiness necessary to him, though he derives nothing from it, except the pleasure of seeing it."

[2]See also Collard (1975) for a discussion of Edgeworth results.

[3] Existing allocative-social-preference models are designed for environments in which economic agents (subjects) receive one good (money at the end of the experiment). We propose a natural extension to multi-good environments below.

[4]See, for example, Rabin (1993), Levine (1998), Charness and Rabin (2002), Dufwenberg and Kirchsteiger (2004), and Falk and Fischbacher (2006).

ences, this folklore is backed by formal results in Fehr and Schmidt (1999) for a proposer-competition model. The main aim of the paper is to theoretically analyze under what general conditions and to what extend allocative social preference do not matter in competitive markets. We analyze this question in the most fundamental economic market model: the perfectly competitive exchange economy.

Conceptually, we divide our tasks into two subtasks. First, we look for conditions on social preferences under which agents in the exchange economy behave as if they had selfish preferences. Second, supposing that agents' preferences satisfy these conditions, we ask whether and how the fundamental welfare theorems extend to economies with social preferences. To the best of our knowledge, the question under what conditions agents behave as-if they were selfish is completely novel. Regarding the second question, we build on results by Edgeworth (1881) Borglin (1973), Hochman and Rodgers (1969), Rader (1980), and Winter (1969) that seem to have been somewhat overlooked in the recent literature on social preferences.

We first clarify under what conditions an agent behaves as if she was egoistic. We say that an agent behaves as if selfish if there exists a material utility function defined over an agent's own consumption level that accurately predicts her behavior for all possible price vectors and endowments. Under standard technical assumptions, we show that an as-if-selfish utility function exists if and only if agent's preferences can be represented by a utility function that is separable between her own consumption vector and that of all others in the following sense. There exists a function $m^i(x^i)$ and a function $V^i(m^i, x^{-i})$ such that the agent prefers an allocation x to an allocation y if and only if

$$V^i\left(m^i(x^i), x^{-i}\right) \geq V^i\left(m^i(y^i), y^{-i}\right) \ .$$

It is straightforward to see that the marginal rate of substitution is independent of x^{-i} if the agent has such a utility function. It is more difficult to see, though, that as–if–selfish behavior implies the existence of such a utility function. We rely on the classical integrability theory of demand functions to establish this result.

This class of separable utility functions contains a very natural class of social preferences constructed as follows: Suppose each agents derives a material well-being $m^i(x^i)$ from her own consumption. Agents get utility from their own material well-being as well as from comparing their own material well-being to that of others (which allows to incorporate altruistic, spiteful, efficiency, fairness and reciprocity considerations into an agent's preferences). Then, if an agent aggregates the material well-being of others using their material preferences and every agents material preferences satisfy standard assumptions, an agent i's preferences can be represented by a "Bergsonian utility function" of the form $U_i(m^1, ..., m^N)$, where m^j is the material well-being of agent j. These utility functions are separable and represent a natural extension of the allocative social preference models mentioned above. Nevertheless, this rules out certain type of interdependent preferences that may be economically important. Suppose, for example, each agent cares about status and status is allocated according to relative consumption of good 1. While our general formulation of social preferences would allow for such type of preferences, the more specific Bergsonian social preferences do not. The class of Bergsonian social preferences, however, does contain the natural generalization of the recent inequity-aversion models to multi-good environments in which inequity is defined over the material well-being of the agents in the exchange economy.

Restricting attention to this class of Bergsonian social preferences, we can use existing results for standard competitive models to show that a Walrasian equilibrium exists. While the Walrasian equilibrium is materially efficient—in the sense that it is impossible to make one agent materially better of without making another agents materially worse of—, the competitive allocation is not necessarily Pareto-efficient. In other words, the First Fundamental Welfare Theorem fails. We provide a simple example in which agents are altruistic and in which only a subset of the materially efficient allocations is Pareto-efficient. Intuitively, if an altruistic agent becomes too rich relative to others, she may be willing to sacrifice some of her own consumption in order to help others. If this is case, such a redistribution can make both herself and others better off—i.e. there is scope for Pareto-improving redistribution.[5]

We also establish through an example that Pareto-efficient allocations need not be materially efficient. In this somewhat pathological example, each agent hates his fellow agent so much that she is better of if both agents receive less, and thus a Pareto-efficient solution is for both agents to consume nothing, which is obviously not materially efficient. We then introduce a simple "growth condition" that rules out such pathological examples. The condition requires an agent to be better off if all agents material well-being

[5]Our example is in the spirit of those in Edgeworth (1881, p. 51) and Hochman and Rodgers (1969).

is proportionally increased. Under this mild condition, all Pareto-efficient allocations are materially efficient, and hence the Second Welfare Theorem prevails. That the Second Welfare Theorem holds, has been established by Winter (1969) for the case of separable social preferences that are (weakly) altruistic and increasing in an agent's own material well-being. It has been extended by Borglin (1973) and Rader (1980) to the class of separable social preferences that allow for both spitefulness and altruism.

We then introduce uncertainty into our exchange economy and show that, in general, Bergsonian social preferences matter for behavior in the presence of uncertainty. Technically, the reason is that even though a Bergsonian social utility function is separable ex post, it is not separable across agents from an ex-ante point of view. To understand why, suppose there are two states of nature and consider an agent whose utility depends on her material well-being and on the comparison to a given fellow consumer. Suppose further that she gets disutility from a social comparison to her fellow agent, if and only if he is materially better of than she is and let this disutility be increasing in the distance between their material well-being. Now, for a given endowment and price vector, consider the consumption bundle that maximizes her material well-being. If her fellow agent consumes strictly more than her in state one and less than her in state two, her utility increases when she shifts some consumption from state two to state one. Since she started at a materially optimal consumption bundle, such a redistribution has only a second-order effect on her material well-being. But it has a first-order effect in reducing the disutility she suffers from the social comparison. Hence, agents with social preferences do not behave as if selfish in the presence of uncertainty. We also show, however, that if there is no aggregate risk in the economy and agents are risk averse, a selfish equilibrium remains an equilibrium under a relatively mild condition if we allow for Bergsonian social preferences. The reason is that in the selfish equilibrium, agents are fully insured and the social comparisons are perfectly identical in all realized states of nature.

We then show that social preferences are important in the presence of a public good. Consider an economy inhabited by purely selfish agents in which agent i contributes to the provision of a public good. If agent i is purely selfish, she will contribute up to the point at which her personal sacrifice in private consumption from contributing an extra unit is equal to her personal benefit from contributing an extra unit. Now consider this outcome and suppose that agent i becomes altruistic. In this case, if she contributes an extra unit to the public good, this has a second-order effect on her own material well-being. The extra unit of the public good, however, increases the material well-being of all other agents in the economy. Hence, if agent i is altruistic, increasing her contributions has positive first-order effect on her utility. Thus, agent i will not behave as if she was selfish in a public goods economy.

Most closely related to our paper is recent (independent) work by Sobel (2007). Among a variety of market institutions, Sobel also analyzes an exchange economy. When considering an exchange economy, he assumes additive separability of preferences and focuses on the question under what conditions the usual price-taking assumption is justified as an approximation of a large finite economy in which agents have social preferences. In contrast to Sobel, we take the price taking assumption as given and focus on the necessary and sufficient assumptions for individuals with social preferences to behave as if selfish. Furthermore, in contrast to Sobel, we formally discuss the impact of uncertainty and public goods. In addition, we reconsider the fundamental welfare theorems.

In Section 2, we introduce allocative social preferences into an otherwise standard exchange economy and characterize under what conditions an agent behaves as if she was selfish in a perfectly competitive market. Section 3 discusses properties of exchange economies with separable social preferences and Section 4 reconsiders the fundamental welfare theorems when agents have Bergsonian social preferences. Section 5 shows that even Bergsonian social preferences will typically matter for predicting behavior if we introduce uncertainty or a public good into our exchange economy. Concluding remarks are contained in Section 5.

2 Exchange Economy with Social Preferences

This section introduces a standard exchange economy in which consumers have preferences over allocations. We then define selfish preferences as ones in which an agent cares only about the consumption vector she receives and not about what others receive. In contrast, we say she has social preferences if her well-being is also influenced by what others receive. Intuitively, this allows for a wide variety of social comparisons. For example, an agent may be spiteful: Taking her own consumption as given, she prefers her fellow agents to receive as little as possible. On the other hand, she may be generous or altruistic and prefer her fellow agent to receive as much as possible. She may dislike certain outcomes because they are inequitable in line with theories developed by Fehr and Schmidt (1999) and Bolton and Ockenfels (2000). She may be envious or interested in status, which could depend on the (absolute or relative) consumption level of a given status good. She may also compare herself only with some of her fellow agents, so that her well-being depends on what these agents receive, or she may care about the efficiency of allocations—in line with Charness and Rabin (2002) and the example in Edgeworth (1881).

Consider the following exchange economy. There are $L \geq 2$ commodities. A *consumption bundle* is a vector $(x_1, \ldots, x_L) \in \mathbb{R}^L_+$. Consumers $i = 1, \ldots, I$ enter the market with an endowment $e^i \in \mathbb{R}^L_+$. $e = \left(e^1, \ldots, e^I\right)$ is the initial endowment vector and $\bar{e} = \sum_{i=1}^I e^i$ is aggregate endowment. An *allocation* is a vector $x = \left(x^1, \ldots, x^I\right) \in \mathbb{R}^{IL}_+$. Sometimes it is convenient to write (x^i, x^{-i}) for an allocation, where x^{-i} are the consumption bundles of all agents other than i.

Consumer i has a *preference relation* over allocations x, which we denote by $\succeq^i$.[6] We assume that the consumers' preference relations are complete and transitive.[7] To ensure that each consumer's preference relation $\succeq^i$ can be represented by a utility function $U^i(x)$ defined on the consumption set $\mathbb{R}^{IL}_+$, we will assume that $\succeq^i$ is continuous unless specified otherwise.[8] We assume that agent i's preferences are strictly convex over her *own consumption*, i.e. that for all x^{-i} and for all $x^i \neq y^i$, $(x^i, x^{-i}) \succeq^i (y^i, x^{-i})$ implies that $(\alpha x^i + (1-\alpha) y^i, x^{-i}) \succeq^i (y^i, x^{-i})$ for all $\alpha \in (0, 1)$. This does not require strict convexity over allocations, which would be far more stringent. For example, strict convexity over allocations would rule out that an agent is only interested in the consumption bundle she receives, because an appropriate change in the consumption bundle of a fellow agent would have to make her better of. Indeed, if one loosely thinks of a convex redistribution as making the other individual agent better of, agent i may be jealous and, hence, worse off if she has social preferences. We, therefore, only require strict convexity of

[6]We could allow a consumers preference relation to depend on the initial endowment, which would only require minor notational changes below.

[7]Completeness requires that for all allocations x and x', either $x \succeq^i x'$ or $x' \succeq^i x$. Transitivity presumes that for all allocations x, x', x'', if $x \succeq^i x'$ and $x' \succeq^i x''$, then $x \succeq^i x''$.

[8]A preference relation is continuous if for any sequence of pairs $\{x^n, x'^n\}$ with $x^n \succeq^i (x')^n$ for all n, $lim_{n\to\infty} x^n \succeq^i lim_{n\to\infty}(x')^n$.

preferences over an agents own consumption bundles.

A *price* is a a vector $p \in \mathbb{R}^L_+$. For a given price p and income $w^i > 0$, the budget set of consumer i is given by

$$B^i = \left\{ x \in \mathbb{R}^L_+ : px \leq w^i \right\} .$$

We restrict attention to strictly positive income and price levels in the following, to ensure that the budget set for each agent is always compact. As long as we analyze individual behavior alone, we take the income $w^i > 0$ as given. For equilibrium considerations, $w^i = pe^i$ is endogenous, of course.[9]

To analyze whether social preferences matter in an exchange economy, we begin by defining selfish preferences. We say that an agent's preferences are selfish whenever her evaluation of social outcomes is completely self-centered; i.e. her ranking of any two allocations depends only on the consumption bundle she receives in those allocations.

Definition 1 *Preferences* $\succeq^i$ *of agent* i *are selfish if for all allocations* $x = \left(x^1, \ldots, x^I\right)$ *and* $y = \left(y^1, \ldots, y^I\right)$ *we have*

$$\left(x^i, x^{-i}\right) \succeq^i \left(y^i, x^{-i}\right)$$

if and only if

$$\left(x^i, y^{-i}\right) \succeq^i \left(y^i, y^{-i}\right) .$$

It is immediate that the utility function $U^i(x)$ of a selfish agent does not depend on the consumption choice of other agents, i.e. one can choose U^i such that it is independent of x^{-i}.

Whenever an agent's preferences are not-selfish, we say that the agent has social preferences. One central question that this paper addresses is whether agents in perfectly competitive markets behave "as if" they had selfish preferences. To do so, we compare observable implications of preferences, i.e. demand behavior. Since agents preferences can be represented by a continuous utility function and the budget set is compact, the demand correspondence exists. Because we furthermore assumed that an agent's preferences over her own consumption bundles are strictly convex, each agent has a demand function given by

$$d^i\left(p, w^i; x^{-i}\right) = \arg \max_{px^i \leq w^i} U^i(x) .$$

[9] Here, px denotes the usual scalar product in $\mathbb{R}^L$: $px = \sum_{l=1}^{L} p_l x_l$.

Note that the demand function depends on the consumption choice of other agents x^{-i} in general.

Definition 2 *Agent i behaves as if selfish if her demand function $d^i\left(p, w^i; x^{-i}\right)$ is independent of x^{-i}.*

Next, we characterize agents who behave as if selfish. Intuitively, social preferences do not matter for an individual's choices if for a given income and price vector, she chooses the same consumption bundle irrespective of the consumption bundles of others. Suppose that her preferences are monotone in her own consumption bundle—so that she always spends her entire endowment—and suppose for a moment that her preferences can be represented by a differentiable utility function. Then, at the optimal consumption bundle, her marginal rate of substitution is equal to the relative price of any two commodities. Now, holding her initial endowment as well as the price vector fixed, change the consumption bundles that others receive. Behaving as if selfish requires that the agent chooses the same consumption bundle as before. For this consumption bundle to still be optimal, her marginal rate of substitution between any two commodities must remain unchanged. It is easy to see that if the agent has a utility function that is separable in own consumption—i.e. can be represented by a utility function $V^i(m^i(x^i), x^{-i})$—then her marginal rate of substitution is independent of x^{-i} since in this case

$$MRS^i_{kl} = \frac{\frac{\partial U^i(x)}{\partial x^i_k}}{\frac{\partial U^i(x)}{\partial x^i_l}} = \frac{\frac{\partial V^i\left(m^i(x^i), x^{-i}\right)}{\partial m^i}\frac{\partial m^i(x^i)}{\partial x^i_k}}{\frac{\partial V^i(m^i(x^i), x^{-i})}{\partial m^i}\frac{\partial m^i(x^i)}{\partial x^i_l}} = \frac{\frac{\partial m^i(x^i)}{\partial x^i_k}}{\frac{\partial m^i(x^i)}{\partial x^i_l}}.$$

The proof of the theorem below generalizes the above argument to allow for V^i to be non-differentiable as is typically the case in inequity-aversion models such as Fehr and Schmidt.

The theorem also establishes the more difficult and deeper converse—that if an agent behaves as if selfish then her preferences can be represented by a separable utility function—under the assumptions of local non-satiation and continuously differentiable demand. To see why non-satiation is needed for the converse statement, consider the two-good case and suppose agent i has a bliss point at $(1, 1)$. Furthermore, suppose agent i has non-selfish preferences but that changes in x^{-i} only affect her utility function in the quadrant to the north-east of $(1, 1)$. Independent of his initial endowment and the price level, agent i never chooses a consumption bundle in this region beyond her bliss point and, hence, preference changes in this region are irrelevant for her consumption choice. But this implies that we cannot conclude from the agents observed as if selfish behavior that his utility function does not change in such irrelevant regions and, therefore, the converse statement is not true in this case.

Theorem 1 1. *Suppose that agent's preferences can be represented in the form*

$$V^i\left(m^i(x^i), x^{-i}\right)$$

for a strictly quasiconcave, continuous function $m^i : \mathbb{R}^L \to \mathbb{R}$ *and a function* $V^i : D \subseteq \mathbb{R} \times \mathbb{R}^{(I-1)L} \to \mathbb{R}$ *that is increasing in its first variable. Then agent* i *behaves as if selfish.*

2. *Suppose that agent* i*'s preferences are locally non–satiated and smooth enough such that the demand function* $d^i(p, w; x^{-i})$ *is continuously differentiable*[10] *in* (p, w)*. If agent* i *behaves as if selfish, then her preferences can be represented in the form*

$$V^i\left(m^i(x^i), x^{-i}\right)$$

for a strictly quasiconcave, continuous function $m^i : \mathbb{R}^L \to \mathbb{R}$ *and a function* $V^i : D \subseteq \mathbb{R} \times \mathbb{R}^{(I-1)L} \to \mathbb{R}$ *that is increasing in its first variable.*

Proof : We prove 1. first. As m is continuous and strictly quasiconcave, the standard utility maximization problem

$$\max_{x \geq 0, px^i \leq w} m(x^i)$$

has a unique solution $d^i(p, w)$ for $p \gg 0$ and $w > 0$. Obviously, this standard demand function does not depend on x^{-i}. Now take any x^{-i}. We have for all budget–feasible x^i

$$m(x^i) \leq m(d^i(p, w)) .$$

[10] A sufficient condition for this is that preferences are $\mathscr{C}^2$ in own consumption without critical points, and that the bordered Hessian of U is nonzero at all x. See Mas-Colell (2001), Chapter 2 or Mas-Colell, Whinston, and Green (1995), Chapter 3, Appendix.

As $V(m, x^{-i})$ is increasing in m, it follows that

$$V\left(m\left(x^i\right), x^{-i}\right) \leq V\left(m\left(d^i(p,w)\right), x^{-i}\right) .$$

Thus, $d^i(p,w)$ also maximizes utility for agent i. In particular, her demand function is independent of x^{-i}; in other words, she behaves as if selfish.

Now consider the more difficult converse 2. Let $d(p,w)$ be the demand function of agent i which, by assumption, does not depend on x^{-i}. In a first step, we construct a (material) utility function on the consumption set $\mathbb{R}^L_+$ of agent i. This is a standard integrability problem. Such a function $m(x^i)$ exists if

- d is continuously differentiable,
- homogenous of degree zero,
- d has a symmetric and negative semidefinite Slutsky substitution matrix,
- d satisfies Walras' law: $pd(p,w) = w$ for all $p \gg 0$ and $w > 0$.

By assumption, d is continuously differentiable. As demand d is derived from utility maximization (albeit with an additional parameter x^{-i}), homogeneity of degree zero and negative semidefiniteness of the substitution matrix hold true as well. Walras' law follows from local nonsatiation. We can then apply an integrability theorem of Hurwitz and Uzawa (1971) to obtain a material utility function $m(x^i)$ that rationalizes x^i. In particular, we have for all x^{-i} that

$$U(x^i, x^{-i}) \geq U(z^i, x^{-i}) \Leftrightarrow m(x^i) \geq m(z^i) \qquad \left(x^i, z^i \in \mathbb{R}^L_+\right) . \tag{1}$$

We can thus define a function $V(\mu, x^{-i})$ on the image of m and $\mathbb{R}^{(I-1)L}_+$ by setting

$$V(\mu, x^{-i}) = U(x^i, x^{-i})$$

for some x^i with $m(x^i) = \mu$. Note that this definition does not depend on the particular x^i chosen as we have $U(x^i, x^{-i}) = U(z^i, x^{-i})$ for all x^i, z^i with $m(x^i) = m(z^i)$ by Equation (1).

Finally, we have to show that V is increasing in μ. Let $\mu > \nu$ for two numbers μ, ν in the image of m. Choose x^i, z^i with $\mu = m(x^i)$ and $\nu = m(z^i)$. We then get from $m(x^i) > m(z^i)$ and (1) that

$$U(x^i, x^{-i}) > U(z^i, x^{-i}) .$$

By definition of V, this is equivalent to

$$V(\mu, x^{-i}) > V(\nu, x^{-i})\,.$$

Thus, V is increasing in its first variable.

□

From now on, we call preferences *separable* if and only if they can be represented in the form

$$V^i\left(m^i(x^i), x^{-i}\right)$$

for a strictly quasiconcave, continuous function $m^i : \mathbb{R}^L \to \mathbb{R}$ and a function $V^i : D \subseteq \mathbb{R} \times \mathbb{R}^{(I-1)L} \to \mathbb{R}$ that is increasing in its first variable.

If a consumer i has separable preferences, $m^i(x^i)$ specifies what consumption bundles a consumer prefers to others. Below, we refer to the function $m^i(x^i)$ as a consumers *material payoff* function. Loosely speaking, we think of this function as a measure of the consumer's well-being absent any social comparisons.

In the class of all social preferences, as–if–selfish behavior is quite restrictive as it requires a certain separability for the representing utility functions. It is thus intuitive that the class of separable social preferences is non-generic in the class of social preferences.[11] It would be wrong, however, to conclude that separable preferences are an unreasonable assumption. Note that technically, of course, selfish preferences are also non-generic in the bigger class of social preferences. Below, we will introduce a subclass of separable social preferences that naturally generalizes recent social preferences models to multi-good environments.

3 Equilibrium with Separable Social Preferences

We now briefly introduce the concepts necessary to define efficiency and equilibrium in an economy in which agents have separable social preferences. We will also define a hypothetical economy in which all agents have corresponding selfish preferences in order to formally investigate the implications of social preferences for behavior and welfare.

[11] A formal proof of this is available upon request.

An allocation x is called *feasible* if $\sum_{i=1}^{I} x_l^i \leq \bar{e}_l$ for all commodities $l = 1, \ldots, L$. A feasible allocation x is *efficient* if there is no other feasible allocation y that makes every consumer better off in terms of utility, that is, with $U^i(y^i) > U^i(x^i)$ for all $i = 1, \ldots, I$. A feasible allocation x is *material efficient* if there is no other feasible allocation y that makes every consumer better off in terms of material payoffs, that is, with $m^i(y^i) > m^i(x^i)$ for all $i = 1, \ldots, I$.

An *Walrasian equilibrium* consists of a price vector p and a feasible allocation x such that every consumer maximizes his utility given prices p, *others' material payoffs, and endowment* e, that is, for all $i = 1, \ldots, I$ and $y \in \mathbb{R}_+^L$ we have

$$\text{if } U^i(y) > U^i(x) \text{ then } py > px^i .$$

An *economy* $\mathscr{E}$ is fully described by a tuple $(I, e, (U^i))$ of agents, endowments, and preferences. We denote the set of Walrasian equilibria of an economy $\mathscr{E}$ by $WE(\mathscr{E})$, i.e.

$$WE(\mathscr{E}) = \{(p, x) \mid (p, x) \text{ is a Walrasian equilibrium of } \mathscr{E}\}.$$

To understand the role of social preferences, we will often compare an economy $\mathscr{E}$ to its corresponding hypothetical 'ego-economy' $\mathscr{E}^{ego} = (I, e, (m^i))$. In an ego-economy each agent has the same endowment and material preferences as in the original economy $\mathscr{E}$. In the ego-economy, however, all agents are purely selfish, i.e. their preferences are not affected by comparisons to others.

Having defined an economy, an immediate corollary of Theorem 1 is that:

Corollary 1 *Suppose that all agents have separable preferences. Then the set of Walrasian equilibria of an economy $\mathscr{E}$ coincides with the set of Walrasian equilibria of its corresponding ego-economy $\mathscr{E}^{ego}$.*

In particular, if the ego–economy $\mathscr{E}^{ego}$ satisfies the usual conditions of General Equilibrium Theory, an equilibrium exists in the economy $\mathscr{E}$.[12]

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[12] The standard conditions that ensure existence are the following. First, wealth of agents must always be positive, i.e. we need a cheaper point condition. Here, $e^i \gg 0$ would be enough. Furthermore, a boundary condition is needed when some prices tend to zero. For example, if $p_n \to p \neq 0$, but $p_l = 0$ for some commodities l, one might require that demand for some commodity tends to infinity, i.e.

$$\max_{l=1,\ldots,L} d_l^i(p_n) \to \infty .$$

Strict monotonicity of m^i would be enough to ensure this.

In the above sense, social preferences do not matter in competitive markets. If all agents' preferences are separable in their own consumption bundles and all agents' prefer to spend their entire wealth, concerns such as envy, fairness or inequity aversion that are captured in social preferences are irrelevant for positive predictions on market outcomes.

It is perhaps worth emphasizing that the above Corollary requires not only separability but also that every agent i's preferences are locally non-satiated, which rules out, for example, that an agent who is very well-off chooses not to consume all of her income in order to reduce inequality in society. In this sense, the requirement of local non-satiation limits the inequity concerns that agents are allowed to have. The following result shows that local non-satiation is needed, as otherwise, the set of Walrasian equilibria with social preferences differs from the set of Walrasian equilibria of the ego-economy.

Corollary 2 *Suppose that all agents have separable preferences. Consider an economy $\mathscr{E}$ and a Walrasian equilibrium (p^*, x^*) of its corresponding ego-economy $\mathscr{E}^{ego}$. If for some agent i, $\frac{\partial V^i}{\partial m^i}(m^i(x^i), (x^*)^{-i}) < 0$ at $(x^i = (x^*)^i)$, then (p^*, x^*) is not a Walrasian equilibrium of the economy $\mathscr{E}$.*

Another consequence of Theorem 1 is that equilibrium allocations are material efficient.

Corollary 3 (Modified First Welfare Theorem) *Suppose that all agents have separable preferences. A Walrasian equilibrium allocation is material efficient.*

PROOF : This follows directly from Corollary 1, as a Walrasian equilibrium of $\mathscr{E}$ is also a Walrasian equilibrium of $\mathscr{E}^{ego}$. Apply the classical First Welfare Theorem. □

Note that the Corollary does not claim that every Walrasian equilibrium is efficient. Indeed, we show in the next section that this is not the case.

Corollary 4 (Modified Second Welfare Theorem) *Suppose that all agents have separable preferences. Every material efficient allocation is a Walrasian equilibrium for an appropriate choice of initial endowments.*

PROOF : This follows directly from Corollary 1, as a Walrasian equilibrium of $\mathscr{E}$ is also a Walrasian equilibrium of $\mathscr{E}^{ego}$. Apply the classical Second Welfare Theorem. □

4 Bergsonian Social Preferences and Welfare

From the preceding section, we know that an agent with social preferences behaves as if selfish if and only if one can represent her preferences by a utility function of the form $V^i(m^i(x^i), x^{-i})$ that separates her own consumption of others' consumption. A natural subclass that is economically meaningful separates even further the other agents. Below, we emphasize the class of *Bergsonian social preferences*, which is a class of social preferences in which each agent's preferences respect the other agents' preferences for their own consumption bundles. Technically, we construct this class of preferences as follows: Consumer i derives a material payoff $m^i(x^i)$ from consuming the bundle x^i, which captures the utility a consumer derives from consumption absent any social comparisons. A consumer's overall utility, however, depends on this material utility as well as the comparison to the material well-being of others. If a consumer has Bergsonian social preferences, she evaluates the material well-being of a fellow consumer by aggregating his material well-being in exactly the same way he does, and then comparing her material well-being to his. Formally, the social preferences of consumer i are represented by a function $V^i\left(m^1, \ldots, m^I\right)$, where m^i are the material payoffs of the I consumers. At times, it is more convenient to write the utility as $V^i(m^i, m^{-i})$, to emphasize that the material payoffs of others are taken as given by consumer i when she maximizes her utility.

In recent allocative social preference models, economic agents receive one-dimensional payoffs (monetary rewards in experiments) and agents overall utility depends on ones own monetary reward as well as comparisons to the monetary rewards of others. In the class of Bergsonian social preferences, the monetary reward is replaced with an agents material well-being, which seems to us the natural generalization of these social preference models. Thus, for example, the allocative social preference model of Fehr and Schmidt generalizes to[13]

$$V^i\left(m^1, \ldots, m^I\right) = m^i - \sigma_i \frac{1}{I-1} \sum_{j \neq i} (m^j - m^i)^+ - \rho_i \frac{1}{I-1} \sum_{j \neq i} (m^i - m^j)^+,$$

where Fehr and Schmidt assume that $\sigma_i \geq \rho_i \geq 0$ and $\rho_i < 1$. The first parameter assumption ensures that agents suffer more from being behind then they gain from being ahead. In the context of a single good and linear

[13] In this paper $(\cdot)^+$ denotes the indicator function.

material well-being assumptions, $\rho_i < 1$ ensures that the utility function is monotonically increasing in ones own material well-being. Similarly, the model of Bolton and Ochenfels generalize to

$$V^i\left(m^1,\ldots,m^I\right) = m^i - \sigma_i \left| m^i - \frac{\sum_j m^j}{I} \right|,$$

where $0 \leq \sigma_i < 1$. Finally, the social-welfare preferences proposed in Charness and Rabin[14] simplify to

$$V^i\left(m^1,\ldots,m^I\right) = (1-\lambda_i)m^i + \lambda_i \left[\delta_i \min\{m^1,\ldots,m^I\} + (1-\delta_i)\sum_{j=1}^{I} m^j\right].$$

Intuitively, one may think of an agent as being maximizing the combination of his own well-being and a given social welfare function. Indeed, the model of Charness and Rabin can be viewed as extending Edgeworth's example in which

$$V^i\left(m^1,\ldots,m^I\right) = (1-\lambda_i)m^i + \lambda_i \left[\sum_{j=1}^{I} m^j\right]$$

by adding a Rawlsian type concern for the worst of to this social welfare function.

Of course, the above extensions of the recent allocative social preference models ignore some thorny issues when moving from simple laboratory environments to a general equilibrium model. In particular, in the laboratory subjects typically compare their well-being to that of other subjects. The reference group for social comparisons in our general equilibrium environment, however, may be a strict subset of the population. Or people may have different types of social preferences regarding different subjects. Our general setup with a Bergsonian social welfare function, however, allows agents to compare themselves to arbitrary subsets of the population. What we implicitly rule out, however, is that a person's social comparisons depend on the consumption bundle she chooses.[15] Also, the above extensions restrict

[14] Charness and Rabin extend their model to incorporate reciprocity. In a large anonymous market-place, however, reciprocity presumably plays no significant role in determining behavior.

[15] von Siemens (2006) considers this possibility in a labor market context in which some agents are inequity averse and compare their earnings only to the earnings of coworkers that are employed in the same firm.

attention to the case in which agents aggregate their fellow agents' material well-being according to their fellow agents' material utility functions. As we have shown, such a strong assumption is not needed for the result that individuals behave as if selfish but we make use of it below when considering the welfare properties of market outcomes.

For the remainder of the paper, we assume that agents have *Bergsonian social preferences* as defined above, i.e. they have material payoff functions $m^i(x^i)$ for own consumption and an *aggregator*

$$V^i : \mathbb{R}^I \to \mathbb{R}$$

such that their utility function can be written in the form

$$U^i(x^1, \ldots, x^I) = V^i(m^1(x^1), \ldots, m^I(x^I))\,.$$

Moreover, we make the standard assumption that m^i is increasing: the material well–being of an agent increases when she consumes more.

Corollary 3 proves that a Walrasian equilibrium allocation is material efficient. We next show that a Walrasian equilibrium, however, need not be Pareto-efficient. To do so, we provide an example in the spirit of Edgeworth, which establishes that materially efficient allocations need not be efficient.

Example 1 Altruism Requires Redistribution for Pareto Efficiency. *Consider an economy with two altruists who have* $V^1(m^1, m^2) = m^1 + 0.9m^2$, $V^2(m^1, m^2) = 0.9m^1 + m^2$. *Suppose that their material payoff functions are identical,* $m^1(x_1, x_2) = m^2(x_1, x_2) = (x_1 x_2)^{1/3}$ *and that the aggregate endowment* $\overline{e} = (2, 2)$. *Then the materially efficient allocations* (x^1, x^2) *lie on the diagonal and satisfy* $x^1 = (\alpha, \alpha)$ *for some* $\alpha \in [0, 2]$. *It is easy to check that the materially efficient allocations at the boundary of the Edgeworth box are not efficient. Indeed, for* $x^1 = (2, 2)$ *and* $x^2 = (0, 0)$, *utility is* $4^{1/3} \simeq 1.59$ *for agent* 1 *and approximately* 1.43 *for agent* 2. *If agent* 1 *gives some amount of both commodities to agent* 2, *both are better off because the marginal utility of agent* 2 *is infinite whereas agent* 1*'s marginal utility is finite. Here, utility for the allocations* $x^1 = (1.9, 1.9)$ *and* $x^2 = (0.1, 0.1)$ *is* $U^1 \simeq 1.73$ *and* $U^2 \simeq= 1.60$.

Efficient allocations solve the problem of maximizing the weighted utility $\lambda U^1(x^1, x^2) + (1 - \lambda)U^2(x^1, x^2)$ *for some* $\lambda \in [0, 1]$. *Somewhat tedious calculations show that the efficient allocations have*

$$\alpha = \frac{2(\lambda + 9)^3}{19(3\lambda^2 - 3\lambda + 91)}\,.$$

Approximately, α must be between 0.84 *and* 1.16*.*

While in this example the addition of a simple charity option would suffice to reestablish Pareto-efficiency, in general this is not the case because of potential free-rider problems in redistribution.[16]

We next show that the set of efficient allocations may not be included in the set of materially efficient allocations.

Example 2 Hateful Society. *Consider an economy with two identical agents with utility functions $V^i = m^i - 2m^j$, where $m^i(x^i) = (x_1^i x_2^i)^{\frac{1}{2}}$ and $i \neq j$. Let the aggregate endowment be $\overline{e} = (1,1)$. The allocation $((0,0),(0,0))$, which is obviously not material efficient as none of the endowment is consumed, is Pareto efficient.[17] In this hateful society, it is impossible to make agent 1 better of without making agent 2 worse of. Clearly, therefore, the set of Pareto efficient allocations is not a subset of the materially efficient allocations.*

To rule out such pathological cases, we introduce a weak regularity condition on social preferences. The condition requires an agent's utility to increase if everyone get proportionally better off and is satisfied by all social preference models discussed above.

Condition 1 *A proportional increase in material well-being makes all individuals better of, i.e. for all $\lambda > 1$ one has $U^i\left(\lambda m^1, \ldots, \lambda m^I\right) > U^i\left(m^1, \ldots, m^I\right)$.*

Under the above sufficient condition, Pareto-efficient allocations must be materially efficient. Intuitively, the condition ensures that if an outcome is not materially efficient then in the set of allocations in which all agents are materially better of, there exists an element in which the material gains are divided between all agents in such a way that everyone is better off. Indeed, one could slightly weaken the above condition by just requiring the existence of one such element.[18] The above condition, however, is easy to interpret and covers the class of preferences we are especially interested in.

[16] For an example, see Winter (1969)

[17] If the endowment cannot be destroyed, then the edge of the Edgeworth box are the set of Pareto efficient allocations, while the diagonal is the set of materially efficient allocations.

[18] Rader (1980) uses such a slightly weaker condition.

Theorem 2 *Suppose Condition 1 holds. Then the set of Pareto-efficient allocations is a subset of the set of materially-efficient allocations.*

Proof : Note that the (continuous) material payoff functions are bounded on the compact set of feasible allocations. Hence, we can assume without loss of generality that they are strictly positive.

Assume that there exists a Pareto-efficient allocation x that is not materially efficient. Hence, there exists a feasible allocation y such that $m^i(y^i) > m^i(x^i)$ for all i. Let $\lambda^i := m^i(y^i)/m^i(x^i)$ and note that $\lambda := \min_i \lambda^i > 1$, as the number of agents is finite. Without loss of generality, $\lambda^1 = \lambda$. Denote by $\mathbf{1}$ the vector in $\mathbb{R}^L_+$ that has 1 in every component. Define a new allocation z by setting $z^1 = y^1$, and $z^j = y^j - \epsilon^j \mathbf{1}$ where $\epsilon^j > 0, j = 2, \dots, I$ is chosen such that $m^j(z^j) = \lambda m^j(x^j)$. The allocation z is obviously feasible as we have $\sum_j z^j \leq \sum_j y^j$. Moreover, $m^i(z^i) = \lambda m^i(x^i)$ for all i. Condition 1, however, implies that $\overline{x}$ Pareto-dominates x, a contradiction. □

An immediate consequence of the above theorem is the Second Welfare Theorem.

Corollary 5 (Second Welfare Theorem) *Suppose condition 1 holds. Then every Pareto-efficient allocation can be achieved as a Walrasian equilibrium by using suitable lump–sum transfers.*

Proof : Since every materially efficient allocation can be implemented under Condition 1 and the set of Pareto-efficient allocation is a subset of the set of materially efficient payoffs, the result follows. □

Following the example of Edgeworth (1881), Example 1 considers altruistic preferences in which the payoff to different agents was substitutable. We will consider an example with complementary altruism below.

Example 3 Substitutable and Complementary Altruism. *A Bergsonian agent can view the material payoff of others as a substitute or as a complement for his own payoff. This example treats the cases of* perfect *substitutes and* perfect *complements. As in Example 1, let material payoff functions be* $m^i(x_1, x_2) = (x_1 x_2)^{1/3}$*, and aggregate endowment* $\bar{e} = (2, 2)$.

1. *Perfect substitutes. Continuing Example 1, we now solve explicitly for the set of Pareto optima. Efficient allocations solve the problem of maximizing the weighted utility* $\lambda U^1(x^1, x^2) + (1 - \lambda) U^2(x^1, x^2)$ *for*

some $\lambda \in [0,1]$. *Somewhat tedious calculations (see maple–sheet inefficiency.mws) show that the efficient allocations have*

$$\alpha = \frac{2(\lambda+9)^3}{19(3\lambda^2 - 3\lambda + 91)}\,.$$

Approximately, α *must be between* 0.84 *and* 1.16.

2. *Perfect complements. Let*

$$V^1(m^1, m^2) = \min\left\{m^1, \beta m^2\right\}$$

and

$$V^2(m^1, m^2) = \min\left\{m^2, \beta m^1\right\}$$

for some parameter $\beta \geq 1$. *Thus, agent* 1 *is egoistic as long as the his own well–being compared to the well–being of agent* 2 *does not exceed a limit* $\beta \geq 1$.

The materially efficient allocations lie on the diagonal of the Edgeworth box.

For $\beta = 1$, *only the allocation* $(x_1^i, x_2^i) = (1/2, 1/2)$ *is efficient.*

More generally, efficiency requires for $\beta > 1$ *that* $m^i(x^i) \leq \beta\ m^j(x^j)$ *and that the allocation is material efficient. Thus, an efficient allocation lies on the diagonal and satisfies*

$$\frac{1}{1+\beta^{3/2}} \leq x_1^i = x_2^i \leq \frac{\beta^{3/2}}{1+\beta^{3/2}}\,.$$

Taking the limit $\beta \to \infty$, *we obtain (almost) the egoistic outcome. For* $\beta = \infty$, *all allocations on the diagonal are efficient except those at the edges.*

Example 4 Inequity Aversion. *Fehr and Schmidt (1999) suggest social preferences of the form*

$$V^1(m^1, m^2) = m^1 - \alpha(m^1 - m^2)^+ - \beta(m^2 - m^1)^+$$

for some parameters $0 \leq \alpha \leq \beta < 1$. *We have* $V(\lambda m) = \lambda V(m)$. *Hence, our Condition 1 is satisfied as long as* V *is positive.*

This Bergsonian utility can be written as

$$V^1(m^1, m^2) = m^1 - \alpha(m^1 - m^1 \wedge m^2) - \beta(m^2 - m^1 \wedge m^2)$$
$$= (1-\alpha)m^1 - \beta m^2 + (\alpha+\beta)\left(m^1 \wedge m^2\right) .$$

it thus represents a mixture of hateful and complementary altruism utility functions. Now suppose that the other agent is egoistic, $V^2(m) = m^2$. Then only those materially efficient allocations that make agent 1 too rich are inefficient.

In this example, a Pareto-inefficiency arises if the inequity–averse agent's material payoff is greater than that of the purely self-fish agent. The reason is that the inequity–averse, as well as the selfish, agent is better of in this situation if parts of his consumption bundle are transferred to his fellow agent. Observe, however, that no such opportunities for a Pareto-improvement exist whenever the selfish agent consumes more than the inequity–averse one. The reason is that a selfish agent is always being made worse off by consuming less.

5 On the Impact of Bergsonian Social Preferences: Risk, Public Goods, and Intertemporal Choice

In this section, we illustrate that Bergsonian social preferences can play an important role in shaping behavior in exchange economies. We view the examples below as qualifications of the benchmark result that social preferences do not matter for predicting behavior in competitive markets.

5.1 Uncertainty

Following the usual expected utility paradigm, we consider *EU Bergsonian Utility Functions* of the form

$$U^i(x) = \sum_{s=1}^{S} \pi_s V^i\left(m^1(x_s^1), \ldots, m^I(x_s^I)\right) \tag{2}$$

for agents. Here, $s = 1, \ldots, S$ denote the states of nature, π_s is the probability for state s to occur, and $V^i\left(m^1(x_s^1), \ldots, m^I(x_s^I)\right)$ is the Bergsonian utility function we introduced above for a deterministic environment. Throughout this section, we maintain the assumption that $V^i(m^i, m^{-i})$ is increasing in m^i. The agents use this utility to evaluate their consumption ex post, after uncertainty is revealed. For ease of presentation, we only present the case in which $L = 1$, i.e. there is one physical good in each state of nature. The results extend in the obvious fashion to the case of multiple physical goods $L \geq 2$. x_s^i denotes agent i's consumption in state s.

Natural as this formulation might be, it is *not* a separable utility function ex ante. To see this informally, just consider the marginal utility between consumption in state $s > 1$ and state $s = 1$. It is given by

$$\frac{\pi_s \frac{\partial V^i\left(m^1(x_s^1),\ldots,m^I(x_s^I)\right)}{\partial m^i} \frac{\partial m^i(x_s^i)}{\partial x^i}}{\pi_1 \frac{\partial V^i\left(m^1(x_1^1),\ldots,m^I(x_1^I)\right)}{\partial m^i} \frac{\partial m^i(x_1^i)}{\partial x^i}}. \tag{3}$$

In general, $m^i(x_s^i) \neq m^i(x_1^i)$, and the marginal contribution of V^i does not cancel if the aggregator function is non-linear.

Theorem 3 *Suppose that agent i's preferences can be represented by a EU Bergsonian utility function as in* (2) *for smooth functions V^i and m^i, where V^i is strictly increasing in m^i, and m^i is strictly increasing and satisfies the Inada condition $\frac{\partial m^i(0)}{\partial x^i} = \infty$. Suppose also that $\frac{\partial^2 V^i}{\partial m^j \partial m^i} \neq 0$ for some $j, j \neq i$. Then the agent i does not behave as if selfish.*

PROOF : Fix strictly positive prices p and income w and some consumption bundles x^{-i} for all other agents than i. Due to the Inada assumption, agent i chooses an interior consumption bundle x^i. This bundle satisfies

$$\frac{\pi_s \frac{\partial V^i\left(m^1(x_s^1),\ldots,m^I(x_s^I)\right)}{\partial m^i} \frac{\partial m^i(x_s^i)}{\partial x^i}}{\pi_1 \frac{\partial V^i\left(m^1(x_1^1),\ldots,m^I(x_1^I)\right)}{\partial m^i} \frac{\partial m^i(x_1^i)}{\partial x^i}} = \frac{p_s}{p_1}.$$

Choose the agent $j \neq i$ for which $\frac{\partial^2 V^i}{\partial m^j \partial m^i} \neq 0$. Now slightly change the consumption plan of agent j in state 1 to $z_1^j \neq x_1^j$ such that $\frac{\partial V^i\left(m^1(x_1^1),\ldots,m^i(z_1^i),\ldots,m^I(x_1^I)\right)}{\partial m^i} \neq \frac{\partial V^i\left(m^1(x_1^1),\ldots,m^I(x_1^I)\right)}{\partial m^i}$. Let $z_s^j = x_s^j$ for states $s = 2, \ldots, S$. Also hold the consumption plans of all other agents $k \neq j$ fixed, i.e. let $z^k = x^k$ for $k \neq j$. At this new allocation, the marginal rate of substitution of agent i is no longer equal to the price ratio. Hence, x^i is no longer the demand of agent i. □

Hence, social preferences do matter for predicting behavior under uncertainty. But although EU Bergsonian preferences matter for predicting individual behavior, in an exchange economy with no aggregate uncertainty, social preferences are irrelevant *in equilibrium* under a relatively mild condition. Formally, an economy under uncertainty exhibits no aggregate uncertainty if the aggregate endowment

$$\bar{e} = \sum_{i=1}^{I} e^i$$

does not depend on the states of the world $s = 1, \ldots, S$. Under classical EU preferences with strictly risk–averse agents, every Walrasian equilibrium is a full insurance allocation in the sense that every agent's consumption bundle x^i has equal consumption in every state. Intuitively, this suggests that Bergsonian social preferences typically do not matter absent aggregate uncertainty because in a full insurance equilibrium agents face no uncertainty. More formally, if the material utility of all agents is the same in all states, the marginal rate of substitution for EU Bergsonian preferences as given in (3) is equal to the material marginal rate of substitution. It is necessary, however, to ensure that agents with social preferences do not prefer to face risks. The following condition ensures that agents social utility function is concave whenever their material utility function is concave.

Condition 2 $V^i(\alpha m^i + (1-\alpha)\tilde{m}, m^{-i}) \geq \alpha V^i(m^i, m^{-i}) + (1-\alpha)V^i(\tilde{m}^i, m^{-i}), \quad \forall m^i, \tilde{m}^i, m^{-i}$ *and* $\alpha \in [0,1]$.

The above condition is, for example, satisfied by the social preference models of Fehr and Schmidt, Bolton and Ockenfels as well as Charness and Rabin that we introduced above. Thus, for these models one has:

Theorem 4 *Suppose that social preferences satisfy Condition 2 and that V^i is strictly increasing in m^i. Consider an economy with no aggregate uncertainty. Let m^i be concave and let (p^*, x^*) be a full insurance equilibrium of the ego–economy. Then (p^*, x^*) is also an equilibrium under social preferences.*

Proof : In a full insurance equilibrium of the ego–economy, without loss of generality, prices are equal to probabilities , i.e. $p^*_s = \pi_s$. The only thing we have to check is that x^{*i} is agent i's demand for the EU Bergsonian utility. Take a consumption plan y that is budget–feasible for agent i. In particular, we have

$$\sum_{s=1}^{S} p_s y_s = \sum_{s=1}^{S} \pi_s y_s = \sum_{s=1}^{S} \pi_s x_s^i = x^i$$

where we write $x^i = x_s^i$ for the full insurance consumption plan x^i. By Condition 2 and monotonicity of V^i in m^i, the EU Bergsonian utility function U^i is concave and monotone in x^i. Hence,

$$U^i(y, x^{*,-i}) \leq \sum_{s=1}^{S} \pi_s U^i(x^*) = U^i(x^*)\,.$$

□

To see why Condition 2 is needed consider the following example. Let there be one consumption good in each of two states of nature that are equally likely, and let there be two agents. Suppose material well-being of each agent is (approximately) linear and identical across agents so that in the selfish equilibrium the relative price is one. Let $m(0) = 0$. Suppose in the selfish equilibrium agent 2 consumes 2 in each state of nature while agent 1 consumes 1 in each state of nature. Now consider social preferences of agent 1. Suppose they are of the form $U^1(m^1, m^2) = m^1 - g[(m^2 - m^1)^+]$, where $g(0) = 0$, and $2g(1) > g(2)$. If agent two consumes one in each state of nature, her expected utility is $m^1(1) - g(1)$. If the agent, however, consumes 2 in state 1 and nothing in state 2, her utility is $1/2m^1(2) - 1/2g(2)$. Thus, if m^1 is sufficiently linear, the agent prefers the unequal consumption bundle over the full insurance one. Intuitively, she takes a risk and bets on the realization of state 1 in order to avoid falling behind agent 1.

With aggregate uncertainty, however, it is easy to exhibit examples where EU social preferences that satisfy Condition 2 affect behavior. Let us also mention that the analysis of this section carries over to intertemporal settings if we impose the usual additively–separable type of intertemporal utility functions.[19]

[19] See Gebhardt (2005) for an intertemporal-asset-economy example in which the equilibrium allocation can be supported by a unique price vector if agents are selfish but can be supported by a continuum of price vectors if all agents become inequity averse.

5.2 Public Goods

We now introduce a public good into our exchange economy and show that in such a situation social preferences are important for predicting behavior. To intuitively understand why this is the case, consider a hypothetical ego economy in which agent i contributes to the provision of a public good. If agent i is purely selfish, he will contribute up to the point in which his personal sacrifice in private consumption from contributing an extra unit is equal to his personal benefit from contributing an extra unit. Now consider this outcome and suppose that agent i is altruistic rather than selfish. In this case, if he contributes an extra unit to the public good, this has a second-order effect on his material well-being. The extra unit of the public good, however, makes all other agents in the economy better off in terms of their material well-being. Hence, if agent i is altruistic, this has positive first-order effect on his utility. Thus, agent i will not behave as if he was selfish in a public goods economy.

To formalize this intuition, suppose there are two agents and two goods. The first good is private, whereas the second good is public. Agents can produce the public good from the private one by using a common technology modeled by a concave production function g. We take the private commodity as a numéraire. Agents are endowed with an amount $e^i > 0$ of the private good. There is no endowment in the public good. The agent's utility function is

$$U^i(x^i, x^{-i}, y) = V^i\left(m^i(x^i, y), m^{-i}(x^{-i}, y)\right) . \tag{4}$$

In equilibrium, agent i chooses an amount z^i to use as input for the production of the public good. She then maximizes

$$V^i\left(m^i\left(e^i - z^i, y\right), m^{-i}\left(e^{-i} - z^{-i}, y\right)\right)$$

subject to

$$y = g(z^i) + g(z^{-i}) ,$$

while taking z^{-i} as given.

In the ego–economy, the agent equates the marginal rate of transformation and her marginal rate of substitution, i.e.

$$g'(z^i)\frac{\partial m^i}{\partial y} = \frac{\partial m^i}{\partial x^i} .$$

Let ζ^i be the optimal solution in the ego–economy.

In the economy with social preferences, we get the first–order condition

$$g'(z^i)\left[\frac{\partial V^i}{\partial m^i}\frac{\partial m^i}{\partial y}+\frac{\partial V^i}{\partial m^{-i}}\frac{\partial m^{-i}}{\partial y}\right]=\frac{\partial V^i}{\partial m^i}\frac{\partial m^i}{\partial x^i}\,.$$

At the optimum of the ego–economy, the marginal utility of an agent with social preferences is

$$g'(\zeta^i)\left[\frac{\partial V^i}{\partial m^i}\frac{\partial m^i}{\partial y}+\frac{\partial V^i}{\partial m^{-i}}\frac{\partial m^{-i}}{\partial y}\right]\;-\;\frac{\partial V^i}{\partial m^i}\frac{\partial m^i}{\partial x^i}\quad=\quad g'(\zeta^i)\frac{\partial V^i}{\partial m^{-i}}\frac{\partial m^{-i}}{\partial y}\,.$$

Hence, as long as the agents cares about the other agent's utility level, she behaves differently than her egoistic counterpart. Social preferences matter when there are public goods. If the agent is locally altruistic, i.e.

$$\frac{\partial V^i}{\partial m^{-i}}>0\,,$$

then she produces more from the public good than her egoistic part would suggest. If an agent is rather spiteful at the optimum, she produces less than in the ego–economy. The following example makes this reasoning explicit.

Example 5 *We now assume that agent* 1 *views the utility levels as perfect complements whereas agent* 2 *is egoistic. Hence,*

$$V^1(m^1,m^2)=\min\{m^1,m^2\},\quad V^2(m^1,m^2)=m^2\,.$$

Agent 1 *is rich:* $e^1 \gg e^2$*. The poor agent then maximizes as usual, i.e.*

$$g'(z^2)\frac{\partial m^2}{\partial x^2}=\frac{\partial m^2}{\partial x^2}\left(e^2-z^2,g(z^1)+g(z^2)\right)\,.$$

The rich agent, however, produces just enough of the public good as to achieve equality of utility levels:

$$m^1(e^1-z^1,y)=m^2(e^2-z^2,y)\,.$$

As material payoff functions are increasing, and the public good consumption is, of course, the same for both agents, we get

$$e^1-z^1=e^2-z^2\,.$$

The rich agent transfers utility through the public good. This is, however, quite inefficient as we have

$$g'(z^2) \gg g'(z^1)\,.$$

In fact, the social optimum here is the following. Choose a weight $\alpha > 0$ *and maximize*

$$\alpha \min\{m^1(x^1, y), m^2(x^2, y)\} + m^2(x^2, y)$$

subject to the constraints

$$x^1 + x^2 + z^1 + z^2 = e^1 + e^2$$

and

$$y = g(z^1) + g(z^2)\,.$$

It is optimal to have $m^1 = m^2$*. This implies, as above,* $x^1 = x^2$*. Given this, the social planner just maximizes*

$$m^2\left((\bar{e} - z^1 - z^2)/2, g(z^1) + g(z^2)\right)\,.$$

It is optimal to have

$$z^1 = z^2 = z$$

where z *solves*

$$\frac{1}{2} g'(z) \frac{\partial m^2}{\partial y}\left((\bar{e} - 2z)/2, 2g(z)\right) = \frac{\partial m^2}{\partial x^2}\left((\bar{e} - 2z)/2, 2g(z)\right)\,.$$

Technically, one can understand why Bergsonian social preferences matter in the presence of a public good also directly from equation (4). Even though agent i has Bergsonian social preferences, the presence of a public good destroys the separability of his utility function. Analogously to the case of a public good, if we consider a multi-good economy in which—say due to environmental pollution—consumption of one good has a negative effect on the material well-being of others, social preferences will in general matter for predicting behavior.

6 Conclusion

As a benchmark result, we establish that under mild regularity conditions social preferences do not matter for predicting behavior in perfectly competitive markets if each agent's social preferences are separable in her own consumption and that of all others. An economically meaningful subclass of separable social preferences are Bergsonian social preferences, which contains the natural extensions of the most important recently developed allocative social preference models. We show that for these preferences the First Welfare Theorem fails, while the Second Welfare Theorem holds.

We also point out, however, that even in this subclass of preferences, social preferences matter in general for predicting behavior in public good economies, in risky environments, or in intertemporal settings.

References

Bolton, G., and A. Ockenfels (2000): "ERC-A Theory of Equity, Reciprocity and Competition," *American Economic Review*, 90, 166–193.

Borglin, A. (1973): "Price Characterization of Stable Allocations in Exchange Economies with Externalities," *Journal of Economic Theory*, 6(5), 483–494.

Charness, G., and M. Rabin (2002): "Understanding Social Preferences with Simple Tests," *Quarterly Journal of Economics*, 117, 817–869.

Collard, D. (1975): "Edgeworth's Propositions on Altruism," *The Economic Journal*, 85, 355–360.

Dufwenberg, M., and G. Kirchsteiger (2004): "A Theory of Sequential Reciprocity," *Games and Economic Behavior*, 47, 268–298.

Edgeworth, F. (1881): *Mathematical Psychics*. Augustus M Kelley Pubs.

Falk, A., and U. Fischbacher (2006): "A Theory of Reciprocity," *Games and Economic Behavior*, 54(2), 293–315.

Fehr, E., and K. Schmidt (1999): "A Theory of Fairness, Competition, and Cooperation," *Quarterly Journal of Economics*, 114, 817–868.

GEBHARDT, G. (2005): "Investment Decisions with Loss Aversion over Relative Consumption," Working Paper, University of Munich.

HOCHMAN, H., AND J. RODGERS (1969): "Pareto Optimal Redistribution," *American Economic Review*, 59(4), 542–557.

HURWITZ, L., AND H. UZAWA (1971): "On the Integratability of Demand Functions," in *Preferences, Utility and Demand*, ed. by H. L. Chipman, J., and H. Sonnenschein, pp. 174–214. Harcourt Brace, Jovanovich, New York.

LEVINE, D. (1998): "Modeling Altruism and Spitefulness in Experiments," *Review of Economic Dynamics*, 1, 593–622.

MAS-COLELL, A. (2001): *The Theory of General Economic Equilibrium: A Differentiable Approach.* Cambridge University Press, Cambridge, MA.

MAS-COLELL, A., M. WHINSTON, AND J. GREEN (1995): *Microeconomic Theory.* Oxford University Press.

RABIN, M. (1993): "Incorporating Fairness into Game Theory and Economics," *American Economic Review*, 83, 1281–1302.

RADER, T. (1980): "The Second Theorem Of Welfare Economics When Utilities Are Interdependent," *Journal of Economic Theory*, 23(3), 420–424.

SMITH, A. (1759): *The Theory of Moral Sentiment.* London: A. Millar.

SOBEL, J. (2005): "Interdependent Preferences and Reciprocity," *Journal of Economic Literature*, 43(2), 396–440.

——— (2007): "Do Markets Make People Selfish?," Working Paper, University of California, San Diego.

VON SIEMENS, F. (2006): "Social Preferences, Sorting, and Employment Contracts," Working Paper, University of Munich.

WINTER, S. (1969): "A Simple Remark on the Second Optimality Theorem of Welfare Economics," *Journal of Economic Theory*, 1, 99–103.