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Abstract

This paper proposes to balance considerations from welfarism and virtue ethics for normative analysis of economic models with endogenous preferences. Our framework introduces two concepts that are useful in evaluating alternative social states. First, we introduce the moral evaluation function (MEF), which is used to evaluate alternatives based on virtue ethics. Second, we introduce the social objective function (SOF), which gives weights to both the standard social welfare function (SWF) and the MEF. We illustrate our evaluation approach in the context of a model of intergenerational altruism with endogenous time preferences.

Keywords: Moral virtue ethics; Welfarism; Cultural transmission of preferences; Tough love
JEL classification: D03, Z18

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1. Introduction

In normative economics, we seek to evaluate social states. The two widely accepted normative criteria are the Pareto principle (and therefore Pareto efficiency), and Bergson-Samuelson social welfare functions. The basis for both of these methods is welfarism, which recommends the evaluation of social states based on the weak Pareto principle.

There exist many important economic models in which preferences change endogenously in the economic system. In the models studied in the literature of intergenerational cultural preference transmission and formation (see Bisin and Verdier (2011) for a survey), children's preferences are affected by parents' decisions. Habit formation models have been used in the literature on addiction (see, e.g. Becker and Murphy 1988), macroeconomics (see, e.g., Christiano et al. 2005, and finance (see, e.g., Constantinides 1990). In the literature of behavioral economics, reference points are often endogenously determined (see, e.g., Kőszegi and Rabin 2006).

One difficulty in using welfarism for models with endogenous preferences is that the preference ordering conditional on endogenous economic variables cannot be used as a yardstick for evaluation of social states. In order to overcome this difficulty, Pollak (1978) defines unconditional preference ordering. This solves the first difficulty. But the second difficulty is that, given that we have many preferences, some preferences may be considered "better" in terms of moral virtue. Even though the unconditional preference ordering is desirable in terms of exogeneity, it may not be the preference ordering that is most preferred in terms of moral virtue.

In this paper, we seek to solve the second difficulty by expanding the policy evaluation procedure that balances considerations from both pure welfarism and virtue ethics. For this purpose, we first define a *moral evaluation function* (MEF) that expresses evaluations based on moral virtue ethics. We then define the *social objective function* (SOF), which is defined as a function of both the MEF and a social welfare function (SWF).

Hausman and McPerson (1993) provide an excellent discussion of the role of moral arguments in the traditional economic analysis. In this paper we introduce virtue ethics considerations in economic policy evaluation which is inspired by Sandel (2009), who promotes Aristotle's moral virtue ethics after considering other major alternatives. According to Aristotle, "moral virtue comes about as a result of habit." In his explanation, these are "the virtues we get by first exercising them, as also happen in the case of the arts as well." In addition, the purpose of politics for Aristotle is not to set up a framework of rights that is neutral among ends. It is to form good citizens and to cultivate good character.

For the purpose of illustrating our approach by an example, we apply it to a version of Bhatt and Ogaki's (2012) tough love model, which is extended by a bequest motive. In this model the child's time preference, captured by her discount factor, is endogenously determined by the childhood consumption. The parent with a tough love motive can use childhood transfers to impact the child's discount factor. In the model, the parent thinks that he should not spoil the child, in order that the child will grow to be patient, but is tempted to spoil the child because he enjoys watching his child having higher childhood utility. The parent can use the money saved by lowering childhood transfers in order to increase the bequest he leaves to the child after she grows up. Hence the government has a policy tool the bequest tax rate that can be used to influence the optimizing behaviors of the parent and the child. When the bequest tax rate is higher, the parent is more tempted to spoil the child, because the money he saves by giving less transfers to the child will be taxed away when he gives the bequest.

In the aforementioned framework, unconditional preference ordering is expressed by the utility function when the child is born, which includes the effects of childhood consumption on the child's endogenous discount factor. We call this the unconditional utility function. Conditional preference ordering is expressed by the conditional utility function given the discount factor determined by the level of the parent's childhood transfers. We show an example in which a policy change of raising the tax rate from a negative rate to zero results in a Pareto improvement in terms of the unconditional utility function, because both the child and the parent can obtain higher utility levels from more spoiling by higher childhood transfers.[1] In this example, the grown-up child is more patient before the tax rate is raised, and actually prefers the equilibrium consumption stream with the lower tax rate. If the society values patience as a moral virtue, then the society may not solely rely on the Pareto improvement based on the unconditional utility function to evaluate this policy change. This example shows why Pareto improvement and the Pareto efficiency may have limitations in evaluating social sates for models with endogenous preferences.

The MEF is designed to evaluate conditional utility functions in terms of moral virtue

[1]The negative tax rate here means that the government subsidizes bequests. In the numerical example in Section 3, a policy to maximize the SWF leads to a positive tax rate but a policy to maximize the SOF can lead to a negative tax rate in order to promote more bequest and patience.

ethics. In order to define the MEF for our example economy, we need to have a mathematical formulation of virtue. We define the virtue of patience as when the child's discount factor is one. This follows Ramsey's (1928) argument that time discounting is ethically indefensible. We view the time discount factor as a parameter that determines the altruism of the present self toward her future self. If the time discount factor is less than one, then the present self is considered too selfish, while if it exceeds one, then the present self is considered to have excessive altruism. For example, in models in which time discounting is related to discounting the utility of future generations as in Barro's (1974) model, a slight time discounting can lead to virtually zero weight on many future generations. Such preferences cannot be viewed as virtuous. Based on these considerations, we define the MEF so that larger deviations from the virtue of patience yield a lower value.

Once the MEF is defined, the SOF is defined by giving weights to the MEF and SWF based on the unconditional utility function. In our example economy, the laissez-fair policy of setting the tax rate to zero does not maximize the SWF because of externalities, etc. The SWF is maximized at a positive tax rate. Thus, one cost of the laissez-faire policy is a welfare loss. If the society wishes to maximize the SWF, then the society needs to deviate from the laissez-faire policy. However, once the tax rate is set at a nonzero rate, the government is already affecting patience of the child, even as it ignores moral virtue ethics by maximizing the SWF. Given this, it seems irresponsible for the government to ignore the fact that its policy is affecting the child's preferences. When the MEF is given a nonzero weight, the optimum policy may actually be to set the tax rate to be zero, for reasons that have nothing to do with libertarian principles. It is important to separate the idea of laissez-faire from the idea of ignoring the moral virtue elements in setting the government policy. Further, we find that evaluations based on SOF maximization can potentially resolve some problems we encounter in applying Pareto efficiency principles to our endogenous time preference model.

The rest of the paper is organized as follows. Section 2 reviews the related literature. Section 3 shows limitations of the Pareto efficiency by an example of a tough love altruism model with bequest. Section 4 defines the MEF and SOF and shows an example of an application for the tough love model. Section 5 concludes.

2. Related Literature

In this section we provide a brief review of the related literature. One of the main contribution of our paper is to propose considerations for virtue ethics in policy making. Hence, we begin this section by providing examples from the literature that make a similar argument. This is followed by a discussion of recent research papers that develop and apply conceptual frameworks that balance welfare and virtue ethics considerations to different kinds of economic environments.

Developing the MEF can be viewed as an effort to provide a mathematical framework to evaluation of social states by virtue ethics. As such, the concept of the MEF can be viewed as a reply to Sandel's (2013) call to bring more value judgment into economics. Instead of relying solely on virtue ethics for this purpose, we seek to combine welfarism and virtue ethics by the SOF. In the same issue of the *Journal of Economic Perspectives*, Bruni and Sagden (2013) argue that classical and neoclassical economics already incorporate many elements of virtue ethics when "market virtues" are considered. The virtue of patience on which we focus here can be considered a market virtue. Thus, we argue that economics can benefit from formalizing the notion of market virtues with an approach such as ours.

Among various approaches proposed to bring moral considerations into economics (see, e.g., Hausman and McPherson (1993) and Goldfarb and Griffith (1991) for surveys), our approach is most closely related to the framework of meta-preferences (see, e.g., Sen (1974, 1977) and George (1984)). In this framework, moral judgments are expressed by rankings of preference rankings. The MEF applies this framework to rank conditional preference orderings in models with endogenous preferences for the purpose of introducing moral virtue ethics into this class of models. .Our application of this framework is more related to the sense of duty emphasized by Sen than to the free choice emphasized by George. We will talk more about this in Section 3 after defining the MEF.

Another related literature is economics of happiness. Frey (2008, p.5) lists eudaimonia as one of the three concepts of happiness. Eudaimonia is Aristotle's concept of happiness as a "good life" defined by the acquisition of and use of virtue. Hence the MEF can be viewed as an expression of an aspect of eudaimonia. Benjamin et al. (forthcoming) used surveys with personal and policy scenarios to estimate relative marginal utilities. They estimated high relative marginal utilities not only for happiness and life satisfaction, but also for aspects related to values (morality and meaning), among other things. Thus they show that eudaimonic aspects are important for policy considerations.

Another example of an application of the MEF and SOF is in a companion paper by

Bhatt et al. (2013). In that paper, we apply the MEF and SOF to an endogenous altruism model a ĺa Mulligan (1997), in which a worker becomes more altruistic toward a disabled stranger. In that model, we consider the virtue of altruism toward strangers; . Such a virtue is not a market virtue. So our approach can also be applied to non-market virtues.

Our paper is also related to the literature of behavioral normative economics, especially because many models of behavioral economics explicitly or implicitly have endogenous preferences. For example, the reference point of the prospect theory is often simply assumed to be the level of the initial endowment. Because the initial endowment has been determined endogenously in the economic system from the view point of dynamic economic models, prospect theory is a model with endogenous preferences. Bhatt et al. (2013) provides a review of the literature on behavioral normative economics, and explains that the ideas in that literature are based on welfarism.

In Bhatt and Ogaki (2014), we apply our approach to a rational addiction model. If a society finds that preferences with drug addiction caused by past drug consumption are less virtuous than preferences without any drug addiction, then the optimum tax rate for the drug is not zero even when there is no externality in the rational addiction model. Just as a parent may think that it is better for his child to grow without any abuses of a drug even when he knows the child would enjoy pleasure from the drug, a society may exhibit a different value judgment. We think that it is desirable for economists to have a mathematical framework to express the value judgments of such a society.

3. Limitations of Welfarism in Models with Endogenous Preferences

An important limitation of applying conventional welfare analysis to models with endogenous preferences arises from the conditionality of the preference ordering on endogenous economic variables. Pollak (1978) suggests the use of unconditional preference ordering in welfare analysis. Although such an approach meets the exogeneity condition, given that a multitude of conditional preference orderings exist, some of these preferences may be deemed "better" on moral virtue grounds. In this section, we illustrate that fact by using a model of endogenous preferences that introduces a bequest motive for the parent in Bhatt and Ogaki's (2012) tough-love altruism model.

3.1. A Tough Love Model with Bequest

Imagine a three-period model economy with three agents; the representative parent, the representative child, and the government. For simplicity, we consider the case of a single parent and a single child. The three periods considered are childhood, work and retirement for the child. We make the following seven assumptions. First, the timing of the model is assumed to be such that the life of the parent and the child overlap in the first two periods of the child's life. Hence, the parent has the child in the second period of his own life, which in turn corresponds to the first period of the child's life. Second, the parent not only cares about his own consumption, but is also altruistic toward the child. He assigns a weight of θ to the child's lifetime utility, where $0 \leq \theta \leq 1$.[2] Third, the parent receives an exogenous income, denoted by y^P, in period 2 of his life. For simplicity, we assume that the parent receives no income in the last period of his life, but simply divide savings from the previous period into his own consumption and bequest, the latter of which is taxed by the government. Fourth, the parent maximizes utility over the last two periods of his life by choosing consumption, inter-vivos transfers, and bequest, denoted by C^P, T, and B, respectively. Fifth, the child is assumed to be a non-altruist, and derives utility only from her own consumption stream $\{C_t^K\}_{t=1}^3$.[3] y_2^K denotes child's second period exogenous income, and we assume that she receives no income in the first and last period of her life. Sixth, the child's childhood consumption is assumed to be equal to the parent's inter-vivos transfers, because of social convention (alternatively, the child is assumed to be borrowing constrained in period 1 with a binding constraint) . Lastly, there is no uncertainty in the economy.

In the tough love model, the parent thinks that the child should grow to be patient, but is tempted to spoil the child.This interpretation is captured by the following two important features of the model. First, the child's discount factor is endogenously determined as a decreasing function of period 1 consumption:

$$\beta_K(C_1^K) \quad ; \quad \frac{d\beta_K}{dC_1^K} < 0.$$

[2]When compared to the framework of Bhatt and Ogaki (2012), we have the following relationship:

$$\theta = \widetilde{\beta}\left(\frac{1-\eta}{\eta}\right)$$

[3]In this simple consumption good economy, we view consumption as a composite good that may include leisure activities such as TV time, video game time etc.

We assume that the child's childhood consumption equals transfers from the parent ($C_1^K = T$). Therefore, the childs period t discount factor is given by $\beta_K(T)$. The idea is that if the child is spoiled by too much consumption (e.g. of toys and sweets during her childhood), then she will grow to be impatient.

Second, the parent does not use the child's endogenous discount factor, but uses a constant discount factor, $\beta_{t,P}$ to evaluate the child's lifetime utility,

$$U_P(x) = u(C_2^P) + \widetilde{\beta} u(C_3^P) + \theta \Big(u(C_1^K) + \beta_P u(C_2^K) + \beta_P^2 u(C_3^K) \Big). \tag{1}$$

where $\widetilde{\beta}$ is the parent's own consumption discount factor and β_P is the discount factor used to evaluate the child's future utility, and θ denotes the altruism parameter.

The government collects the bequest tax from the parent (τ is the bequest tax rate), and distributes s as a lump sum subsidy. We assume that $\tau = s$. An allocation in this economy consists of $x = (C_2^P, C_3^P, C_1^K, C_2^K, C_3^K)'$.

The child's unconditional utility function, which represents her *unconditional preference ordering* is assumed to be

$$U_K(x) = u(C_1^K) + \beta_K(C_1^K) u(C_2^K) + \beta_k(C_1^K)^2 u(C_3^K). \tag{2}$$

Given the state variable of the parent's transfer, T, the child's conditional utility function, which represents *conditional preference ordering*, is

$$U_K(x|T) = u(C_1^K) + \beta_K(T)u(C_2^K) + \beta_k(T)^2 u(C_3^K). \tag{3}$$

The parent solves the following optimization problem:

$$\begin{aligned} &\max_{C^P,T,B} \Big[v(C^P) + \widetilde{\beta} v(R(y^P - C^P - T) - B)\Big] \\ &+\theta\Big[u(T) + \beta_P u(C_2^{K*}) + \beta_P^2 u(R(y_2^K + (1-\tau)B + s - C_2^{K*}))\Big], \end{aligned} \tag{4}$$

subject to:

$$\{C_2^{K*}\} \equiv \arg\max_{C_2^K} \Big[u(C_2^K) + \beta_K(T)u(R(y_2^K + (1-\tau)B + s - C_2^K))\Big]. \tag{5}$$

where R is the gross interest rate, which is assumed to be exogenously fixed by a linear technology.

In the above framework, the government can influence the child's patience by changing the bequest tax rate. If the bequest tax rate is reduced, then the parent has a greater incentive to leave bequests than to make transfers to the child. Lower transfers in turn would imply a higher discount factor for the child. It should be noted that the government's objective when setting the bequest tax rate may not have anything to do with affecting the child's preferences, but any nonzero tax rate does in fact affect her preferences.

3.2. Simulation Results

We use the tough love altruism model to illustrate what we view as important limitations of the concept of Pareto efficiency for models with endogenous preferences. For this purpose we will present simulation results for the model with different parameter values. Using numerical methods we show that under certain parametric specifications a policy that yields a Pareto improvement in terms of the child's unconditional preference ordering may not lead to a Pareto improvement in terms of her conditional preference ordering. We then argue that a reasonable value judgment may not agree with the policy that produces the Pareto improvement.

The optimization problem for the parents described by equations (4) and (5) has no closed form solution. Hence, we numerically solve the parent's optimization as a non-linear root finding problem. For the purpose of simulations, we choose the following parameter values:

$$u(C) = \frac{C^{1-\sigma}}{1-\sigma}. \tag{6}$$

The discount factor is given by:

$$\beta_K(T) = \beta_0 + \frac{1}{1+aT} \quad \textit{where} \quad a > 0 \textit{ and } \beta_0 \leq 0. \tag{7}$$

In our solution algorithm we impose the government's budget constraint: $s = \tau B$. We use the same parametric values as used by Bhatt and Ogaki (2012).[4]

[4]The details of our solution algorithm are provided in the appendix.

Imagine that $\tau_0 = -0.15$ is the original policy situation. The government has been promoting bequests using this negative bequest tax rate. Consider a policy change to eliminate this negative tax by setting the tax rate to zero: $\tau_1 = 0$. Let $x(\tau_i)$ be the allocation under the bequest tax rate of τ_i, $U_P(x(\tau_i))$ be the parent's utility under τ_i, and $U_K(x(\tau_i))$ be the child's unconditional utility under τ_i. Let $U_K(x|T(\tau_0))$ be the child's conditional utility given $T(\tau_0)$ (the equilibrium transfer when the tax rate is τ_0). The conditional utility is the child's retrospective evaluation of her lifetime consumption stream in the allocation x based on the grown-up child's utility function under the original policy regime.

We now seek to show an example in which a policy that yields a Pareto improvement in terms of the child's unconditional preferences may not be desirable for the society in this economy. Table 1 shows the result. In terms of the unconditional utility function, we have a Pareto improvement when the policy changes from τ_0 to τ_1:

$$U_P(x(\tau_1)) > U_P(x(\tau_0)) \tag{8}$$

$$U_K(x(\tau_1)) > U_K(x(\tau_0))$$

The parent gains utility from the policy change because he gets more utility from succumbing to temptation to spoil the child. If the child is asked about the policy change during childhood, she will prefer being spoiled under the zero tax rate.

However, in terms of the child's conditional utility function given the original tax rate, the child is made worse off by this policy change:

Table 1: Pareto Efficiency and Policy Evaluation

Global Parameters		
$\theta = 0.51$; $R = 0.4$; $\sigma = 1.2$; $\beta_0 = -0.5$		
$\widetilde{\beta} = \beta_p = 0.99$; $y_2^K = 1$; $y^P = 10$; $a = 0.18$		
	$\tau_0 = -0.15$	$\tau_1 = 0.0$
$U_P(x^P(\tau_i))$	-16.8126	-16.8067
$U_K(x^K(\tau_i))$	**-6.8551**	-6.8241
$\beta_K(T(\tau_i))$	0.3107	0.3066
$V_K(x^K(\tau_1)\vert T(\tau_0))$	-	**-6.8604**

(9) $$U_K(x(\tau_1)|T(\tau_0)) < U_K(x(\tau_0)|T(\tau_0))$$

If the child, after growing up to be patient under the negative tax policy, is asked in retrospect about the policy change, then she will prefer the negative tax rate. If the society values patience, then the society may prefer the original tax rate given this. This example illustrates why a Pareto improvement in terms of the unconditional utility function may not be socially desirable. The unconditional preference ordering is convenient for our welfare analysis because it is exogenous. However, our value judgments tell us that some conditional preference orderings are socially more desirable than others, we may not rely exclusively on the unconditional preference ordering in evaluating different allocations.

4. Moral Evaluation and Social Objective Functions

In this section we seek to introduce the element of moral virtue ethics into our normative analysis. We illustrate our approach by applying it to the tough love model. For this purpose, we use the same parametric specification under which Pareto efficiency failed to make a consistent evaluation of bequest tax policy in the previous section.[5]

Consider an economy with N agents. Let x denote a social state and $U_i(x)$ be the utility function of agent i, and $\psi_i(x)$ be a function that express properties of the endogenous utility function of agent i. Let $SWF(U_1(x), ..., U_N(x))$ be the social welfare function. The moral evaluation function (MEF) is a function $MEF(\psi_1(x), ..., \psi_i(x))$ that evaluates $(\psi_1(x), ..., \psi_i(x))$ in terms of moral judgments such as deviations of these properties from moral virtue. The social objective function $SOF(MEF(x), SWF(x))$ is a function that evaluates social states by considering both moral virtue aspect and welfarism.

For the purpose of illustration, we now define a social welfare function (SWF), a moral evaluation function (MEF), and a social objective function (SOF) for our model. The SWF is defined as follows:

$$SWF = U_p + V_k \tag{10}$$

where U_P and V_K are given by equations (1) and (2), respectively.

The MEF is given by:

$$MEF = -(\beta_K(T) - 1)^2 \tag{11}$$

such that larger deviations from the virtue of patience are evaluated to be morally un-

[5]Bhatt et al. (2013) introduced the principle of learning to unconditionally love, and our approach can be viewed as an application of this principle.

desirable. Here, we define the virtue of patience as the time discount factor being exactly one, following Ramsey's (1928) argument that time discounting is ethically indefensible. We view the time discount factor as a parameter that determines altruism of the present self toward the future self. If the time discount factor is less than one, then the present self is considered too selfish, while if it exceeds one, then the present self is considered to have excessive altruism. The MEF expresses a moral judgment that the present self should value the future self as much as her present self; this is a sense of duty. When the child cultivates preferences such that she is pleased with this duty, she is said to have the moral virtue of patience. It should be noted that this sense of duty is in terms of preferences in our model, rather than in terms of actions; the choice of how much to save depends on the interest rate even when she has the virtue of patience.[6]

For the purpose of defining the SOF, we choose positive affine transformations of the MEF and SWF: $MEF^* = b_1 + b_2 \times MEF$ and $SWF^* = b_3 + b_4 \times SWF$ where $b_2 > 0$ and $b_4 > 0$.

Finally, we define the SOF as follows:

$$SOF = (MEF^*)^{\alpha} \times (SWF^*)^{1-\alpha} \tag{12}$$

where $0 \leq \alpha \leq 1$ is the parameter of the SOF that decides the relative weight given to the moral virtue and welfare considerations.

[6]In order to model free choice that George (1984) emphasizes, we need to model the decision making process when the sense of duty expressed by the MEF affects individual behaviors. For example, one can model the voting behavior of the child in the model when she feels that the MEF expresses her sense of duty and when she is tempted to vote for more spoiling. That type of modeling is beyond the scope of this paper.

Table 2: SOF vs SWF

Global Parameters

$\theta = 0.51;\ R = 0.4;\ \sigma = 1.2;\ \beta_0 = -0.5;\ \widetilde{\beta} = \beta_p = 0.99$
$y_2^K = 1;\ y^P = 10;\ a = 0.18$

τ	-0.55	-0.45	-0.15	0	0.1	0.15	0.2
β_K	0.3207	0.3183	0.3107	0.3066	0.3039	0.3024	0.3010
$SOF(\alpha = 0)$	6.1865	6.2271	6.3323	6.3692	6.3843	6.3880	**6.3884**
$SOF(\alpha = 0.1)$	4.8465	4.8721	4.9364	4.9569	4.9638	**4.9645**	4.9629
$SOF(\alpha = 0.2)$	3.7967	3.8120	3.8482	3.8578	**3.8593**	3.8582	3.8554
$SOF(\alpha = 0.3)$	2.9743	2.9825	2.9998	**3.0024**	3.0007	2.9984	2.9951
$SOF(\alpha = 0.4)$	2.3301	2.3335	**2.3385**	2.3367	2.3330	2.3303	2.3268
$SOF(\alpha = 0.5)$	1.8254	**1.8258**	1.8230	1.8185	1.8139	1.8110	1.8075
$SOF(\alpha = 0.6)$	**1.4300**	1.4285	1.4211	1.4153	1.4103	1.4074	1.4042
$SOF(\alpha = 1.0)$	**0.5386**	0.5353	0.5248	0.5192	0.5154	0.5134	0.5114

In Table 2, we present simulations for four policy scenarios, each of which is consistent with one of four alternative principles guiding government policy in the model economy shown in Table 1. The first is based on laissez-faire, wherein the government avoids affecting preferences through policy action. In this case the government would set the tax rate to zero. The second is based on welfarism, which involves maximizing the social welfare function (SWF). In our framework this implies setting $\alpha = 0$ and maximizing the $SOF(\alpha = 0)$.[7] The third is based on the principle of giving weight to both welfarism and moral virtue ethics, which can be achieved in our framework by setting $\alpha \in (0, 1)$ and then by maximizing the social objective function(SOF). Under this principle, both the SWF and the MEF are given positive weight. Finally, the fourth is based solely on moral virtue ethics and aims to maximize only the moral evaluation function (MEF). This obtained by setting $\alpha = 1$ in our model.

[7]Note that the value of SOF with $\alpha = 0$ is the value of SWF*, which is a positive affine transformation of SWF. Hence, maximizing $SOF(\alpha = 0)$ is equivalent to maximizing the SWF.

We assume that the tax rates available to the government range from -0.55 to 0.55, with an increment of 0.05, for political reasons. In Table 2, the optimum tax rate for each version of the SOF is given in bold.

There are several findings of interest from the simulation results presented in Table 2. First, because laissez-faire and welfarism do not coincide for our economy with externalities, a policy based on laissez-faire may lead to a social cost in terms of lower welfare. This can be observed from the simulations corresponding to $\alpha = 0$ in Table 2. We observe that based on laissez-faire the tax policy of $\tau = 0$ does not maximize the SWF. Second, if we follow the principle of welfarism, which seeks to only maximize social welfare ($SOF(\alpha = 0)$), the optimal tax policy is $\tau = 0.2$. Hence, the government can achieve a higher level of welfare in our model economy by abandoning laissez-faire and following welfarism. An important point to note here is that in this case the government policy is impacting the preferences of the child, leading to a lower level of patience.

Third, given that the government policy is affecting preferences when it follows welfarism, it seems irresponsible for the government to completely ignore the moral virtue consideration by setting $\alpha = 0$. A more balanced approach would be to assign positive weights to both SWF and MEF and base policy on maximization of the SOF. As we observe from Table 2, for small enough values of α (less than 0.3), the optimum policies based on maximizing the SOF leads to smaller but positive tax rate. On the other hand, if the government chooses to put a larger weight on moral virtue ethics (by setting $\alpha > 0.3$), then the optimum tax rate is negative. An interesting policy scenario is that of setting $\alpha = 0.3$. In this case the SOF is maximized at $\tau = 0$. Thus in our model economy, a balanced consideration of both moral virtue ethics and welfarism can lead to the policy of a zero tax rate; this is superficially similar to laissez-faire, but the motivations for the policy recommendation are different. Fourth, an extreme case is when the government only pursues moral virtue ethics and sets $\alpha = 1$. We observe that even in this case, the optimum tax policy of $\tau = -0.55$ fails to perfectly attain the virtue of patience, because the corresponding level of $\beta_K < 1$.

Finally, because the economy in Table 2 is the same as the one in Table 1, it is of interest to investigate whether policy evaluation based on the SOF can resolve the limitation of the Pareto efficiency principle highlighted earlier. As we observed from Table 1 simulations, using the Pareto efficiency principle, it is not possible to consistently evaluate the two social states that result from two alternative tax policy scenarios ($\tau = -0.15$ and $\tau = 0$). We now use the simulation results presented in Table 2 to illustrate that the SOF based evaluation can consistently evaluate these two policy scenarios. With $\alpha = 0$, the evaluation by the SOF must satisfy the weak Pareto principle. Therefore, the SOF value should be higher for $\tau = 0$ than for $\tau = -0.15$. For small enough values of α, the SOF value needs to be higher for $\tau = 0$. From Table 2, we observe that for $\alpha \leq 0.3$, we get higher SOF values when $\tau = 0$ than when $\tau = -0.15$. However, for large enough values of α, the SOF value can be smaller for $\tau = 0$. From Table 2, we find that for $\alpha \geq 0.4$, the SOF value corresponding to $\tau = 0$ is indeed smaller than those associated with $\tau = -0.15$. Hence, for a high enough weight on moral virtue ethics (in this case $\alpha \geq 0.4$), the Pareto improvement obtained by changing the tax rate from $\tau = -0.15$ to $\tau = 0$ is not evaluated to be socially desirable. In this way, the evaluation based on the SOF can resolve the limitation of the Pareto efficiency principle in an economic environment with endogenously determined preferences.

5. Conclusion

In this paper, we proposed a new approach to evaluate social states for models with endogenous preferences. In our approach, moral value ethics is used in combination with welfarism. Based on informal discussions, we believe that many economists object to the use of moral value ethics considerations in public policy evaluation, because such an approach involves the government influencing people's preferences. Using a model of intergenerational altruism, we first illustrate that a government policy based solely on welfarism can also influence an agents preferences. This shows that the government may be influencing people's preferences even when it does not make any moral virtue consideration. On the other hand, for a certain weighting parameter, the optimum tax rate is zero when we maximize the SOF. Thus, introducing moral virtue ethics may result in a policy that does not affect people's preferences. This illustrates that introduction of moral virtue ethics need not automatically lead to governmental influence on people's preferences.

Given these, one implication of the theoretical analysis presented in this paper is that whether or not a certain government policy influences people's preferences is an empirical issue that is independent of whether or not we think that the government should influence preferences. We believe that an important direction for future research in public policy is to gather empirical evidence for or against models with endogenous preferences. For the tough love altruism model, there already exists some empirical work. A starting point of any model with endogenous time discounting is that genetic factors do not completely determine time discounting. Using a unique data set of twins in Japan, Hirata et al. (2010) found empirical evidence in favor of this. Kubota et al. (2013ab) found empirical evidence that is consistent with the tough love model, using unique survey data for U.S. and Japan. Akkemik et al. (2013) found evidence for the tough love model for Germany, Turkey, and Turkish migrants in Germany. We believe that more efforts to empirically validate models of endogenous preferences are needed to provide better insights into the potential of government policies to influence preferences. In our view, robust empirical evidence on this issue will significantly inform the discussion on public policy evaluation.

References

Akkemik, Ali K., Mehmet Bulut, Marcus Dittrich, Koray Göksal, Kristina Leipold, and Masao Ogaki. 2013. "Worldviews and Intergenerational Altruism - A Comparison of Turkey and Germany." Unpublished.

Barro, Robert J. 1974. "Are government bonds net wealth?" *The Journal of Political Economy*, 82(6): 1095–1117.

Becker, Gary, and Kevin M. Murphy. 1988. "A Theory of Rational Addiction." *The Journal of Political Economy*, 96(4): 675–700.

Benjamin, Daniel J., Ori Heffetz, Miles S. Kimball, and Nichole Szembrot. 2014. "Beyong Happiness and Satisfaction: Toward Well-Being Indices Based on Stated Prference." *American Economic Review*. forthcoming.

Bhatt, Vipul, and Masao Ogaki. 2012. "Tough Love and Intergenerational Altruism." *International Economic Review*, 53: 791–814.

Bhatt, Vipul, and Masao Ogaki. 2014. "Rational Addiction and Optimal Taxation: A Reexamination Based on the Social Objective Function." Unpublished.

Bhatt, Vipul, Masao Ogaki, and Yuichi Yaguchi. 2013. "Normative Behavioral Economics Based on Unconditional Love and Moral Virtue." Paper presented at 10th Biennial Pacific Rim Conference, Western Economic Association International, Tokyo, Japan.

Bisin, Alberto, and Thierry Verdier. 2011. "The Economics of Cultural Transmission and Socialization." In *Handbook of Social Economics*. Vol. 1A, , ed. Alberto Bisin Jess Benhabib and Matthew O. Jackson, 339–416. The Netherlands: North-Holland:Elsevier.

Bruni, Luigino, and Robert Sugden. 2013. "Market Reasoning as Moral Reasoning: Why Economists Should Re-engage with Political Philosophy." *Journal of Economic Perspectives*, 27: 141–164.

Constantinides, George M. 1990. "Habit Formation: A Resolution of the Equity Premium Puzzle." *The Journal of Political Economy*, 98: 519–543.

Frey, Bruno S. 2008. *Happiness: A Revolution in Economics.* Cambridge, MA:MIT Press.

George, David. 1984. "Meta-Preferences: Reconsidering Contemporary Notions of Free Choice." *International Journal of Social Economics*, 11(3/4): 92–107.

Goldfrab, Robert, and William Griffith. 1991. "Amending the Economists Rational Egoist Model to Include Moral Values and Norms Part 2: Alternative Solutions." In *Social Norms and Economic Institution.* , ed. K. Koford and Miller J, 59–84. Ann Arbor, MI:University of Michigan Press.

Hausman, Daniel M., and Michael S. McPherson. 1993. "Economics and Contemporary Moral Philosophy." *Journal of Economic Literature*, 31(2): 671–731.

Hirata, Kenjiro, Hirokuni Iiboshi, Kazuo Hayakawa, Shinsuke Ikeda, Yoshiro Tsutsui, and Fumio Ohtake. 2010. "Genetic Inheritance of Time-Discounting Behavior: A Bayesian Approach Using Markov Chain Monte Carlo Method." Paper presented at the 2010 Japanese Economic Association Spring Meeting, Chiba University, Chiba, Japan.

Kőszegi, Botond, and Mathew Rabin. 2006. "A model of reference-dependent preferences." *The Quarterly Journal of Economics*, 121(4): 1133–1165.

Kubota, Kohei, Akiko Kamesaka, Masao Ogaki, and Fumio Ohtake. 2013*a*. "Cultures, Worldviews, and Intergenerational Altruism." Paper presented at the European Regional Science Association 2013 Congress, Palermo, Italy.

Kubota, Kohei, Akiko Kamesaka, Masao Ogaki, and Fumio Ohtake. 2013*b*. "Time Discounting and Intergenerational Altruism." Unpublished.

Lawrence, Christiano J., Martin Eichenbaum, and Charles L. Evans. 2005. "Nominal rigidities and the dynamic effects of a shock to monetary policy." *The Journal of Political Economy*, 113(1): 1–45.

Mulligan, B. Casey. 1997. *Parental Priorities and Economic Inequality.* Chicago, IL:The University of Chicago Press.

Pollak, Robert A. 1978. "Endogenous Tastes in Demand and Welfare Analysis." *American Economic Review*, 68(2): 374–379.

Ramsey, Frank P. 1928. "A mathematical theory of saving." *The Economic Journal*, 38(152): 543–559.

Sandel, Michael J. 2009. *Justice: What's the Right Thing to Do?* New York, NY:Farrar Straus & Giroux.

Sandel, Michael J. 2013. "Market Reasoning as Moral Reasoning: Why Economists Should Re-engage with Political Philosophy." *Journal of Economic Perspectives*, 27: 121–140.

Sen, Amartaya K. 1974. "Choice, Orderings and Morality." In *Practical Reason.* , ed. Stephan Korner, 55–66. New Haven, NY:Yale University Press.

Sen, Amartaya K. 1977. "Rational Fools: A Critique of the Behavioral Foundations of Economic Theory." *Philosophy and Public Affairs*, 6(4): 317–344.

Appendix: Solution Algorithm

In this appendix we explain the numerical optimization method we used to solve the decision-maker's problem outlined in Section 3.2.

Step 1: Given T and B, the child solves the following optimization problem:

(A-1)
$$\max_{C_2} \frac{C_2^{1-\sigma}}{1-\sigma} + \beta_k \frac{[R(y_2 + (1-\tau)B + z - C_2)]^{1-\sigma}}{1-\sigma}$$

where

$$\beta_k = \beta_0 + \frac{1}{1 + a(y_1 + T)}$$

The above optimization problem gives us a closed form solution for optimal values of C_2 and C_3:

(A-2)
$$C_2^* = \frac{R(y_2 + (1-\tau)B + z)}{R + (\beta_k R)^{\frac{-1}{\sigma}}}$$

(A-3)
$$C_3^* = R(y_2 + (1-\tau)B + z - C_2^*)$$

Step 2: We substitute for optimal C_2 and C_3 in the objective function and solve the parent's optimization problem:

(A-4)
$$\max_{T,B} W \frac{[R(y_p - T) - B]^{1-\sigma}}{1-\sigma} + \theta \left(\frac{T^{1-\sigma}}{1-\sigma} + \beta_k \frac{C_2^{*1-\sigma}}{1-\sigma} + \beta_k^2 \frac{C_3^{*1-\sigma}}{1-\sigma} \right)$$

where

$$W = \frac{1 + \tilde{\beta}(\tilde{\beta}R)^{\frac{1-\sigma}{\sigma}}}{[R + (\tilde{\beta}R)^{\frac{1}{\sigma}}]^{1-\sigma}}$$

The step 2 optimization problem has no closed form solution for T and B. Hence we use numerical methods to find the solution to the above function. For this purpose we define a grid for T and B and choose a baseline for model parameters. Given these we search for the values of T and B that yields the maximum value for the objective function defined in equation (4). To implement this we need to initialize values of three key variables: T,B and the level of subsidy i.e. z. For a given tax level set by policy, τ, we adopt the following algorithm to choose initial values:

1. For a given τ_i, we set:

$$T_{0i} = T^*(z^*_{i-1}; \tau_{i-1})$$

$$B_{0i} = B^*(z^*_{i-1}; \tau_{i-1})$$

2. For choosing the initial level of the subsidy we use:

$$z_{0i} = \tau_i B^*(z^*_{i-1}; \tau_{i-1})$$

We initialize the above process by first solving for the laissez-faire policy of $\tau = z = 0$.